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1. Executive Summary

This report presents the findings of Work Package 2 (WP2), Laying the Foundation: Needs Assessment, Capacity Assessment, and Centre Preparation, of the SHE-GROWS project. It provides the gender-responsive evidence base for the design of the hydroponics and sustainable entrepreneurship curriculum, trainer preparation, pilot implementation and cooperative development in Béja and Jendouba.

WP2 used a mixed-methods design combining the quantitative baseline survey, 27 in-depth interviews, 10 key-informant interviews, two gender-separated focus groups involving 6 women and 11 men, and structured stakeholder engagement. The survey platform recorded 1,038 submissions, exceeding the target of 1,000. The final respondent-level analytical export available for D2.1 contains 1,031 valid records: 393 women, 629 men and 9 respondents who preferred not to disclose gender. The evidence-source inventory and KPI status are provided in Annex A.

Agriculture remains central to livelihoods: 81.7 % of valid survey respondents report agriculture as the main source of household income. The evidence also documents water scarcity, climate variability, high input costs, infrastructure constraints and weak market access. The 27 in-depth interviews show that rural women already contribute substantially to farming, livestock, processing, marketing and household income, and demonstrate practical knowledge, adaptive capacity and strong willingness to learn. The central challenge is therefore not a lack of motivation, but the difficulty of converting knowledge and interest into viable productive activity.

Gender differences are important but not unidirectional. Women report lower access than men to agricultural land (82.2 % versus 89.2 %) and credit or microfinance (63.6 % versus 73.8 %), while reporting higher digital-device access (73.0 % versus 59.0 %) and higher market access within this survey sample (57.5 % versus 28.1 %). These descriptive differences should not be interpreted causally. They show why gender analysis must distinguish access from effective control and examine how resources, household decision-making, mobility, care responsibilities and institutional support interact. Full gender-disaggregated statistics are reported in Annex B.

Training accessibility is a major implementation issue. Only 20.1 % of valid survey respondents report previous vocational or non-formal training. Distance to training centres or transport costs are reported by 51.1 % of women compared with 22.9 % of men, and training/material costs by 30.3 % of women compared with 10.2 % of men. The qualitative evidence confirms strong demand for practical, local and flexible training, understandable language, hands-on demonstrations and structured technical follow-up. These findings support decentralised practical delivery complemented by simple digital resources.

Hydroponics is relevant to many participants, but interest should not be confused with readiness. Overall, 26.8 % of valid respondents had prior awareness of hydroponics and 78.9 % were at least moderately interested in training. Among women, prior awareness was 43.5 % compared with 15.9 % among men, while 83.7 % of women were at least moderately interested and 38.2 % were extremely interested. The focus groups nevertheless identify finance, water, technical knowledge, equipment, markets and continuing support as decisive conditions. Women's focus-group rankings are led by finance (mean rank 2.2) and water (3.2), while the men's group places training and technical support first (2.3) and finance second (2.4). Detailed focus-group evidence is provided in Annex C.

Collective action is a significant opportunity but should be developed progressively. Current organisational membership is low at 10.5 % overall, yet positive readiness to join a new sustainable agricultural cooperative is substantially higher among women (59.5 %) than men (27.8 %). This creates a strong entry point for WP5, but stated willingness does not replace the need for trust-building, transparent governance, defined roles, equitable benefit-sharing and meaningful women's participation in leadership and financial decisions. The institutional support ecosystem is mapped in Annex D.

The overall finding is that hydroponic adoption is shaped by a layered combination of material, technical, household, institutional and market conditions rather than by a single gender barrier. Training alone is insufficient. Adoption is most plausible when practical skills are combined with technically suitable sites, realistic financing, access to inputs and markets, household-compatible labour requirements, post-training mentoring and coordinated institutional support. WP2 does not establish that any specific hydroponic system, crop or business model is universally feasible; water quality, energy requirements, input supply, operating costs and crop-specific market demand must be verified during pilot preparation.



For WP3, the evidence supports an integrated curriculum combining technical hydroponics with water and climate management, entrepreneurship, financial literacy, digital skills, marketing, cooperative governance and gender-responsive agency. For WP4, trainers require practical adult-learning, inclusive facilitation, gender-responsive pedagogy and troubleshooting capacity. For WP5, recruitment should extend beyond already organised women, training should be practical and locally accessible, post-training support should be structured, and cooperative development should proceed from informed participation and demonstrated value towards formalisation.

The resulting intervention logic is: awareness and informed interest → accessible practical training → technical competence → access to productive resources → supported application → cooperative and market participation → continued mentoring and scaling. D2.1 therefore shifts the project focus from training access alone to the conditions required for women to convert skills into sustainable productive and economic opportunities.

2. SHE-GROWS Context, Purpose and Scope of deliverable D2.1

2.1 Project context

SHE-GROWS, *Sustainable Hydroponic Education for Growing Rural Opportunities*, is an Erasmus+ Capacity Building in Vocational Education and Training initiative designed to strengthen the resilience, skills and economic opportunities of rural communities in Tunisia, with particular attention to women and other vulnerable groups. The project responds to a set of closely interconnected challenges affecting rural livelihoods, including increasing climate pressure and water scarcity, persistent socio-economic vulnerability, unequal access to productive resources and decision-making, and gaps between available vocational education and the practical skills required for emerging forms of sustainable agriculture.

Within this context, hydroponic agriculture is introduced not simply as a new production technology, but as a potential vehicle for climate adaptation, vocational skills development, entrepreneurship and greater economic participation. Its capacity to produce crops with reduced dependence on agricultural land and more efficient use of water makes it particularly relevant to areas facing increasing pressure on conventional agricultural production. At the same time, adopting hydroponics requires new technical competencies, access to equipment and finance, reliable support systems, appropriate market opportunities and, critically, the ability of prospective users to access and benefit from relevant training. For rural women, these requirements interact with wider gender-related constraints affecting mobility, time availability, resource ownership, household decision-making and participation in economic and collective activities.

SHE-GROWS therefore combines technical innovation with vocational education, gender-responsive approaches and sustainable entrepreneurship. The project does not assume that introducing new agricultural technology will, by itself, generate inclusion or economic empowerment. Instead, its intervention logic recognises that successful and equitable adoption depends on the surrounding social, economic, institutional and educational environment. This is why the project begins with a dedicated needs-assessment phase before moving to curriculum development, trainer capacity building, pilot training and cooperative development. The project proposal explicitly positions this first phase as the evidence base for tailoring subsequent interventions to the realities of rural communities in Béja and Jendouba.

Deliverable D2.1, *Gender-Responsive Mapping Report: Barriers and Opportunities for Women in Hydroponic Adoption in Tunisia*, is the principal analytical output of this foundation phase. It brings together the evidence generated through the quantitative baseline survey, qualitative field research and stakeholder engagement in order to identify not only the barriers that may restrict women's participation, but also the enabling conditions and opportunities that can support meaningful and sustainable engagement in hydroponic agriculture. The intention is therefore not merely diagnostic. D2.1 is designed to translate evidence into concrete design choices for the subsequent stages of SHE-GROWS.

2.2 Specific Objective 1 and WP2 objectives

Deliverable D2.1 directly responds to Specific Objective 1 (SO1) of SHE-GROWS, which is to identify and analyse the technical, social and cultural barriers affecting rural women's capacity to adopt hydroponic farming in Tunisia. SO1 places

particular emphasis on four interrelated areas: cultural norms and social expectations surrounding women's participation in innovative agriculture; local decision-making structures and their influence on women's agency in agricultural choices; gender-specific constraints affecting access to technical and vocational education and training; and water-management practices within existing social frameworks, including community support systems and possible resistance to change.

WP2, *Laying the Foundation: Needs Assessment, Capacity Assessment, and Centre Preparation*, operationalises this objective through a broader gender-sensitive assessment of the local context. It seeks to understand the socio-economic, cultural and technical conditions affecting rural populations in Béja and Jendouba, with particular attention to vulnerable groups, women and female-headed households. In parallel, it examines participation, cooperativism and collective action; maps relevant stakeholders and institutional networks; and analyses existing agricultural practices and climate-adaptation strategies in order to identify realistic opportunities for hydroponic integration.

The WP2 research framework therefore treats women's capacity to adopt hydroponics as a multidimensional issue rather than a narrow technical question. Five interconnected analytical dimensions were established to guide the research: socio-economic conditions and vulnerabilities; gender dynamics and agency; VET and training gaps; agriculture, water and climate adaptation; and cooperativism and the institutional landscape. Cooperativism is considered cross-cutting because it connects questions of resources and agricultural conditions with women's agency, training, collective organisation and access to markets and institutional support.

This multidimensional framing is essential to gender-responsive analysis. A woman may, for example, express strong interest in hydroponics while still being unable to participate because training is inaccessible, investment capital is unavailable, transport is difficult, household responsibilities limit her time, or she lacks decision-making authority over productive resources. Conversely, existing agricultural experience, family or community support, accessible practical training, peer networks, cooperative arrangements or institutional assistance may substantially improve the conditions for adoption. D2.1 therefore examines both constraints and agency, and both barriers and enabling conditions, rather than interpreting women's participation solely in terms of individual motivation.

In methodological terms, WP2 was explicitly designed so that different forms of evidence complement one another. Quantitative data describe the frequency and distribution of socio-economic characteristics, conditions and perceptions within the achieved sample; qualitative interviews and focus groups provide insight into lived experience, motivations, perceptions and underlying mechanisms; and stakeholder consultations contribute institutional, technical and implementation perspectives. These evidence streams converge in D2.1 through triangulation.

2.3 Geographic and population scope

The territorial focus of WP2 and D2.1 is the north-western Tunisian governorates of Jendouba and Béja, where agriculture remains an important component of rural livelihoods and where the project seeks to explore the relevance of hydroponics within a context of increasing climate and resource pressures. The analysis is deliberately grounded in the realities of these territories rather than treating rural women in Tunisia as a homogeneous population.

The primary population of interest is rural women who are currently engaged in agriculture, interested in agricultural activities or potentially able to benefit from vocational training and new livelihood opportunities. Particular attention is given to women whose capacity to participate may be affected by socio-economic vulnerability, household responsibilities, limited access to productive assets, geographic isolation or other constraints. Female-headed households are explicitly identified within the WP2 framework as an important group for analysis. At the same time, the research includes men, community actors, agricultural practitioners and institutional stakeholders because women's opportunities and choices are shaped by relationships and decision-making structures extending beyond the individual woman.

This wider population perspective is particularly important for a gender-responsive mapping exercise. Gender analysis does not consist solely of describing women as a separate target group. It requires examination of relationships, institutions, resource distributions and social expectations that influence women's capacity to make and act upon economic and agricultural decisions. Accordingly, men's perspectives are used to help understand the wider social environment surrounding women's participation, while consultations with public institutions, agricultural extension services, women's organisations, training providers and other stakeholders provide evidence on the institutional conditions within which adoption would take place.



The quantitative baseline was designed to capture socio-demographic characteristics, agricultural practices, climate and water pressures, gender and resource access, training preferences, digital readiness, cooperativism and hydroponics readiness. The baseline data are treated as descriptive. The mixed administration approach, combining online self-completion with field-assisted collection, broadened participation beyond digitally connected respondents, although the achieved sample should not be interpreted as a statistically representative estimate of the rural population. Triangulation with focus groups, interviews and stakeholder consultations is therefore used throughout D2.1 before implications for training and pilot design are formulated.

The geographical claims made in this report consequently follow the evidence actually collected. While the project-level research framework covers both Jendouba and Béja, conclusions are interpreted in relation to the achieved distribution of respondents and qualitative participants and are not automatically generalised to all rural women in either governorate or to Tunisia as a whole. This distinction is important for maintaining the analytical credibility of the mapping exercise while preserving the potential transferability of its framework and recommendations to comparable rural contexts.

2.4 How D2.1 feeds downstream work

D2.1 functions as the evidence-to-action bridge between the WP2 needs assessment and subsequent SHE-GROWS activities. Its findings inform WP3 curriculum content and learning outcomes, WP4 trainer preparation and inclusive delivery approaches, and WP5 recruitment, pilot implementation, cooperative development and market engagement. These implications are developed in detail in Sections 12-14.

3. Research Questions and Gender-Responsive Analytical Framework

The analytical framework developed for D2.1 is designed to move beyond a simple inventory of barriers. Its purpose is to understand how structural conditions, gender relations, access to skills and resources, agricultural realities, and institutional arrangements interact to shape women's capacity to participate in, adopt and potentially benefit from hydroponic agriculture.

This approach reflects the design of WP2, in which the quantitative survey, qualitative fieldwork and stakeholder consultations were deliberately structured around a limited number of interconnected analytical dimensions rather than treated as separate research exercises. The framework is explicitly gender-responsive. Gender is treated not only as a demographic variable to be added at the end of the analysis, but also as a factor that may shape access to resources, time, mobility, knowledge, decision-making power, institutional support and economic benefits at every stage of the participant adoption pathway. The framework therefore examines both women's constraints and women's agency, while also considering household, community and institutional environments that may enable or restrict participation.

3.1 Overarching research question

The WP2 research design is organised around the following overarching question:

“What technical, socio-economic, cultural and institutional barriers and enablers shape rural women's capacity to adopt hydroponic farming in Béja and Jendouba, and what are the implications for gender-responsive VET curriculum design and project implementation?”

The question deliberately combines barriers and enablers. This distinction is important because the absence of a barrier does not automatically create an enabling environment. For example, a woman may not experience explicit opposition to participation in agricultural training, but she may still lack transport, available time, finance, childcare, confidence, information or practical technical support. Conversely, interest in hydroponics does not necessarily indicate readiness for adoption if the resources and support required for implementation are unavailable.

The analysis therefore addresses a set of subsidiary questions:

- What socio-economic and livelihood conditions influence women's ability to engage in new productive activities?
- How do gender roles, household responsibilities, access to productive resources and decision-making arrangements shape women's agency?
- What knowledge, skills and training-access gaps affect participation in hydroponics-related VET?
- How do current agricultural practices, water constraints and climate pressures influence the relevance and feasibility of hydroponics?
- What forms of collective action, institutional support and cooperative organisation could enable sustained participation and economic benefit?
- At which stages of the participant pathway do the most significant barriers arise, and what interventions could prevent those barriers from translating into exclusion or dropout?

These questions allow D2.1 to distinguish between interest, participation, capability, adoption and sustained economic engagement. This distinction is important because the WP2 evidence shows that interest in hydroponics can coexist with limited awareness, resource constraints and low current collective participation.

3.2 Five analytical dimensions

The WP2 research design operationalises the overarching research question through five interconnected analytical dimensions: Socio-Economic Conditions and Vulnerabilities; Gender Dynamics and Agency; VET and Training Gaps; Agriculture, Water and Climate Adaptation and Cooperativism and the Institutional Landscape.

The dimensions are complementary rather than independent. The same constraint may operate through several dimensions. For example, limited mobility can affect training access, institutional engagement, market access and cooperative participation, while finance can influence both initial adoption and longer-term continuity.

3.2.1 Socio-Economic Conditions and Vulnerabilities

The first dimension examines the material and socio-economic conditions that influence whether women are in a position to engage in a new productive activity such as hydroponics.

Its central analytical question is:

“What is the socio-economic baseline, and which vulnerability factors most constrain women's capacity to engage in new productive activities?”

The analysis covers household livelihood strategies, dependence on agriculture, employment and income security, education, access to land and productive assets, credit and financial services, and other conditions affecting the ability to attend training, invest in equipment and inputs, absorb financial risk and sustain productive activity.

A gender-responsive interpretation requires particular attention to the distinction between access and control. Household access to land, finance, water or agricultural assets does not necessarily imply that women can independently decide how these resources are used. This dimension is therefore interpreted together with the analysis of agency and household decision-making.

3.2.2 Gender Dynamics and Agency

The second dimension examines how gender relations influence women's capacity to make and act upon decisions related to training, agriculture and entrepreneurship.

Its central question is:

“How do cultural norms, household relations and local power structures enable or constrain women's agency in agricultural choices and access to training?”

The analysis considers gender roles in agricultural and domestic labour, time and care responsibilities, mobility, household decision-making, control over productive resources, participation in investment decisions, social acceptability and women's capacity to exercise voice and leadership.

Women's agency is understood as more than participation. Attendance at training, involvement in farming or membership in a cooperative does not necessarily demonstrate the ability to influence decisions or control resulting benefits. Particular attention is therefore given to women's ability to participate meaningfully, apply acquired skills,



influence investment and production decisions, assume leadership responsibilities and benefit equitably from productive activity.

3.2.3 VET and Training Gaps

The third dimension addresses both what participants need to learn and what determines whether they can access and benefit from the learning opportunity.

Its central question is:

“What knowledge and skill gaps exist, and what practical constraints shape the target population's ability to access, complete and benefit from VET?”

The analysis covers previous VET and non-formal learning, hydroponics knowledge, transport and distance, scheduling, care responsibilities, training costs, learning preferences, digital access and confidence, language and practical learning requirements.

The framework distinguishes formal availability of training from effective accessibility. A training opportunity may be technically available while remaining difficult to use because of distance, timing, transport, domestic responsibilities or digital requirements. Similarly, access to a digital device is not automatically equivalent to readiness for independent online learning.

3.2.4 Agriculture, Water and Climate Adaptation

The fourth dimension grounds the intervention in the agricultural and environmental realities of Béja and Jendouba.

Its central question is:

“What is the current agricultural reality, how are rural communities responding to climate and water pressures, and under what conditions could hydroponics constitute a relevant adaptation option?”

The analysis considers farming and livestock activities, irrigation and water sources, perceptions of climate change, local adaptation practices, existing agricultural knowledge and awareness of hydroponics.

Hydroponics is therefore assessed as a potential and conditional adaptation and livelihood option, not as a universally appropriate technological solution. Its practical relevance depends on local production objectives and on factors such as reliable water supply and quality, energy, equipment, inputs, maintenance, technical support, crop suitability and market demand.

3.2.5 Cooperativism and the Institutional Landscape

The fifth dimension examines whether the social and institutional environment can support participants beyond the individual training experience.

Its central question is:

“What social and institutional infrastructure exists for collective action, and how can it support equitable and sustainable participation in hydroponic agriculture?”

The analysis covers existing cooperatives, associations and women's groups, willingness to engage in collective activity, trust, governance, institutional actors and the organisational environment surrounding cooperative development.

A gender-responsive approach distinguishes formal membership from meaningful participation. Women's inclusion in a cooperative does not automatically demonstrate influence over governance, production, financial decisions or benefit-sharing. The analysis therefore considers voice, leadership, transparency, equitable participation and the distribution of responsibilities and benefits.

Institutional actors are assessed according to the functions they may provide across the adoption pathway, including mobilisation, VET, technical advice, finance and investment guidance, cooperative support, market linkage and post-training follow-up.

3.3 Linking the analytical dimensions to the participant pathway

The five analytical dimensions identify which factors matter, but adoption is better understood as a pathway through which participants progressively move from awareness to sustained productive engagement.

For D2.1, the participant pathway is conceptualised through six interconnected stages:

Participant pathway stage	Core analytical question	Principal dimensions involved
1. Awareness and perceived relevance	Does the participant know what hydroponics is, understand its potential uses and perceive it as relevant to her livelihood and local agricultural conditions?	D3 VET and Training; D4 Agriculture, Water and Climate
2. Access to and participation in training	Can she receive information about the opportunity, enrol, travel to the training location, attend regularly and participate effectively?	D1 Socio-Economic Conditions; D2 Gender Dynamics and Agency; D3 VET and Training
3. Acquisition of skills and confidence	Does the training provide sufficient practical competence, confidence and support for her to manage hydroponic activities safely and independently?	D2 Gender Dynamics and Agency; D3 VET and Training; D4 Agriculture, Water and Climate
4. Application and access to productive resources	Can she mobilise finance, space, water, equipment, inputs, time and household support to apply what she has learned?	D1 Socio-Economic Conditions; D2 Gender Dynamics and Agency; D4 Agriculture, Water and Climate
5. Collective organisation and market engagement	Can she participate meaningfully in cooperative structures, access buyers and markets, and obtain economic value from production?	D1 Socio-Economic Conditions; D2 Gender Dynamics and Agency; D5 Cooperativism and Institutions
6. Continuity, leadership and scaling	Are technical support, institutional links, replacement inputs, finance, peer networks and opportunities for leadership available sufficiently to sustain participation over time?	All five dimensions, particularly D2 and D5

Progression through this pathway is conditional rather than automatic. Awareness may generate interest without leading to training participation if mobility or household constraints intervene. Training completion may not result in application if finance, water, equipment or productive space are unavailable. Successful production may not generate livelihood benefits without viable market access. Likewise, cooperative membership may not translate into empowerment if women have limited influence over governance or benefits.

The pathway therefore helps D2.1 identify not only what the barriers are, but where they become consequential. Different stages require different responses: sensitisation and demonstration at the awareness stage; accessible and flexible delivery at the training stage; practical competency development and mentoring at the skills stage; finance and resource mobilisation at the application stage; governance and market support at the collective stage; and technical, institutional and peer support for continuity.

The pathway should not be interpreted as rigid or strictly linear. Participants enter SHE-GROWS with different levels of agricultural experience, education, resources, household support and economic aspirations, and may progress differently between stages. Gender also interacts with age, education, household position, income, location, mobility, digital readiness and access to productive resources.

Taken together, the five analytical dimensions and the participant pathway provide the organising logic for the remainder of D2.1. The dimensions explain which factors shape participation and adoption, while the pathway identifies when and how those factors become enabling conditions or barriers.

4. Methodology, Sampling, Ethics and Evidence Triangulation

The methodological design of WP2 was developed to generate an evidence base capable of addressing a multidimensional research question in which technical, socio-economic, cultural, gender-related and institutional factors



are closely interconnected. For this reason, D2.1 is based on a mixed-methods exploratory design that combines quantitative survey evidence, qualitative fieldwork and structured stakeholder engagement.

The rationale for this approach is that no single method can adequately explain women's capacity to engage with hydroponic agriculture. Quantitative data can indicate how frequently particular conditions or perceptions are reported across a comparatively large sample, but they cannot fully explain the processes through which household responsibilities, mobility, social expectations, institutional relationships or previous experiences shape individual decisions. In contrast, focus groups and interviews can provide depth and contextual understanding, but their findings should not be interpreted as population-level prevalence estimates. Stakeholder consultations add a third perspective by examining the institutional, technical and implementation environment surrounding the prospective participants.

The WP2 research design therefore explicitly established three converging evidence streams: the baseline survey under T2.2; qualitative research including interviews, focus groups and case-based evidence under T2.4; and stakeholder mapping and consultation under T2.3. These streams are brought together through triangulation in D2.1.

This design is particularly appropriate for a gender-responsive assessment. Gender-related barriers are often embedded in interactions between material conditions and social relations. A transport problem, for example, is simultaneously an infrastructure issue, a financial issue and potentially a gendered mobility constraint. Similarly, access to agricultural land or credit cannot be interpreted solely through whether a household reports having access; it is also necessary to consider who controls the resource and who can decide how it is used. The mixed-methods design makes it possible to examine such relationships from several complementary perspectives.

4.1 Mixed-methods design

The WP2 methodology follows an integrated mixed-methods logic, in which the different methods contribute different forms of evidence to the same analytical framework rather than operating as independent studies.

The research design allocated different methodological strengths to the five analytical dimensions introduced in Section 3. Socio-economic conditions were primarily examined through the quantitative survey and complemented by qualitative accounts. Gender dynamics and agency relied more heavily on interviews and focus groups, with survey indicators providing broader contextual information. VET and training gaps were assessed through a combination of survey and qualitative evidence. Agriculture, water and climate adaptation were investigated through mixed methods with a stronger qualitative contribution, while cooperativism and the institutional landscape were primarily addressed through stakeholder engagement and key-informant evidence.

This integration is consistent with the WP2 implementation responsibilities. OpenCom developed the research framework, sampling methodology, survey, interview and focus-group protocols and research ethics; Elemtiez led the quantitative fieldwork and qualitative research; GIY led stakeholder mapping and consultations; UTAP facilitated access to farmers, rural networks, communities and local actors; and the European VET partners contributed technical and pedagogical validation.

Crucially, the mixed-methods approach was not intended simply to accumulate evidence. Its purpose was to allow findings from one source to be confirmed, qualified, explained or challenged by another source. This principle is central to the interpretation of results throughout D2.1.

4.2 Quantitative survey

The quantitative component of WP2 consisted of the baseline questionnaire Territorial Diagnosis for Sustainable and Hydroponic Agriculture Development. Data collection followed a mixed administration approach. Approximately half of the questionnaires were self-completed online by respondents through the EUSurvey platform ("<https://ec.europa.eu/eusurvey/runner/SheGrows2026>"), while approximately half were administered with the assistance of field pollsters in rural areas of Béja and Jendouba. For the field component, pollsters approached potential respondents directly, particularly through door-to-door outreach and in rural markets, and recorded their responses

electronically through the same EUSurvey questionnaire. EUSurvey therefore functioned both as the online self-completion interface and as the common digital data-capture tool for field-administered responses. Arabic was used for field administration to facilitate comprehension and participation among rural respondents.



The survey platform recorded 1,038 submissions, exceeding the project target of 1,000. The final respondent-level analytical export available for D2.1 contains 1,031 valid records and is used for the gender-disaggregated analyses in this report. See Annex A for the evidence inventory and Annex B for the statistical tables.

The questionnaire addressed the principal domains required by SO1 and the five-dimensional analytical framework. These included socio-demographic characteristics, livelihood conditions, agricultural practices, water access and climate pressures, gender and decision-making, access to productive resources, VET and training experience, logistical barriers to training, digital readiness, cooperativism and collective action, and awareness of and interest in hydroponic agriculture.

Sampling approach

The WP2 research design initially envisaged a stratified random/quota sampling approach, with gender, age, household headship and proximity to VET infrastructure identified as important stratification variables. In implementation, recruitment combined the online dissemination of the questionnaire with direct field outreach in rural communities. Field pollsters approached respondents through door-to-door visits and in rural markets in Béja and Jendouba, helping to extend participation beyond people who were able or inclined to respond independently online. The available reporting documentation does not provide a sufficiently detailed fieldwork log to reconstruct the exact number of pollsters, the complete list of localities covered, or the application of formal quotas during field recruitment. These elements are therefore not retrospectively inferred in D2.1.

For D2.1, the survey is treated principally as a large descriptive baseline rather than as a statistically weighted population estimate.

The achieved analytical sample is not gender-balanced. Of the 1,031 valid respondent-level records, 629 are men (61.0 %), 393 are women (38.1 %) and 9 respondents (0.9 %) preferred not to disclose gender. The 393 women respondents provide a substantial descriptive subsample for within-sample gender comparisons, but these comparisons are not population estimates.

Analytical treatment

The quantitative analysis is primarily descriptive. Frequencies and percentages are used to characterise the study population and identify patterns relevant to the design of SHE-GROWS.

For D2.1, the methodological priority is not simply to reproduce aggregate percentages from the baseline questionnaire report. Particular attention is given to gender disaggregation and, where the underlying data permit, to intersections with variables such as age, household-headship status, educational profile, territorial location and other



indicators of vulnerability. This is necessary because an overall sample percentage may conceal substantially different conditions among women and men or among different categories of women.

A further distinction is made between variables measuring access and those that can reasonably be interpreted as control or agency. For example, reported household access to land, finance or water should not automatically be interpreted as evidence that women personally own or control those resources. Such questions are therefore interpreted jointly with qualitative evidence on decision-making and women's agency rather than in isolation.

Survey limitations

The mixed administration approach helped broaden participation beyond respondents able to complete the questionnaire independently online. Field-assisted data collection through door-to-door outreach and rural-market contact was particularly valuable for reducing potential exclusion associated with limited internet access or digital confidence. Nevertheless, the achieved sample should not be interpreted as statistically representative of the rural population of Béja and Jendouba. Online self-selection and direct field recruitment may reach different respondent profiles, and the available dataset does not contain a sufficiently detailed administration-mode variable to assess possible mode effects systematically. The survey is therefore treated as a large descriptive baseline and triangulated with focus groups, interviews and stakeholder evidence.

These recruitment dynamics most plausibly explain several counter-intuitive gender patterns reported in Annex B. Where the female subsample records higher market access (57.5 % against 28.1 %), higher digital-device access, stronger cooperative readiness (59.5 % against 27.8 %) and greater prior awareness of hydroponics (43.5 % against 15.9 %) than the male subsample, this most likely reflects who the survey reached rather than a genuine female advantage. Under both administration modes, and reinforced by the purposive qualitative recruitment, the women reached appear disproportionately to be those already connected to markets, digital tools and agricultural or women's organisations. These figures are therefore best read as characteristics of the women the study reached, not of rural women in the two governorates as a whole. The implication for WP5 is direct: reported readiness, awareness and access probably overstate the position of the harder-to-reach women the pilot is expected to include, which reinforces the recommendation to recruit beyond already organised groups and to verify readiness locally rather than infer it from these values.

The principal methodological role of the survey results in D2.1 is to establish the scale and distribution of reported conditions and to identify patterns that can then be interpreted through the qualitative evidence.

The survey instrument itself underwent partner review for content validity and cultural appropriateness and was pilot-tested before full deployment. The baseline documentation also records preparation in English and translation into French and Arabic, including back-translation of key items.

4.3 Qualitative evidence

The qualitative component provides the interpretive depth required to understand how the conditions identified through the survey are experienced, negotiated and understood by rural communities and the institutions working with them.

The original WP2 research framework envisaged purposive, maximum-variation qualitative sampling involving rural women, agricultural practitioners, community actors and key institutional informants, together with gender-separated focus groups and stakeholder engagement. The achieved qualitative evidence consists of 27 in-depth interviews, 10 key-informant interviews, a women's focus group with six participants and a men's focus group with 11 participants, complemented by stakeholder mapping and consultations. Sample details and analytical roles are summarised in Annex A.

4.3.1 Women's focus group

A women's focus-group session was conducted in Ain Draham, Jendouba, on 13 April 2026, involving six participants. The discussion was conducted in Tunisian dialectal Arabic, allowing participants to express their views in a familiar

linguistic setting. The post-session report describes the discussion as open and participatory, while also noting differences in the degree to which individual participants contributed to the conversation.



The focus group had two complementary analytical functions. First, open discussion generated qualitative evidence concerning participants' agricultural experiences, perceptions, needs, aspirations and preferred forms of support. Second, a structured obstacle-ranking exercise required participants to rank identified barriers from 1, representing the greatest obstacle, to 8, representing the least important obstacle. Lower mean scores therefore indicate greater perceived severity.

The ranking exercise is useful because it provides a structured comparison of priorities within the group, but it is not treated as a statistical estimate of the wider population. Its primary value lies in showing relative priority and within-group heterogeneity. This is particularly important where mean values conceal disagreement. For example, the women's report records substantial variation in the way traditions and social expectations were ranked, demonstrating that social constraints were not experienced uniformly across participants.

Accordingly, D2.1 uses both the ranking scores and the accompanying qualitative discussion. The rankings indicate what participants prioritised, while the discussion helps explain why, under what circumstances, and for whom a particular barrier matters.

4.3.2 Men's focus group

A separate men's focus-group session was held in Jendouba on 25 April 2026, involving 11 participants, also in Tunisian dialectal Arabic. The post-session report records an interactive and open discussion, while noting unequal levels of participation among group members.



The men's focus group used the same obstacle-ranking logic, with 1 representing the greatest obstacle and 8 the least important. This methodological consistency makes it possible to compare the pattern of priorities expressed in the two groups, but the two samples are not combined into a single numerical ranking.

The role of the men's group in a gender-responsive study requires careful interpretation. Men's perceptions are valuable for understanding household and community attitudes, agricultural concerns, perceived support for women's participation and the wider social environment. They should not, however, be used as substitutes for women's accounts



of their own constraints. When men and women interpret the same issue differently, that divergence is itself an important finding rather than a discrepancy to be eliminated.

This is especially relevant because the male focus-group report identifies economic, technical and environmental constraints as particularly important while social and cultural barriers were generally rated as less important, although substantial variation remained within the group. The report itself notes that these patterns differ from the more heterogeneous assessment of social and family-related barriers within the women's group.

4.3.3 In-depth interviews and key-informant interviews

The interview component comprised two complementary strands within the same qualitative evidence stream: 27 in-depth interviews with rural women and agricultural practitioners, exceeding the target of at least 20, and 10 key-informant interviews with institutional and organisational stakeholders, meeting the target of at least 10. Keeping the two interview types together reflects their common qualitative logic, while maintaining a clear analytical distinction between lived-experience evidence and institutional or expert evidence.

The 27 in-depth interviews were analysed primarily as experiential and contextual evidence. They provide detailed insight into agricultural livelihoods, household decision-making, access to resources, training experience, climate adaptation, aspirations, collective action and the practical mechanisms through which barriers affect women at individual and household level. The interview sample is purposive and contains a relatively high proportion of women already connected to agricultural organisations or women's groups, which is considered when interpreting collective-action findings.

In accordance with T2.4, which foresaw documentation of local agricultural methodologies and climate-adaptation practices, the in-depth interview material was also reviewed for case-based evidence. Because the available qualitative dataset is organised primarily through anonymised thematic analysis rather than complete publishable individual biographies, D2.1 presents four anonymised case-based syntheses in Section 5.6. These draw only on practices and experiences documented in the interview corpus and are intended to illustrate mechanisms and local adaptation pathways. They do not constitute additional participants, are not counted as a separate sample, and should not be interpreted as prevalence evidence.

The 10 key-informant interviews were analysed primarily as institutional, technical and organisational evidence. Relevant profiles include agricultural organisations, rural women's organisations, technical services and VET actors. They provide evidence on training accessibility, technical support, institutional coordination, administrative procedures, cooperative development and the support environment required for implementation.

The two strands are therefore complementary rather than interchangeable. A rural woman describing her own difficulty attending training provides direct lived-experience evidence; a key informant identifying transport as a common barrier provides an institutional assessment. Convergence strengthens interpretation, while divergence is retained as an analytical result.

Across both strands, recurring themes include practical training, transport and mobility, finance, water and climate pressures, technical follow-up, market access, cooperative development and institutional coordination. D2.1 uses this evidence to explain mechanisms and implementation conditions.

Detailed qualitative source characteristics are recorded in Annex A, while the focus-group rankings are reproduced in Annex C and the institutional ecosystem is consolidated in Annex D.

4.3.4 Stakeholder engagement and consultations

Stakeholder engagement under T2.3 complements the formal KII evidence by mapping organisations, support functions, coordination gaps and possible referral pathways relevant to training, technical assistance, finance, cooperative formalisation and markets. This stream is treated separately from the interview count to avoid double-counting institutional respondents. Its principal analytical output is the institutional and stakeholder map presented in Annex D.

4.4 Triangulation protocol

Triangulation constitutes the central analytical mechanism through which the different WP2 evidence sources are integrated into D2.1. The purpose is not simply to compare results obtained through different methods, but to determine whether the evidence converges, complements, qualifies or contradicts across participant groups and research instruments.

The WP2 Research Design Framework established three principal evidence streams: the quantitative baseline survey under T2.2; qualitative field research under T2.4, comprising in-depth interviews, key-informant interviews, focus groups and case-based evidence; and stakeholder engagement under T2.3. These streams were deliberately designed to contribute differently to the five analytical dimensions and to converge in the final Gender-Responsive Mapping Report.

Within the qualitative stream, the different methods are also kept analytically distinct. In-depth interviews contribute primarily experiential evidence from local agricultural populations, while key-informant interviews provide institutional, technical and organisational interpretations. Women's and men's focus groups provide group-based perspectives, including structured barrier-ranking exercises and discussion of shared and divergent perceptions. Stakeholder engagement provides a further implementation-oriented perspective on the institutions, services and networks that may support or constrain the subsequent SHE-GROWS intervention.

The resulting triangulation framework therefore operates across the following evidence sources:

Evidence source	Primary analytical contribution
Quantitative baseline survey	Describes the distribution of reported socio-economic conditions, agricultural practices, gender-related constraints, training access, digital readiness, cooperative participation and hydroponics awareness and interest within the respondent sample.
Women's focus group	Provides direct group-based evidence on women's priorities, lived constraints, aspirations, perceptions of hydroponics and preferred forms of training and support.
Men's focus group	Provides a complementary perspective on agricultural constraints, household and community attitudes, and perceptions of the conditions affecting women's participation.
In-depth interviews	Provide detailed experiential evidence on how barriers and opportunities operate at individual, household and livelihood level.
Key-informant interviews	Provide institutional and expert perspectives on training systems, technical support, finance, extension, cooperative development, administration and other enabling conditions.
Stakeholder engagement and consultations	Map the wider institutional ecosystem and identify possible roles, coordination gaps and implementation partnerships relevant to WP3, WP4 and WP5.

This distinction is important because evidence quality depends not only on how many sources mention an issue, but also on who is speaking and from what position. A woman describing difficulty attending training because of transport and family responsibilities provides a different type of evidence from an institutional representative identifying transport as a barrier affecting rural women. Both are valuable, but they are not treated as interchangeable.

Triangulation at the level of the finding

Triangulation is conducted at the level of each substantive finding rather than by presenting the results of each research method in isolation. For example, finance, transport, training access, water availability, household responsibilities or cooperative trust are examined across all relevant sources before an integrated interpretation is formulated.

Each major finding is classified according to the relationship between the available sources:

Triangulation status	Interpretation
Convergent evidence	Two or more independent evidence sources identify the same barrier, enabling condition or implementation need. Where convergence occurs across different participant types and methods, confidence in the finding is strengthened.
Complementary evidence	Different sources identify different aspects of the same issue. For example, the survey may indicate the frequency of a reported constraint, while interviews explain how and why it affects participation.
Divergent	Evidence sources or participant groups interpret the same issue differently. Divergence is retained as



evidence	an analytical result and examined for possible explanations rather than removed through averaging.
Single-source evidence	A finding appears in only one source or a limited number of accounts. It may remain relevant, particularly for vulnerable subgroups, but is reported cautiously and not generalised beyond the available evidence.
Evidence gap	The available material does not permit a sufficiently robust conclusion. The gap is explicitly identified rather than filled through assumption.

This framework is particularly important for gender-responsive analysis. Differences between women's direct accounts, men's perceptions and institutional interpretations are themselves analytically meaningful. For example, the women's focus group showed considerable heterogeneity in perceptions of traditions and social expectations, while the men's group generally ranked these barriers as less important than economic, technical and environmental constraints. Rather than seeking a single average interpretation, D2.1 uses such differences to understand how social constraints may vary between households, individuals and perspectives.

Similarly, key-informant evidence can help explain why an apparently simple barrier has several underlying mechanisms. Interviews with institutional and agricultural actors repeatedly identified transport, finance, irregular or insufficient training, limited technical follow-up and weak institutional coordination as factors affecting participation and implementation. These perspectives can then be compared with direct participant evidence and survey results to determine whether they are corroborated.

Distinguishing prevalence, experience and institutional interpretation

An important principle of the triangulation protocol is that different methods answer different types of questions.

The survey is primarily used to describe the prevalence or distribution of reported conditions within the achieved sample.

The focus groups identify group-level priorities, shared interpretations and variation in perceptions.

The in-depth interviews explain individual and household experiences and the mechanisms through which barriers influence behaviour and choices.

The key-informant interviews explain institutional, technical and organisational conditions.

The stakeholder consultations identify the wider support ecosystem, institutional roles and opportunities for coordinated implementation, and are consolidated in the stakeholder and institutional map in Annex D.

Accordingly, a qualitative statement is not converted into a quantitative claim, and an institutional perception is not represented as women's direct experience. This distinction protects the methodological integrity of the evidence.

Example of the triangulation logic

Analytical issue	Survey	Focus groups	In-depth interviews	Key-informant interviews	Stakeholder evidence	Integrated interpretation
Finance and investment	Indicates reported financial constraints and access conditions	Women rank investment capital among the most important barriers; men also identify finance as a major	Explains how limited resources affect the ability to move from training to implementation	Identifies post-training financing and investment gaps	Helps identify possible finance/support actors	Finance is treated as both an access constraint and a major transition barrier between training and productive adoption

Training and technical support	Indicates previous training, interest and preferred modalities	Participants emphasise practical learning and follow-up	Explains previous training experiences and barriers to participation	Identifies lack of specialised trainers and continuity of support	Identifies VET and extension actors	Training quality, accessibility and post-training support are treated as separate but interconnected conditions
Mobility and transport	Captures logistical barriers where reported	Provides participant perspectives on accessibility	Shows how distance, cost and household circumstances affect participation	Institutional actors repeatedly identify transport as a major constraint	Helps identify potential local delivery arrangements	Training proximity and mobility support become design requirements rather than secondary considerations
Gender and household constraints	Provides indicators of decision-making and perceived barriers	Women's and men's perspectives can be compared	Provides direct evidence of individual and household negotiation	Provides external assessments of constraints affecting rural women	Indicates opportunities for community and family engagement	Gender barriers are treated as context-dependent and interacting with economic and logistical constraints
Cooperativism	Indicates current membership and willingness	Explores confidence and trust in collective action	Identifies individual expectations and concerns	Identifies administrative and organisational requirements	Maps cooperative and institutional support structures	Cooperative development requires gradual trust-building, governance skills and continued institutional assistance

The strength of a conclusion is therefore determined by the quality, independence and consistency of the available evidence, not simply by the number of times a theme is mentioned.

Triangulation also prevents overinterpretation. Where the survey indicates broad interest in hydroponics but qualitative evidence identifies concerns about finance, transport, technical complexity or follow-up, interest is interpreted as an enabling condition, not as evidence that participants are already ready to adopt the technology. Conversely, a barrier identified by only a minority of participants is not dismissed if it may create severe exclusion for a particular group.

The protocol ultimately allows D2.1 to move from a collection of separate findings towards an integrated explanation of what constrains women's participation, how those constraints operate, where they occur along the participant pathway, and which combinations of interventions are most likely to address them.

4.5 Ethics, confidentiality and reflexivity

Ethical considerations were incorporated into the WP2 methodology from the research-design stage. The WP2 framework assigned responsibility for defining research ethics, data-quality standards and gender-inclusive research procedures alongside the development of the survey, interview and focus-group instruments.

The approved Research Design Framework identifies five core principles for qualitative fieldwork: informed consent, confidentiality, do no harm, cultural sensitivity and reciprocity. Participants were to be informed clearly about the purpose of the study, intended use of the information collected and their right to withdraw. The framework allowed verbal or written consent according to literacy and field conditions. It also required anonymisation during transcription, exclusion of participant names from deliverables and secure storage of research material.



Informed and voluntary participation

Participation in the survey, focus groups and interviews was based on the principle of informed and voluntary participation. This is particularly important in a project involving rural populations and institutional stakeholders because participants may associate research activities with future access to training, financial assistance, equipment or other project benefits.

Care is therefore required to avoid creating expectations that participation in the WP2 research guarantees subsequent selection for training, financial support, cooperative membership or other project opportunities. The analytical use of participants' contributions should remain separate from decisions concerning future project participation.

Confidentiality and anonymisation

Confidentiality is particularly important in relation to qualitative evidence because accounts may contain information about household relationships, financial difficulties, institutional performance, trust, community expectations or barriers affecting women's participation.

In accordance with the WP2 ethical framework, individual names do not appear in D2.1. Focus-group participants and respondents to in-depth interviews are therefore represented using anonymised participant categories or evidence codes.

The same principle applies to key-informant interviews. Where institutional context is necessary for interpreting a finding, D2.1 refers to the type of institution, professional function or stakeholder category rather than identifying the individual respondent. For example, evidence may be attributed to an agricultural organisation representative, rural women's organisation, extension actor, VET stakeholder or local agricultural practitioner when such context is analytically relevant.

Institutional information is retained only to the extent necessary to understand the evidence and to map the support ecosystem. The objective is to preserve analytical value without unnecessarily identifying individual respondents.

This approach is also consistent with the sensitive nature of D2.1, which is classified as SEN - Sensitive in the approved project documentation.

Cultural and linguistic sensitivity

The research design explicitly required cultural sensitivity in the implementation of fieldwork. It specified the use of Arabic and/or French according to participant needs, scheduling that respects agricultural calendars and women's responsibilities, and female researchers for interviews with women where appropriate.

The documented women's and men's focus groups were conducted in Tunisian dialectal Arabic. This was important for enabling participants to discuss everyday experiences, social relationships and agricultural practices in a familiar linguistic form rather than requiring them to express complex experiences in a more formal reporting language.

Translation into English for D2.1 therefore represents an analytical step. Terms relating to household responsibilities, social expectations, cooperation, trust, authority or local agricultural practices may carry contextual meanings that do not always have exact equivalents in English. The report consequently prioritises the meaning of participants' statements over overly-literal translation, while avoiding interpretations that are not supported by the source material.

Do no harm

The do-no-harm principle is especially relevant when discussing gender relations, economic vulnerability, institutional trust and household decision-making. The WP2 research framework explicitly required researchers to be prepared for sensitive disclosures and to manage potentially distressing conversations appropriately.

D2.1 therefore avoids framing participants as deficient, resistant to innovation or lacking motivation simply because they face barriers to participation. Constraints such as lack of finance, mobility, time, access to technical support or

decision-making authority are analysed as conditions within the surrounding environment rather than as individual shortcomings.

Similarly, the report does not describe rural women as a homogeneous vulnerable group. The women's focus-group evidence itself demonstrates considerable heterogeneity in the importance attached to different barriers. The analysis therefore preserves variation in experience and agency.

Reflexivity in qualitative interpretation

Reflexivity is a central safeguard in the interpretation of qualitative evidence. Interviews and focus groups are not neutral measurement instruments. What participants say can be influenced by the identity of the interviewer, the presence of other participants, perceived expectations of the project, institutional relationships, language and the social setting in which the discussion takes place.

The post-session reports for both focus groups explicitly note differences in the level of participation among participants, despite generally open and constructive discussions. This means that themes mentioned frequently in group discussion may partly reflect the contributions of more vocal participants and should not automatically be interpreted as unanimous group positions.

The same caution applies to the barrier-ranking exercises. Mean rankings are useful for identifying relative priorities, but they can conceal substantial disagreement between participants. In the women's group, for example, traditions and social expectations received highly divergent rankings. The final analysis therefore considers both the mean ranking and the dispersion of individual responses.

Reflexivity also requires recognising the different positionalities represented by the two interview types. In-depth interview participants speak primarily from personal and livelihood experience, whereas key informants speak partly from professional or institutional experience. Neither perspective is treated as inherently superior. Instead, each is interpreted according to what that source is positioned to know.

Similarly, male participants can provide important evidence concerning community attitudes, household dynamics and the social environment, but their accounts are not used to override women's descriptions of their own experiences. Differences between the groups are retained as evidence of potentially different perceptions of the same social conditions.

Institutional respondents may also have incentives to emphasise particular needs, achievements or constraints associated with their organisations. Statements concerning institutional capacity, service availability or programme effectiveness are therefore interpreted as informed perspectives unless independently corroborated.

Reciprocity and responsible use of findings

The ethical framework also incorporates the principle of reciprocity, meaning that participants should not be treated solely as sources of information. The Research Design Framework states that participants should be informed about project objectives and expected community benefits and that findings should be communicated back appropriately.

In D2.1, reciprocity is operationalised primarily through the practical use of evidence. Findings concerning mobility, training accessibility, technical support, finance, household constraints or cooperative governance should translate into concrete adjustments in WP3, WP4 and WP5 rather than simply being documented.

This is particularly important because WP2 was explicitly designed as the evidence base for curriculum development, trainer capacity building and pilot/cooperative implementation. The ethical value of the research therefore lies partly in ensuring that the realities expressed by respondents are reflected in subsequent project decisions.

Taken together, these safeguards support a methodology that is not only technically credible but also gender-responsive, culturally sensitive and proportionate to the vulnerability and diversity of the participant groups. Confidentiality protects participants, reflexivity limits overinterpretation, triangulation distinguishes direct experience from external perception, and reciprocity ensures that the evidence collected is used to improve the relevance and accessibility of subsequent SHE-GROWS interventions.

5. Territorial, Socio-economic and Agricultural Context



The capacity of rural women to engage with hydroponic agriculture cannot be understood independently of the territories, livelihoods and production systems in which they are already embedded. In Béja and Jendouba, agriculture is not simply an economic sector or a potential area for innovation. For a large proportion of the WP2 respondents and interview participants, it is directly connected to household income, food production, livestock management, seasonal employment, processing activities and wider strategies for coping with economic and climatic uncertainty.

The evidence generated through WP2 depicts a rural context characterised by substantial agricultural knowledge and diversified livelihood strategies, but also by pronounced exposure to water scarcity, climatic variability, rising production costs, infrastructure limitations and restricted market opportunities.

The qualitative fieldwork is particularly valuable because it covers localities including Tibar, Djebba, Nefza, Ouled Gacem, Sidi Kacem, Souk El Jemaa, Tabarka and the wider Jendouba area. These locations encompass irrigated and rain-fed systems, forested and non-forested areas, and communities with differing levels of infrastructure and institutional support. The evidence therefore cautions against treating Béja and Jendouba as homogeneous agricultural territories or assuming that one technical model will be equally appropriate across all locations.

This chapter consequently establishes the structural baseline for the gender-responsive adoption analysis that follows. It focuses on those territorial, socio-economic and agricultural conditions that directly influence the feasibility of participation, training, investment and subsequent livelihood use. Figure 1 summarises the main territorial, livelihood and resource conditions that shape the context in which women's hydroponic adoption would take place.

5.1 Respondent and participant profile

The quantitative baseline used for analysis consists of 1,031 valid respondent records from rural and agricultural households, mainly in Jendouba and Béja. Of these, 629 are men (61.0 %), 393 are women (38.1 %) and 9 respondents (0.9 %) preferred not to disclose gender. The survey should therefore not be described as gender-balanced, although the female subsample is sufficiently large for descriptive gender comparisons relevant to intervention design. These comparisons are reported as sample patterns, not population estimates. See Annex B, Tables B.2 and B.16f.

The age distribution is concentrated primarily in the 35-44 and 45-54 age groups, while respondents aged 18-34 are also represented and older age groups are less prominent. This creates an intervention population that includes both established adult agricultural decision-makers and younger participants who may be considering new productive or training pathways.

Educational attainment is similarly heterogeneous. Most survey respondents have at least secondary education, with upper-secondary qualifications and professional diplomas particularly visible. The qualitative interviews, however, demonstrate a still wider spectrum, extending from women with no formal schooling through primary and secondary education to three-year vocational diplomas and university degrees. Crucially, formal education level does not correspond directly to the absence or presence of agricultural knowledge. Interview participants across educational categories demonstrated detailed practical knowledge of livestock, crop production, processing, local environmental conditions and farming adaptation.

Household position is also relevant. In the valid survey dataset, 509 respondents (49.4 %) identify as household heads and 522 (50.6 %) do not. Household-head status is almost identical among women (49.9 %) and men (49.3 %). The qualitative sample additionally includes female household heads, married women, widows managing farming alongside care responsibilities and younger women living in parental households. Several interviewees participate actively in women's development groups and agricultural collectives that function as channels for training, equipment, information and engagement with agricultural institutions.

This diversity is analytically important. The prospective SHE-GROWS participant should not be conceptualised as a single "rural woman" profile. A woman managing livestock as a household head, a young unemployed graduate, a member of an agricultural development group, a woman with limited formal schooling but extensive farming knowledge, and a participant living in a remote rain-fed area may encounter very different entry conditions for training and agricultural innovation.

The profile therefore supports a differentiated intervention model. Training, communication and support arrangements will need sufficient flexibility to accommodate different educational backgrounds, agricultural experience, household situations, levels of institutional connection and access to productive resources.

Agriculture is central to the socio-economic context captured by WP2. In the valid survey dataset, 842 respondents (81.7 %) report agriculture as the household's main source of income. The gender-disaggregated pattern is also relevant: 87.0 % of women respondents report agriculture as the main household income source compared with 78.5 % of men. This does not demonstrate individual control over agricultural income, but it confirms the high livelihood relevance of the intervention for women in the achieved sample (Annex B, Table B.16).

Table 5.1: Key contextual indicators from the baseline survey

Indicator	WP2 evidence	Relevance to D2.1
Survey submissions / valid analytical records	1,038 submissions / 1,031 valid records	Collection target exceeded; respondent-level gender analysis uses the 1,031-record analytical export
Women in analytical sample	393 (38.1 %)	Requires gender-disaggregated interpretation rather than reliance on whole-sample averages
Household heads	509 (49.4 %)	Captures both formal household heads and other influential household members
Agriculture as main household income	842 (81.7 %)	Agricultural innovation directly affects livelihood security
Access to agricultural land	891 (86.4 %)	High reported access, but not equivalent to ownership, control or site suitability
Difficulty accessing agricultural inputs	547 (53.1 %)	Important constraint on agricultural innovation and input-dependent technologies
Access to credit/microfinance	719 (69.7 %)	Access does not establish affordability, suitability or women's control of investment
Access to extension/advisory services	672 (65.2 %)	Potential support base, while 34.8 % remain outside these services
Access to digital devices	665 (64.5 %)	Supports blended delivery but not digital-only approaches
Access to agricultural markets	409 (39.7 %)	Market access remains a major structural bottleneck

5.2 Dependence on agriculture and livelihood vulnerability

Agriculture is central to the socio-economic context captured by WP2. 81.7 % of survey respondents reported agriculture as their household's main source of income, making livelihood considerations fundamental to any discussion of hydroponic adoption.

The qualitative evidence adds an important dimension to this figure. Rural women's livelihoods are rarely based on a single crop or agricultural activity. Instead, the 27 interviews describe what can be understood as diversified livelihood portfolios, in which women combine several sources of production and income in order to manage risk.

Interview participants reported small-scale irrigated and rain-fed cropping, including figs, vegetables, cereals, fodder and Egyptian spinach; livestock activities involving dairy cattle, sheep, goats, poultry and quail; beekeeping; processing activities such as cheese-making, drying peppers and Egyptian spinach, producing fig jam and dried figs, and distilling aromatic plants; and supplementary activities including pottery, mergoum weaving ¹and seasonal agricultural labour.

This diversification should not simply be interpreted as entrepreneurial variety. It also functions as a risk-management strategy in an environment where individual agricultural income sources can be highly unstable. The interviews reveal pronounced seasonality. Milk and other livestock products can provide relatively regular income, whereas crop income is concentrated around specific harvest periods, such as figs in summer and olives in winter. Households therefore combine activities partly because crop revenues are affected by climate variability, water availability, market fluctuations and land constraints.

¹ A traditional Tunisian flat-woven wool carpet craft featuring geometric patterns and raised embroidered motifs.



Several structural pressures intensify this vulnerability. Interview accounts converge around four particularly important conditions: water scarcity, high input costs, weak infrastructure and financing constraints. Rising prices for fertilisers, seeds and livestock feed have led some households to reduce cultivated areas or alter livestock holdings. Poor or non-existent roads increase the physical burden of transporting water and create difficulties in bringing milk and other perishable products to market. Limited access to suitable finance has led some women to rely on solidarity loans or even personal assets such as jewellery to finance agricultural activities.

The situation is particularly precarious for households in which agricultural uncertainty combines with reduced labour or income security. The interviews include widowed women who simultaneously manage farming, income generation and care responsibilities without a second adult income. More generally, women emphasise that agricultural earnings remain important for everyday expenses, including food and children's education, even when another household member receives a salary.

The livelihood picture emerging from WP2 is therefore not one of agricultural inactivity waiting to be replaced by a new technology. It is one of active but vulnerable livelihood systems in which households already combine multiple productive strategies.

This distinction has important implications for SHE-GROWS. Hydroponics should be considered in relation to existing livelihood portfolios rather than presented as a replacement for agriculture as currently practised. For some women, a small hydroponic activity could potentially complement livestock, processing, rain-fed farming or other household activities. For others, investment requirements, water conditions, markets or workload may make it less immediately suitable. Those questions are examined in greater detail in Sections 7 to 9.

Stakeholder evidence reinforces the need for this livelihood orientation. In Béja, one institutional informant stressed that the central challenge is not simply increasing production but enabling farmers to add value through processing and marketing. Local experience in areas such as Nefza was cited as showing the potential importance of linking production to transformation and sales instead of concentrating exclusively on primary production.

The resulting analytical conclusion is that economic resilience depends not only on producing more, but on stabilising production, diversifying income, reducing avoidable costs and improving the capacity to capture value from what is produced.

5.3 Agricultural systems and current practices

The agricultural context is highly diversified. Survey respondents reported livestock, cereals, vegetables, fruit and olive trees, alongside mixed farming systems. Livestock was the most frequently cited agricultural activity, but the overall pattern demonstrates extensive experience across both crop and animal production.

The 27 interviews provide substantially greater detail. Crop production includes vegetables such as peppers, tomatoes, cucurbits and legumes; cereals and other field crops including wheat, barley and oats; arboriculture including figs, olives, grapes and lemons; and some aromatic or ornamental plants such as lavender. Livestock systems include dairy cattle, sheep, goats, poultry and quail. These activities are often connected through fodder use and recycling of agricultural by-products. Beekeeping, aromatic-plant collection and essential-oil distillation also form part of the productive landscape, particularly where forest and aromatic resources are available.

The field evidence also reveals substantial variation in production environments. Some participants operate within public irrigated perimeters with access to water points or wells. Others farm primarily under rain-fed conditions and depend on rainfall and rainwater storage. Some have access to land but lack a formal irrigation point and therefore transport water manually or purchase it from external sources.

This territorial heterogeneity is reinforced by the broader qualitative sampling, which deliberately includes irrigated and rain-fed areas, forested and non-forested landscapes, and communities with different infrastructure and institutional conditions.

Agricultural knowledge in these communities should not be reduced to conventional or "traditional" production in opposition to innovation. The interviews document several adaptive practices already used by women. These include

compost and manure application to maintain soil fertility, crop rotation, erosion-control practices, strategic crop combinations to make better use of irrigation water, and the use of locally adapted or more drought-tolerant crops. In fig orchards, for example, some women described planting cucurbits within irrigation basins around the trees to maximise use of scarce irrigation water and reduce evaporation.

These practices demonstrate an important principle for SHE-GROWS: innovation should build on existing agronomic knowledge and not assume that local agricultural systems lack adaptive capacity.

Institutional interviews also suggest some territorial differentiation that should be respected. A stakeholder in Jendouba described a diversified agricultural base including cereals, vegetables, livestock and fruit production. In Béja, another informant emphasised the importance of cereals and field crops and explicitly cautioned against transferring agricultural models from other regions without adapting them to Béja's production systems and agricultural identity. These statements reinforce the broader evidence that territorial adaptation is necessary.

For D2.1, the appropriate interpretation is therefore that hydroponics should be evaluated as a potential complementary production option within diverse existing farming and livelihood systems, rather than as a uniform substitute for soil-based agriculture. The relevance of particular crops, system types and scales will need to be judged against local production practices, resource availability, technical capacity and market opportunities.

5.4 Water and climate pressure

Water and climate conditions form one of the clearest areas of convergence across the WP2 evidence base. In the quantitative survey, rainwater is the most frequently reported agricultural water source, followed by public networks, wells, rivers and dams. Groundwater-based production and rain-fed agriculture are both strongly represented, alongside surface and drip irrigation.

This diversity of sources should not be interpreted as security of access. Most survey respondents rated the impact of water scarcity on agricultural production during the previous three years as moderate to high, while only a small proportion reported little or no effect. Respondents also identified reduced yields, plant diseases and pests, erosion, drought and heat stress among recent climatic impacts.

Qualitative interviews add a strong longitudinal and experiential dimension. Across the different field sites, women described prolonged droughts, increasingly erratic rainfall, rainfall arriving at unsuitable periods for crop development, drying or reduced flow of springs and other natural water sources, hotter summers and heatwaves, and increasing evaporation. They also reported soil hardening, declining fertility, fungal disease and insect pressure affecting vegetables, legumes, fruit trees and ornamental crops.

Water pressure is not experienced uniformly. In irrigated areas, women may use public water points or shallow wells and sometimes adopt drip irrigation to stretch limited supplies. In non-irrigated areas, agriculture may depend mainly on rainfall, SONEDE² water and rainwater cisterns, with available water prioritised between crops, livestock and household needs. Other participants reported purchasing tanker water or obtaining water from neighbouring wells, creating additional financial and labour costs.

These pressures are already changing agricultural behaviour. Interview participants reported reducing cultivated areas, abandoning some water-demanding crops, shifting sowing or planting dates and favouring local or more drought-resistant varieties. Livestock systems are affected as well, because water shortages interact with rising feed costs and can lead households to sell animals in order to purchase fodder.

Crucially, women are not responding to these pressures solely through withdrawal from agriculture. The interviews document active adaptation through crop diversification, drought-tolerant varieties, soil conservation, drip irrigation and other water-management strategies.

When asked what would improve their farming conditions, women proposed better irrigation infrastructure, improved maintenance of water networks, solar-powered pumping for wells, rainwater harvesting, improved cisterns, drip irrigation and greater access to training on climate-sensitive production and crop protection. Hydroponics was also frequently perceived by participants as a potentially important water-related innovation.

² National water exploitation and distribution company.



That perception is relevant to SHE-GROWS, but it should be interpreted carefully. The evidence demonstrates strong interest in hydroponics as a possible response to water constraints, not proof that every hydroponic configuration will automatically be feasible or water-secure in every location.

The contextual conclusion is therefore stronger than a simple statement that "water scarcity creates an opportunity for hydroponics." WP2 shows that water scarcity affects production, income, crop choice, labour and investment decisions simultaneously. Any hydroponic intervention must consequently be evaluated against these existing water realities and embedded within wider climate-adaptation and resource-management strategies.

5.5 Access to productive assets and services

The capacity to adopt agricultural innovation depends not only on knowledge and motivation but also on access to the assets, services and infrastructure required to convert knowledge into productive activity. WP2 reveals a mixed picture in this respect.

Land and productive space

At aggregate level, 891 of 1,031 valid respondents (86.4 %) report access to agricultural land. Reported access is lower among women (82.2 %) than men (89.2 %). These values refer to access, not ownership, decision-making authority, irrigation reliability or technical suitability for hydroponic installation (Annex B, Tables B.3 and B.16).

This distinction becomes more important from a gender perspective. Household access to land does not establish women's individual ownership, decision-making authority or capacity to allocate space to a new activity. The relevant implementation question is access to suitable and sufficiently controlled productive space.

Inputs and equipment

Access to agricultural inputs is a significant constraint: 547 respondents (53.1 %) report difficulty obtaining inputs such as seeds, fertilisers and tools. The gender pattern is not in the expected direction, with 39.2 % of women and 62.0 % of men reporting difficulty. This difference should be treated descriptively and examined in relation to activity type, locality and household roles rather than interpreted as evidence that women face fewer input constraints (Annex B, Tables B.3 and B.16).

Qualitative evidence suggests that these difficulties are compounded by rising prices. Women report that increases in fertiliser, seed and animal-feed costs can lead households to reduce cultivated areas, change production strategies or liquidate livestock assets.

This finding is particularly relevant to hydroponics because any system that creates dependence on specialised equipment or recurring inputs must be assessed not only in terms of technical performance but also local sourcing, replacement, affordability and access to repair services. Hydroponic-specific supply chains remain to be verified.

Finance and credit

Credit and microfinance access is reported by 719 respondents (69.7 %), while 312 (30.3 %) report no access. Gender disaggregation shows lower access among women (63.6 %) than men (73.8 %). Even where credit is available, the survey does not establish affordability, suitability for hydroponic investment or women's effective control over borrowing and investment decisions (Annex B, Tables B.3 and B.16).

The qualitative evidence reinforces this distinction. Some women report limited access to formal credit, reliance on solidarity loans with substantial repayment burdens, or the use of personal assets to finance agricultural investments.

The relevant question for SHE-GROWS is therefore not simply whether a participant can reach a financial institution, but whether she has access to an affordable and appropriately scaled financing pathway that can translate training into productive activity without generating disproportionate risk.

Extension and technical services

Extension or technical advisory services are accessible to 672 respondents (65.2 %) and unavailable to 359 (34.8 %). Access is similar but slightly lower among women (63.1 %) than men (66.9 %). This service base is a potential asset for post-training continuity, but it cannot be assumed to provide universal or hydroponic-specific support (Annex B, Tables B.3 and B.16).

However, stakeholder evidence indicates that service availability and effective accessibility should not be assumed to be equivalent. Institutional interviews repeatedly describe training and advisory opportunities as irregular in some rural areas, with shortages of specialised trainers, difficulties reaching remote communities and insufficient post-training follow-up.

The issue is therefore one of both coverage and continuity.

Infrastructure and mobility

Infrastructure emerges strongly from the qualitative material. Poor roads and long distances can increase the burden of water collection, restrict access to training and make it difficult to transport agricultural products, particularly perishables.

Stakeholder consultations reinforce this finding, frequently identifying transport as a central obstacle for rural communities and particularly for women living far from training centres.

Although mobility is examined more fully as a gendered participation issue in Section 6, its infrastructural dimension belongs within the territorial context because remoteness changes the practical value of training, extension, markets and other services regardless of individual motivation.

Digital access

Digital-device access is reported by 665 respondents (64.5 %), with higher access among women in this sample (73.0 %) than men (59.0 %). However, 366 respondents (35.5 %) lack digital-device access and smartphone confidence is predominantly moderate. Digital tools should therefore support, not replace, practical and locally accessible learning (Annex B, Tables B.3, B.10 and B.16).

Digital access should therefore be understood as a supporting asset rather than a universal infrastructure condition.

Market access

Only 409 valid respondents (39.7 %) report access to markets for selling agricultural products, while 622 (60.3 %) report no access. Women in this sample report substantially higher market access than men (57.5 % versus 28.1 %). Because this difference may reflect activity type, collective participation or territorial composition, it should not be interpreted causally without further analysis (Annex B, Tables B.3 and B.16).

The qualitative material explains why this matters. Women already engage in value-added activities involving dairy products, dried agricultural products, honey and essential oils, but groups and individual producers report problems related to logistics, equipment, visibility and permanent points of sale.

This creates a critical distinction for the hydroponic adoption pathway: productive capacity is not equivalent to livelihood value.

A technically successful production system will not necessarily improve women's incomes if products cannot be stored, transported, differentiated, priced appropriately or connected to reliable buyers. Commercialisation must therefore be treated alongside water, finance and technical support as a core feasibility condition.

Integrated reading of productive-resource access

Taken together, the evidence presents a rural environment in which important assets coexist with significant bottlenecks. Many respondents have access to land, credit mechanisms, technical services and digital devices, but none of these indicators alone demonstrates readiness to adopt a new agricultural system. Land may lack irrigation. Credit may be unsuitable or burdensome. Extension services may not provide hydroponic expertise or continuous support. Digital devices may not translate into digital learning confidence. Production may occur without reliable market access.

This distinction between nominal access and effective productive capacity is central to the remainder of D2.1.



Béja and Jendouba offer a strong agricultural knowledge base, diversified rural livelihoods and clear interest in practical adaptation, but these strengths operate within a structurally constrained environment. Water insecurity, climatic variability, seasonal and unstable income, rising input costs, uneven infrastructure, financing limitations, service-access gaps and weak market connectivity shape what rural households can realistically invest in and sustain. Hydroponic adoption must therefore be assessed not as an isolated training or technology decision, but as one possible component of a wider livelihood and climate-resilience strategy whose feasibility depends on the interaction of resources, services, markets and local agricultural systems.

5.6 Illustrative Case Studies of Local Methodologies and Climate Adaptation

The WP2 research design explicitly foresaw the documentation of case studies on local agricultural methodologies and climate adaptation as part of T2.4 qualitative field research. The 27 in-depth interviews were conducted across diverse localities in Béja and Jendouba, including irrigated and rain-fed areas, forested and non-forested settings, and communities with differing levels of infrastructure and institutional support.

The four cases below are anonymised case-based syntheses derived from recurring practices and illustrative examples documented in the interview material. They are not additional participants. Their purpose is to illustrate how agricultural knowledge, climate pressure, gender relations, training and institutional conditions interact in practice.

Case study 1. Making scarce water work harder in fig-based farming systems

Women working in fig-based agricultural systems described locally developed methods for obtaining greater productive value from scarce irrigation water. One repeated practice involves planting cucurbits within the irrigation basins surrounding fig trees. Rather than irrigating the secondary crop separately, women use the same wetted area around the trees, thereby seeking to maximise the productive benefit of the water applied and reduce exposure of wet soil to evaporation. The interviews also describe the use of locally adapted seeds and the substitution of more heat-sensitive crops with crops perceived as better able to withstand increasingly hot and dry conditions.

This case is important because it demonstrates that rural women are not entering SHE-GROWS without agronomic knowledge. Their adaptation practices combine empirical observation of soil, crop and water behaviour with changes in cropping strategy. Across the interviews, women also report using compost or manure, crop rotation and locally adapted varieties, while adopting drip irrigation where water infrastructure permits.

Women's daily involvement in irrigation, harvesting and crop management gives them detailed practical knowledge of water constraints and crop response. However, decisions involving major investments, irrigated land or new equipment may still require household negotiation. In fig-growing and irrigated-vegetable households, participants described joint decisions with husbands concerning irrigation investment and, in some cases, renting irrigated land to maintain production.

Hydroponics training should therefore not be framed as replacing supposedly outdated agricultural practices. It should build from women's existing understanding of irrigation efficiency, crop-water relationships and adaptation. Comparing existing practices with hydroponic recirculation and water-management principles can create a more credible pedagogical bridge between local knowledge and new technology.

Case study 2. When water scarcity becomes a labour, mobility and financing constraint

A second recurring case concerns women farming where reliable irrigation infrastructure is absent. The interviews describe substantial variation in access to water. Women in irrigated perimeters may rely on public water points or shallow wells and use drip irrigation to extend limited supplies. In non-irrigated areas, households depend more heavily on rainfall, public domestic water and rainwater cisterns, sometimes prioritising available water between livestock, crops and household needs. Other women rely on water purchased by tanker or obtained from neighbouring wells for orchards and vegetable plots outside formal irrigation systems.

Water scarcity consequently becomes more than an agronomic problem. Poor roads and distance can require women to carry water manually and make it difficult to transport milk and other perishable products to markets. Some accounts describe repeated journeys under difficult conditions. These labour demands overlap with domestic and care responsibilities.

Financing compounds the problem. Interview evidence describes women with insufficient access to suitable formal finance relying on solidarity loans with substantial repayment obligations. Some agricultural investments have required women to mobilise personal assets, including jewellery. In households with irrigated vegetables and fig orchards, investment in irrigation equipment was sometimes negotiated jointly within the household and financed through women's personal resources.

The case shows why formal indicators such as "access to land" or "access to credit" do not capture effective adoption capacity. A woman may participate actively in farming while still facing constraints in mobilising cash, travelling to obtain inputs, securing reliable water or allocating household resources to a new agricultural system.

Hydroponic adoption should not be promoted solely on the basis of its potential for efficient water use. For a household already purchasing or physically transporting water, any proposed system must be assessed against the reliability and cost of the water source, initial investment requirements, recurrent costs, access to equipment and the labour required for regular operation. Training without an affordable implementation pathway would not resolve the underlying constraint.

Case study 3. From practical training to income diversification: the missing link between skills and enterprise

Several women participating in WP2 had previously accessed short practical training through women's groups, agricultural organisations, regional services and development programmes. Topics included beekeeping and hive management, poultry, distillation of forest and aromatic plants, cheese-making and dairy processing, drying and processing of figs, peppers and Egyptian spinach, project and financial management and basic digital marketing. Women reported that these courses helped them diversify their activities and improve product quality. Practical training in activities such as beekeeping and distillation was particularly valued because it combined existing experience with more systematic technical knowledge.

However, the interviews also reveal a clear "missing middle" between acquiring a skill and establishing a sustainable economic activity. Some groups lack distillation units, incubators or other equipment needed to apply or scale what women have learned, with equipment occasionally borrowed from neighbouring groups. Women producing honey, essential oils, processed figs and cheese also report difficulties in commercialisation because permanent sales points and stronger market connections are lacking. Formal recognition of skills is another concern where access to institutional programmes or finance depends on documented competencies.

Women's groups nevertheless provide important infrastructure. Groups in locations including Tibar, Ouled Kacem, Sidi Kacem, Tabarka and Souk El Jemaa were described as gateways to training, mutual assistance, shared equipment, lower-cost inputs and collective participation in fairs and other marketing opportunities. Group participation can also strengthen confidence, visibility and women's capacity to take initiative.

The case demonstrates that women's empowerment through VET cannot be evaluated simply by counting training attendance. The economic value of training depends on whether participants can subsequently access equipment, finance, certification, markets and technical follow-up.

WP3, WP4 and WP5 should explicitly avoid a "training and exit" model. Hydroponics training should be linked to demonstration units, supervised practice, troubleshooting, business and market competencies and continuing mentoring. Where collective equipment can lower individual investment barriers, women's organisations and emerging cooperative structures may provide appropriate implementation platforms, provided governance and access are equitable.

Case study 4. Combining local knowledge and new technology: a gradual pathway towards hydroponic innovation

The interviews show that women do not generally perceive traditional and modern agriculture as mutually exclusive. Instead, they combine locally accumulated knowledge with new sources of information and technology. Existing practices include local seeds, organic fertilisation, crop rotation and locally developed soil and water management. At the same



time, women use drip irrigation where possible, experiment with more drought-tolerant crops, seek formal training and, in some cases, use digital resources such as YouTube to obtain information about water-saving practices and disease management.

When asked what they would change to improve their agricultural conditions, women identified several complementary forms of adaptation: improved irrigation infrastructure, better maintenance of water networks, solar-powered pumping for wells, rainwater harvesting, improved cisterns, drip irrigation, small-scale irrigation-monitoring tools and training on climate-sensitive crop management. Hydroponics was repeatedly mentioned within this broader portfolio and was perceived by some participants as a potentially important response to water scarcity and limitations on productive land.

The interviews also document aspirations for pilot hydroponic projects that could demonstrate production under water-constrained conditions. At the same time, women identify lack of capital, infrastructure and institutional support as major obstacles to converting these aspirations into functioning enterprises.

Women's interest in new technologies is therefore not evidence of technological passivity or resistance to innovation. The limiting issue is the conversion of interest and knowledge into operational capacity. Finance, household resources, infrastructure, technical support and markets determine whether innovation can move beyond aspiration.

This case provides a particularly important design principle for the project. Hydroponics should be introduced as one additional element within an existing climate-adaptation repertoire rather than as a universal replacement for current agriculture. Training can begin with problems participants already understand, such as irrigation losses, unreliable rainfall, crop stress and water allocation, and progressively introduce hydroponic principles through practical demonstrations. Crucially, the WP2 evidence documents interest and perceived relevance, not an existing population of operational hydroponic farms. Technical and economic feasibility should therefore be demonstrated during subsequent project stages rather than assumed at the needs-assessment stage.

Cross-case synthesis

Taken together, the four cases show that adaptation in Béja and Jendouba is already taking place through a combination of local agronomic knowledge, livelihood diversification, collective action, training and selective adoption of new technologies. At the same time, adaptation capacity is uneven because water infrastructure, finance, mobility, equipment, household responsibilities, markets and institutional support differ between women and locations.

The cases reinforce the central analytical finding of D2.1: women's transition towards hydroponic production cannot be understood as a simple movement from lack of knowledge to technical training. This case-based evidence also explains why the project should build on women's existing knowledge systems. The strongest intervention model is one in which hydroponic competencies are connected to current agricultural practices, accompanied by realistic implementation resources and embedded within wider climate-resilience, enterprise and collective-support strategies.

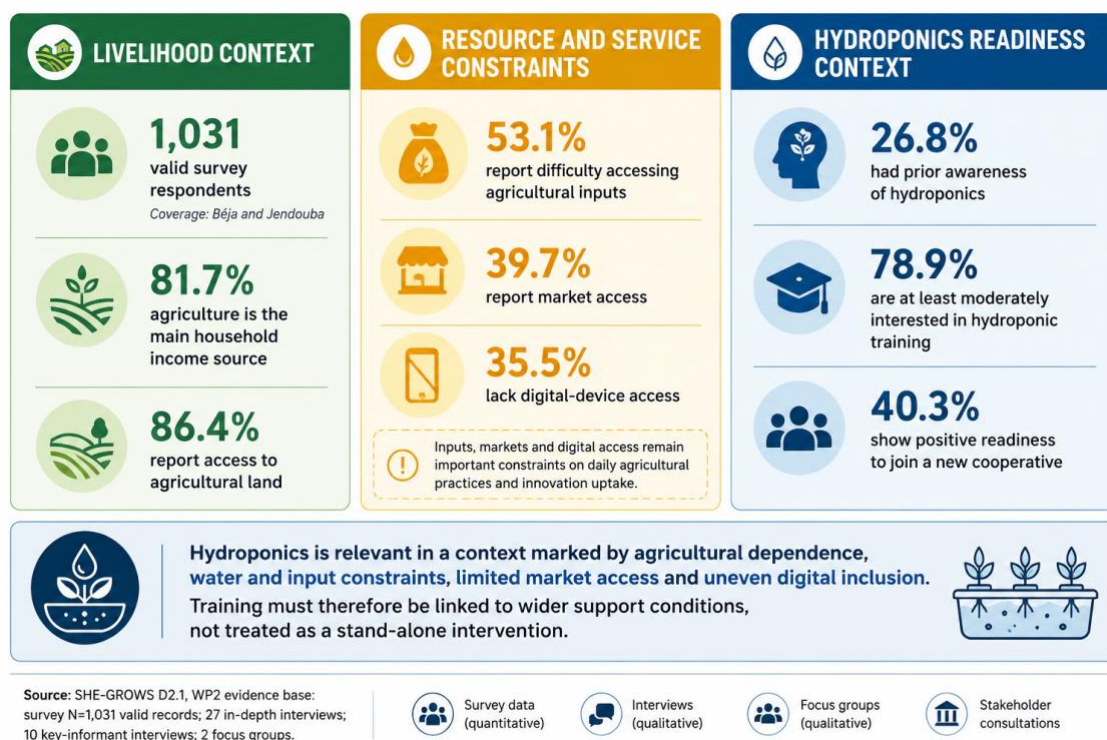


Figure 1. Rural context at a glance: starting conditions for hydroponic adoption in Béja and Jendouba

6. Gender Roles, Agency, Resources and Decision-Making

The evidence from WP2 indicates that rural women's capacity to engage in agricultural innovation is shaped also by how labour, time, resources and decision-making authority are distributed within households, communities and local institutions. This distinction is central to the gender-responsive analysis of D2.1.

The WP2 research framework explicitly defines gender dynamics and agency through women's roles in household and farm labour, autonomy in economic decisions, family and community attitudes, mobility constraints, time poverty, the social acceptability of training participation and gender-related barriers to innovation. Qualitative interviews and focus groups were designated as the principal evidence source for this dimension, with the survey providing complementary indicators.

Across the evidence, the picture is more nuanced than one of simple exclusion. Rural women are already economically active, possess considerable agricultural knowledge, contribute substantially to household production, participate in agricultural decisions and, in some cases, lead specialised activities and collective initiatives. At the same time, their ability to translate this participation into autonomous investment, training access or new enterprise development can be restricted by care responsibilities, mobility, limited finance, unequal control over some productive resources and dependence on household or institutional decisions.

The resulting finding is important for SHE-GROWS: women's agency is present, but it is exercised within structural and relational constraints. The objective of a gender-responsive intervention should therefore not be to assume that women lack initiative or agricultural competence. It should be to strengthen the conditions under which existing knowledge, motivation and influence can be converted into effective choices, practical skills, productive investment and sustained economic participation. Figure 2 provides a visual synthesis of the report's central gender finding: women demonstrate agency, motivation and readiness, but their ability to act depends on unequal enabling conditions.

6.1 Gender division of agricultural and domestic labour



The 27 in-depth interviews demonstrate that rural women perform multiple and overlapping productive roles. They manage or contribute to crop production, irrigation, harvesting, livestock care, beekeeping, processing, marketing and small non-farm activities. Their livelihood portfolios include vegetables and cereals, figs and olives, dairy cattle, sheep, goats and poultry, as well as cheese-making, drying and processing, essential-oil distillation, crafts and seasonal agricultural labour. Even where husbands provide the principal cash income, interviewees describe women's productive contribution as central to household survival.

This evidence challenges any interpretation of rural women as peripheral to agriculture. Women are already deeply embedded in production systems and often possess highly specific practical knowledge. Their daily involvement in irrigation, livestock, harvesting, processing and marketing also gives them direct knowledge of climatic, production and market constraints.

However, productive work is combined with domestic and care responsibilities. The interview sample includes women caring for children, elderly parents or relatives, women heading households because of widowhood or other family circumstances, and women simultaneously carrying out agricultural and household work.

The consequences are not limited to workload. Care obligations directly affect the time and mobility available for training, collective activities and new productive ventures. Women interviewed under WP2 explained that childcare and responsibilities towards elderly or dependent family members can limit their ability to travel or attend training and that participation may depend on support from other family members.

The baseline survey is consistent with this qualitative evidence. Among the perceived barriers to women's agricultural participation, domestic workload appears alongside credit, training, land and mobility constraints. Training-specific results similarly identify unsuitable schedules and lack of childcare among the barriers affecting participation.

The women's focus group adds an important nuance. Lack of time due to domestic responsibilities received a mean barrier rank of 5.0, lower in perceived severity than finance, water and land within this six-person group. This should not be interpreted as evidence that care responsibilities are unimportant. The qualitative interviews show that they become highly consequential for particular women and household situations.

The appropriate interpretation is therefore heterogeneous time poverty. Domestic and care responsibilities do not affect all women equally, but for those carrying substantial responsibilities they can determine whether formal access to training becomes actual participation.

This distinction is critical for SHE-GROWS. Women's participation should not depend on adding training or hydroponic management on top of already intensive productive and reproductive workloads. The qualitative analysis explicitly recommends that training schedules and locations be aligned with women's daily rhythms, agricultural seasons and school calendars so that participation does not create unsustainable double or triple workloads.

Gender-responsive design should therefore consider time as a productive resource in its own right.

6.2 Control over productive resources

Gender-disaggregated survey results show lower reported access among women than men to agricultural land (82.2 % versus 89.2 %) and credit or microfinance (63.6 % versus 73.8 %). By contrast, women in this sample report higher digital-device access and higher market access, while extension access is broadly similar. These descriptive patterns are not causal and do not measure ownership, independent decision-making authority, affordability or the ability to allocate resources to hydroponic investment. They reinforce the need to avoid a deficit model and to analyse each resource together with qualitative evidence on who can decide how it is used (Annex B, Table B.16).

The relevant gender question is therefore not simply whether a resource is present, but whether women can mobilise it for training, investment, production and marketing. Household access can coexist with limited individual control, and apparently favourable access rates can still conceal affordability, quality, reliability or decision-making constraints.

The same principle applies to finance. Although 69.7 % of survey respondents report access to credit or microfinance, this does not demonstrate that financing is affordable, suitable for a hydroponic investment or independently accessible to women.

These aggregate figures establish the overall resource context. Gender-disaggregated rates from the respondent-level analytical export are presented in this section where relevant and consolidated in Annex B.

The qualitative interviews demonstrate why this distinction matters. Women contribute financially to agricultural activities, sometimes drawing on their own resources. Several interviewees described household agricultural investments financed partly through women's personal jewellery, illustrating both women's economic contribution and the difficulties involved in mobilising capital for productive investment.

At the same time, the qualitative analysis reports that formal authority over land and large investments often remains with husbands or older family members, even where day-to-day agricultural decisions are consultative.

Resource control therefore operates on several levels. A woman may work on agricultural land without determining how it is allocated. A household may have access to finance without the woman having independent authority to take on credit. Water may technically be available but require transport, payment or household prioritisation. Equipment may belong to a collective rather than to an individual woman. Income may be generated through women's work while expenditure decisions are negotiated within the household.

These distinctions are particularly relevant to hydroponics because adoption may require decisions concerning capital, space, water, equipment, recurring inputs and time. Training a woman in system management will not automatically enable adoption if decisions concerning these resources lie partly elsewhere.

The women's focus-group ranking supports the importance of this issue. Lack of money or investment capital was the strongest ranked barrier, with a mean score of 2.2, followed by water at 3.2 and land or cultivation space at 4.3. These are direct perceptions from a small qualitative group and should not be generalised statistically, but they clearly demonstrate that women's concerns are strongly connected to the material conditions required for implementation.

The implications for D2.1 are therefore broader than "improving access to resources." The relevant objective is to improve women's effective capacity to mobilise, use and influence decisions over the resources necessary for adoption.

6.3 Household decision-making

Decision-making emerges as one of the most nuanced findings in WP2. The quantitative survey indicates that the largest share of respondents describes agricultural decisions as being made jointly within the household. The baseline correctly notes that this has consequences for innovation: training one person may be insufficient where investment, labour allocation or land-use decisions depend on household consensus.

The 27 interviews provide direct evidence from women that supports and deepens this finding. Most describe decisions regarding what to grow, when to plant and how to sell as being taken "together" or "by consultation" between spouses. Women's continuous engagement in irrigation, harvesting, livestock feeding and processing gives them practical influence over crop decisions, livestock sales and the use of agricultural income.

This should not, however, be interpreted as complete equality of authority across all decisions.

The interviews identify variation according to the type of decision, household configuration, age and expertise. Some younger women living in parental households report more limited influence, particularly where land is small or agricultural activity remains informal. Conversely, women can assume stronger decision-making roles in activities where they hold greater expertise. In areas such as beekeeping or poultry, some women report taking the lead because their technical knowledge exceeds that of male household members.

This suggests that agency is domain-specific rather than binary. A woman may have substantial authority over livestock management or processing but limited authority over land allocation or a large investment. She may control daily operational choices but negotiate larger capital decisions with her spouse or family. She may also gain influence as her technical knowledge and economic contribution increase.

This finding has direct relevance to the SHE-GROWS participant pathway.

Hydroponic adoption may involve several different decisions: deciding to enrol in training; allocating time to attend; identifying space for installation; committing financial resources; selecting crops; managing water and inputs; selling



production; and determining how the resulting income is used. The person attending the training may not necessarily control every one of these decisions.

Gender-responsive intervention design should therefore avoid equating individual training participation with individual decision-making autonomy.

At the same time, household engagement should be handled carefully. The evidence supports communication with the broader household environment where household resources are jointly managed. It does not support shifting authority for women's participation to husbands or other family members.

The appropriate model is therefore supportive household engagement combined with preservation of women's agency. Household actors can be informed about training objectives, workload requirements and economic implications where this facilitates support, while women remain recognised as the principal participants and decision-making actors in their own training and professional development.

6.4 Mobility and training accessibility

Mobility emerges as one of the most consistent gender-relevant mechanisms across WP2. In the respondent-level survey, distance to training centres or transport cost is selected by 51.1 % of women compared with 22.9 % of men, a gap of 28.3 percentage points. Training or material costs are also reported more frequently by women (30.3 % versus 10.2 %). Because the survey item refers to barriers affecting respondents or others in their communities, these rates should be interpreted as reported barriers rather than direct measures of each respondent's personal burden (Annex B, Table B.16a).

The baseline survey identifies distance to training centres and transport costs among the principal barriers to training participation. Unsuitable schedules, childcare, material costs and family or social disapproval further affect accessibility.

The in-depth interviews explain how these factors interact. Women report preferring training delivered at local group premises or nearby farms because travelling to distant centres is costly and time-consuming, particularly where transport is unreliable. Care responsibilities can further restrict the time available for travel.

The evidence therefore distinguishes formal availability of training from effective accessibility. A course may exist, be free of charge and formally open to women but remain practically inaccessible if reaching it requires unaffordable transport, prolonged absence from home or arrangements for childcare that are not available.

Stakeholder interviews strongly corroborate this finding. Representatives of agricultural organisations, women's organisations and training providers repeatedly identify transport as a major barrier for rural women. One training-sector stakeholder described transportation as the principal barrier in the Northwest, noting that even high-quality training may remain inaccessible to women without reliable and affordable transport.

Another stakeholder consultation similarly emphasised that women in remote communities may face transportation costs, family responsibilities and limited awareness of available training opportunities.

This is therefore a strongly convergent finding.

Mobility also affects more than training. The same territorial conditions can shape access to extension services, administrative institutions, markets, finance and collective activities. For a future hydroponic enterprise, mobility may influence the ability to obtain inputs, reach buyers, access repair services or participate consistently in cooperative governance.

Digital tools may reduce some travel requirements but cannot fully resolve accessibility. Although women in this sample report relatively high device access, 35.5 % of all valid respondents lack digital devices, and practical hydroponic learning requires substantial hands-on engagement. Digital delivery should therefore supplement, not replace, physically accessible practical training.

The qualitative evidence supports local or decentralised training, flexible scheduling and use of existing women's groups or nearby farms as delivery points. It also supports careful alignment with farming seasons, school calendars and daily workload patterns.

6.5 Social expectations and acceptability

The evidence on cultural norms and social expectations is more heterogeneous than the evidence on finance, mobility or water. This is an important finding in itself.

The survey identifies cultural norms and social disapproval among perceived barriers to women's agricultural participation, but they are less prominent overall than credit, training, domestic burden, land and mobility.

The women's focus group demonstrates even greater heterogeneity. Traditions and social expectations had a mean rank of 5.7, but this average masks a strongly polarised distribution: four participants ranked the issue as one of the least important barriers, while two ranked it as one of the most important.

This dispersion is analytically more informative than the mean alone. It suggests that cultural constraints are not uniformly distributed across rural women. Household relationships, age, community context, prior experience, group membership and family support can all influence whether social expectations become a meaningful restriction.

The 27 interviews provide further evidence against portraying the local context as uniformly resistant to women's agricultural participation. Participants report that women farmers and rural women workers are generally recognised for their contribution to household survival and agricultural production. Women active in agricultural collectives and women's groups are often perceived as hardworking and courageous and can become visible role models in their communities.

The men's focus group provides a complementary perspective. Most male participants ranked traditions and social expectations relatively low compared with economic, technical and environmental barriers, although responses again varied between individuals. The men's report explicitly notes that social barriers may be context-specific rather than universally experienced.

This male perspective should not be used to conclude that gender norms are unimportant. Men are reporting their perceptions of the surrounding social environment, not women's lived experiences. The divergence between men's relatively low assessment of social barriers and the highly polarised responses within the women's group is itself evidence that gender norms may be less visible to those who are not directly affected by them.

The key conclusion is therefore not that cultural norms are either "strong" or "weak." It is that their influence is conditional and uneven.

This has an important design consequence. A universal intervention built around the assumption that all women face family resistance would misrepresent many participants. Equally, ignoring social and household constraints because they are not the dominant barrier on average could exclude women for whom they are decisive.

SHE-GROWS therefore requires a responsive rather than stereotyped approach to gender norms. Household or community sensitisation may be useful where needed, but it should not be imposed as though women's participation universally requires permission or cultural mediation.

6.6 Confidence, voice and leadership

WP2 provides substantial evidence that rural women's agency extends beyond participation in agricultural labour.

The 27 interviews describe women actively seeking training through groups and agricultural organisations, proposing new projects and expressing interest in experimenting with activities such as beekeeping, poultry, hydroponics and improved water management. The overall interview analysis characterises participants as simultaneously exposed to significant vulnerability and strongly proactive, with clear willingness to learn, innovate and cooperate.

Women's groups and agricultural collectives appear particularly important in strengthening voice and confidence. Interviewees describe these structures as spaces for training, solidarity, access to equipment, collective marketing and institutional contact. Participants also associate group membership with greater self-confidence, social recognition and willingness to speak, decide and take initiative.

This creates an important distinction between individual confidence and enabling social infrastructure. Women's willingness to participate is not solely a personal characteristic. Confidence can be reinforced by peer support, practical experience, recognition and successful participation in collective activities.

The women's focus-group ranking provides an additional nuance. "Lack of confidence to work in a group/cooperative" received an average rank of 6.3, making it the least severe barrier on average in that particular group.



This finding should not be used to dismiss confidence as an issue, but it clearly indicates that the women in that session did not identify personal confidence as their primary constraint compared with finance, water or other material barriers.

This is consistent with the wider qualitative picture: the evidence points more strongly to constrained opportunity than to deficient motivation.

The baseline survey and the in-depth interview sample should nevertheless be interpreted together with care. Cooperative membership in the survey is low, at 10.5 %, whereas many women in the qualitative interview sample are members or office-holders in women's groups and agricultural collectives. This difference likely reflects the purposive qualitative sampling and means that the leadership and collective-action capacities visible in the interview group should not automatically be generalised to all prospective participants.

For SHE-GROWS, existing women leaders and experienced group members nevertheless represent a valuable resource. They can function as peer mentors, co-designers, demonstrators and bridges between less-connected women and institutions. At the same time, recruitment should extend beyond established groups so that the project does not disproportionately benefit women who are already relatively connected to training and institutional networks.

Leadership should also be defined substantively. Women's representation in a group or cooperative does not by itself demonstrate influence. Gender-responsive monitoring should examine whether women contribute to decisions, hold leadership responsibilities, influence financial and production choices, participate in negotiations and benefit equitably from collective activity.

6.7 Local decision-making structures

The WP2 evidence shows that decisions affecting women's participation in agricultural innovation occur at several interconnected levels. The relevant "decision-maker" is therefore not a single actor.

At household level, spouses, parents and other family members can influence labour allocation, use of land, investment, childcare arrangements and participation in training. The interviews show that many agricultural decisions are consultative, but authority varies according to the decision and household context.

At individual level, women's knowledge and experience influence their capacity to initiate activities, select practices and negotiate decisions. Expertise can increase authority, particularly in activities in which women possess specialised knowledge.

At collective and community level, women's groups, agricultural development collectives and local associations can mediate access to training, information, equipment and markets. The qualitative interviews show that such groups can act as gateways between individual women and regional agricultural institutions.

At institutional level, agricultural organisations, extension services, VET providers, local and regional authorities, financial programmes and civil-society organisations influence which opportunities are available, where they are delivered, who receives information and whether technical or financial support continues after training. Stakeholder consultations repeatedly identify stronger coordination among these actors as necessary for effective rural development support.

These structures interact. A training opportunity may be created institutionally but reach women through a local group. A woman may wish to participate but require household reorganisation of care responsibilities. She may acquire the necessary technical competence but still require household agreement over land use or an institutional financing pathway before implementing a system. She may later depend on a cooperative or local association to reach markets.

The resulting decision-making ecosystem can be summarised as follows:

Level	Principal influence on women's participation	Evidence-based implication for SHE-GROWS
Individual woman	Knowledge, experience, aspirations, technical confidence and initiative	Treat women as active economic and agricultural actors, not passive beneficiaries
Household	Time allocation, care responsibilities, land and investment decisions, labour availability	Facilitate supportive household conditions without transferring authority away from women

Women's groups and collectives	Peer support, training access, equipment, information, confidence and collective marketing	Use existing groups as local anchors and co-design partners while reaching women outside established networks
Community environment	Social recognition, norms, perceptions of innovation and women's economic roles	Use context-specific engagement rather than assuming universal social resistance
Agricultural and VET institutions	Training provision, extension, technical expertise and follow-up	Strengthen local accessibility, continuity and referral pathways
Finance and public-support actors	Investment capital, programmes, administrative access and enabling infrastructure	Connect training to realistic financing and implementation pathways
Markets and collective organisations	Commercialisation, pricing, logistics, bargaining and benefit generation	Ensure that women's productive participation can translate into livelihood value and meaningful economic agency

The main conclusion from Section 6 is therefore that women's agency in Béja and Jendouba is neither absent nor unconstrained. Women already farm, manage livestock, process products, seek training, adapt to climatic pressures, participate in household decisions and, in some cases, lead collective initiatives. Yet their capacity to act on new opportunities depends on whether they can mobilise time, transport, finance, land, water, equipment, household support and institutional assistance.

The gender mechanism identified through WP2 is consequently best understood as an interaction between agency and enabling conditions. Material constraints can become gendered when women have less authority over investment or land, greater responsibility for unpaid care, fewer mobility options or weaker access to institutional networks. Conversely, agricultural knowledge, supportive households, peer networks, women's groups and recognised technical expertise can expand women's effective agency.

This distinction provides the analytical bridge to Section 7. The next chapter therefore examines where these gendered conditions translate into concrete barriers along the hydroponic adoption pathway, from finance and training through water, land, time, mobility, social expectations, collective action, institutions and markets.

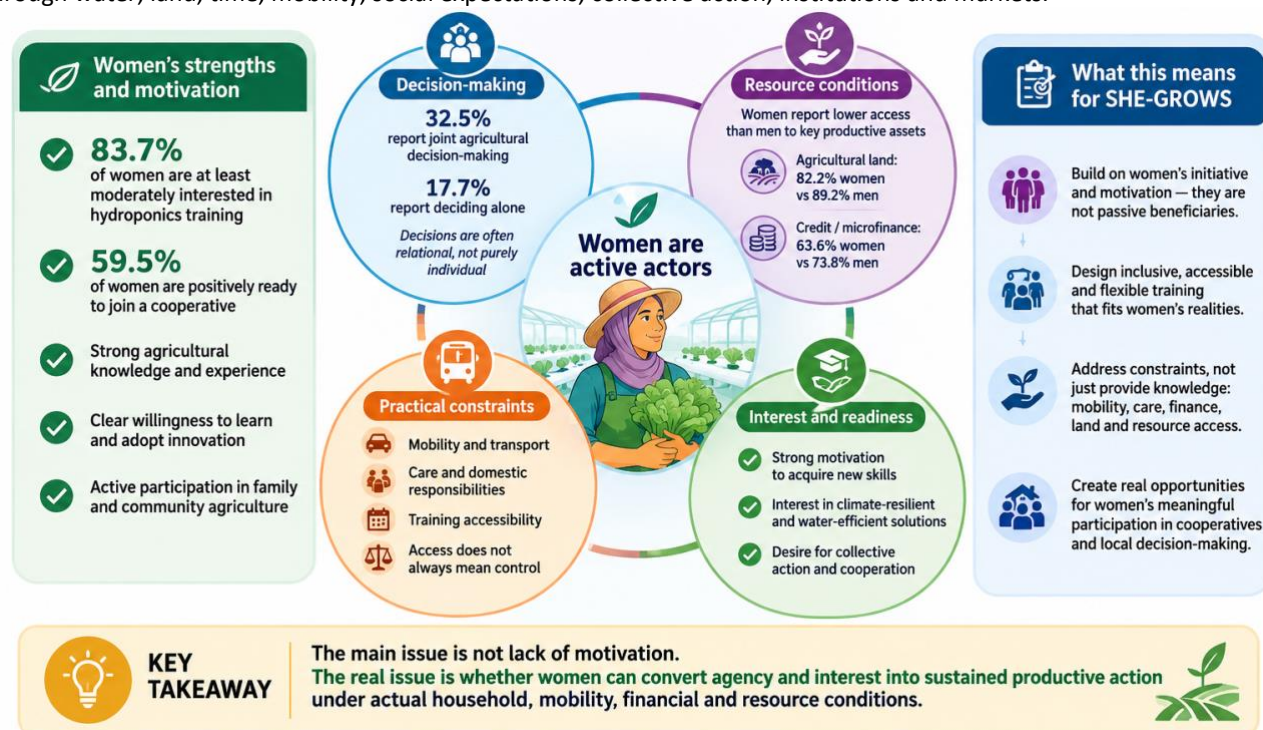


Figure 2. Women's agency is real, but enabling conditions remain uneven



7. Gender-Responsive Mapping of Barriers to Hydroponic Adoption

The WP2 evidence shows that barriers to hydroponic adoption are cumulative and interconnected rather than isolated. A woman may be interested in hydroponics and successfully complete training, yet still be unable to establish a productive activity because she lacks investment capital, suitable space, reliable water, equipment, transport, market access or continuing technical support. Conversely, a participant with access to resources may still face difficulties if training is inaccessible, household responsibilities restrict her time, or the technology remains unfamiliar.

The respondent-level survey indicates a receptive but early-stage hydroponics profile. Only 26.8 % of valid respondents report prior awareness of hydroponics, while 73.2 % report no previous knowledge. Interest is much higher: 78.9 % are at least moderately interested in hydroponics training. These results establish an entry point for sensitisation and practical learning, not evidence of technical, financial or market readiness (Annex B, Tables B.13-B.14).

The 27 in-depth interviews reinforce this interpretation. Women's ability to consider new agricultural practices is shaped simultaneously by water scarcity, unstable incomes, high input costs, infrastructure, finance, household support, training and collective structures. The qualitative analysis explicitly concludes that interventions addressing only one dimension, such as training without equipment or markets, or credit without consideration of care and mobility, are unlikely to respond adequately to women's realities.

Section 7 therefore examines barriers according to where they operate along the adoption pathway. The analytical question is whether a barrier prevents awareness, training participation, investment, technical operation, collective participation, commercialisation or long-term continuity. Figure 3 translates the barrier analysis into an adoption pathway, showing that hydroponic uptake is interrupted by a chain of constraints rather than by a single obstacle.

7.1 Financial and investment barriers

Financial capacity emerges as one of the strongest and most consistently supported barriers across the WP2 evidence.

The quantitative survey provides an apparently more favourable picture at first sight: 69.7 % of valid respondents report access to credit or microfinance. Gender disaggregation, however, shows lower access among women (63.6 %) than men (73.8 %), and the survey does not establish affordability, suitability for hydroponic investment or women's control over borrowing decisions. Finance is therefore treated as both an access issue and a risk-management issue.

The men's focus group produced a closely aligned result. Lack of money or investment capital received a mean rank of 2.4, second only to lack of training and technical support at 2.3. Finance is therefore one of the clearest areas of convergence between women's direct perceptions and men's assessment of the adoption environment.

The qualitative interviews explain the distinction between formal financial access and effective investment capacity. Women describe limited access to suitable formal loans, reliance on solidarity loans that can impose significant repayment burdens, and, in some cases, the sale of personal jewellery to finance agricultural investment. Women also identify lack of capital as a barrier to hydroponic systems, irrigation infrastructure, processing units and other equipment, while existing debts can reduce their ability to assume further financial risk.

Stakeholder evidence strongly corroborates this finding. Institutional respondents repeatedly distinguish between training and implementation, noting that women may acquire skills but lack the financial resources necessary to purchase equipment or establish a productive activity.

The gender mechanism is not simply that women "lack credit." The evidence suggests several more precise risks:

- limited control over household investment decisions;
- inability to mobilise sufficient start-up capital;
- unsuitable or burdensome credit conditions;
- competing household expenditure requirements;
- uncertainty about profitability;
- difficulty financing equipment after training; and

- risk associated with investing in an unfamiliar production technology.

Financial barriers therefore become most consequential at the transition between training and practical implementation, but they can also affect earlier stages if transport, materials or participation itself involve costs.

For SHE-GROWS, the appropriate response is not to assume that conventional credit alone will solve the problem. Financing pathways should be staged, transparent and proportional to the scale of the activity, with realistic costing, business planning and assessment of recurring expenses incorporated before participants are encouraged to invest. Collective ownership or shared use of equipment may provide an alternative where individual investment is unrealistic.

Barrier assessment: High priority, high confidence, strongly convergent across women, men, interviews, survey and stakeholder evidence.

7.2 Training and technical knowledge barriers

The second major barrier concerns the transition from general agricultural experience to competence in hydroponic production.

The starting point is a substantial technology-specific knowledge and VET-access gap. In the final analytical report, 73.2 % report no prior hydroponics awareness and only 20.1 % report previous vocational or non-formal training. Previous VET participation is almost identical among women (20.4 %) and men (19.7 %). The curriculum should therefore begin with accessible orientation and practical demonstration rather than assume prior formal training experience (Annex B, Tables B.6, B.13 and B.16).

This does not mean that participants lack agricultural skills. The 27 interviews demonstrate extensive practical knowledge across crop production, livestock, processing, water management, beekeeping and marketing. The technical gap is therefore technology-specific, not a general absence of agricultural competence.

The in-depth interviews provide a complementary, deliberately non-representative perspective. Within the purposively selected 27-interview sample, many women have previous training experience through women's groups and agricultural organisations. Their accounts show that training quality and continuity are variable: practical demonstrations are valued, while recurring weaknesses include one-off delivery, insufficient follow-up, lack of equipment for practice, weak market links and limited recognition of acquired skills. The contrast with the broader survey reflects different sampling profiles rather than contradictory evidence.

The apparent gender difference is informative. Women in the focus group placed greater immediate emphasis on capital and water, whereas men placed greater emphasis on technical support. These findings are not contradictory. They suggest that different groups emphasise different points in the adoption process.

The evidence therefore identifies at least four separate training barriers:

Awareness gap: many prospective participants are unfamiliar with hydroponics.

Competency gap: hydroponics requires specific knowledge not automatically provided by conventional agricultural experience.

Practice gap: theoretical knowledge cannot replace hands-on experience with operating systems.

Continuity gap: participants may acquire initial knowledge but lack technical assistance when problems occur after training.

Stakeholders strongly support this interpretation. Some report shortages of specialised trainers and argue that practical demonstrations and continued mentoring are necessary for adoption.

The barrier therefore operates across several stages of the pathway, from awareness and training access to technical operation and continuity.

The project response should consequently avoid treating certification as the endpoint. Training should progress from awareness to demonstration, supervised practice, troubleshooting and post-training support. Practical competence should include the ability to recognise and respond to system problems rather than simply reproduce procedural instructions.

Barrier assessment: High priority, high confidence, strongly supported across evidence sources.

7.3 Water, energy and infrastructure barriers

Water scarcity is one of the most consistently documented environmental constraints in WP2.



The women's focus group ranked lack of water as the second strongest barrier, with a mean score of 3.2. The men's group similarly ranked water scarcity among the principal constraints, with a mean of 3.8, alongside broader climate and environmental pressures at 3.5.

The in-depth interviews reveal that the issue is not simply total water availability. Women operate under widely different water conditions, including public irrigation points, wells, rainfall, cisterns and purchased water. Some report declining springs and other natural sources, while others incur substantial labour or monetary costs transporting water.

Water scarcity therefore influences both technical feasibility and financial feasibility. A technology intended to respond to water constraints cannot be considered viable if participants lack a sufficiently reliable water source for continuous operation.

The interviews also identify wider infrastructure concerns. Women propose improvements to irrigation networks, reduced leakage and solar-powered pumping as ways to improve the reliability and cost of water access. Poor roads also affect access to inputs, services and markets, while shortages of equipment constrain the ability of women's groups to operationalise skills acquired through training.

A critical evidence limitation should nevertheless be stated explicitly. The current WP2 material does not provide a systematic technical assessment of water quality, electrical reliability, pumping requirements, hydroponic nutrient availability, protected-cultivation infrastructure or system-specific energy consumption. These variables are relevant to hydroponic feasibility, but they cannot be treated as empirically established barriers from the current dataset.

This is an important distinction. WP2 provides strong evidence that water availability, reliability and cost matter. It does not yet establish whether local water sources meet the chemical quality requirements of specific hydroponic systems or whether electricity supply is adequate for a particular system design.

These issues should therefore be treated as technical verification requirements before installation, rather than assumed findings.

For the subsequent pilot, technical site assessment should precede system selection and should include water quantity and quality, pumping and electricity requirements, climatic exposure, drainage, maintenance capacity and availability of replacement components.

Barrier assessment: Water and general infrastructure, high priority and high confidence. System-specific energy and water-quality constraints, important evidence gap requiring technical verification.

7.4 Land and cultivation-space constraints

Land or cultivation space is a more complex barrier than the aggregate survey results initially suggest.

The final analytical dataset records agricultural-land access for 86.4 % of valid respondents, but reported access is lower among women (82.2 %) than men (89.2 %). These figures do not demonstrate ownership, individual control, site suitability, irrigation availability or authority to allocate space to hydroponic production. The gender difference therefore strengthens, rather than replaces, the qualitative distinction between access and effective control (Annex B, Tables B.3 and B.16).

The women's focus group gives greater prominence to the issue: lack of land or cultivation space received a mean barrier rank of 4.3, placing it behind finance and water but ahead of several social and training-related barriers.

The interviews also demonstrate that land and water access do not necessarily coincide. Some women may have land without a formal irrigation point and therefore depend on purchased or manually transported water.

For hydroponics, this means that "land access" should be reframed as access to suitable productive space. A technically appropriate site requires more than ownership or use rights. It may need reliable water, adequate exposure or protection, physical security, accessibility for maintenance, proximity to electricity depending on system design, and sufficient control over the site for the duration of the investment.

Hydroponics may reduce the amount of agricultural land required for certain forms of production, but the WP2 evidence does not justify claiming that land ceases to matter. System installation still requires secure and usable space.

The gender mechanism lies primarily in the distinction between household access and women's control. If land allocation depends on husbands, parents, extended family or institutions, a woman may have agricultural experience and training without having the authority to establish an installation.

The project should therefore verify not only whether selected participants have "land", but whether they have stable access to an appropriate site and sufficient decision-making authority over its use. Cooperative or shared installations may provide alternatives for participants without individually controlled space.

Barrier assessment: Moderate to high priority for affected women. The finding is supported by the women's focus group, qualitative evidence and the lower reported land-access rate among women in the respondent-level survey. Effective control over land, long-term security of access and technical suitability of available sites remain insufficiently measured and should be verified during pilot preparation.

7.5 Time poverty, childcare and domestic responsibilities

Time-related barriers are strongly gendered but heterogeneous.

In the women's focus group, lack of time due to domestic responsibilities had a mean rank of **5.0**, lower than finance, water, land and unfamiliar techniques. This suggests that domestic responsibilities were not the dominant barrier for all participants in that group.

However, the 27 interviews show that for some women, particularly those caring for children, people with special needs or elderly relatives, care responsibilities have a direct effect on mobility and training attendance. Women report requiring assistance from family members in order to attend training or participate in activities away from home.

The baseline survey also identifies domestic burden, unsuitable training schedules and lack of childcare among barriers affecting women's participation. These results indicate that time constraints should not be treated solely as an individual scheduling preference.

For hydroponic adoption, the relevance of time extends beyond training attendance. Any productive system creates operational responsibilities. Participants need realistic information about the frequency of monitoring, crop management and maintenance before deciding whether a system fits within their existing workload.

The gender risk is that an intervention intended to create economic opportunity could inadvertently add another layer of unpaid or poorly remunerated work to women's existing agricultural and domestic responsibilities.

The appropriate response is therefore to assess **time feasibility** alongside technical and financial feasibility. Training should be scheduled around rural workloads, school calendars and agricultural seasons, and operational models should be realistic about routine labour requirements. The qualitative interviews specifically support local training and schedules aligned with women's daily rhythms.

Barrier assessment: Moderate overall but potentially severe for specific women, particularly female household heads and participants with substantial care responsibilities. Strong qualitative evidence of heterogeneity.

7.6 Mobility and transport barriers

Transport is one of the strongest points of convergence between direct participant accounts and stakeholder evidence.

Women interviewed under WP2 repeatedly report that distant training centres are expensive and time-consuming to reach, especially where public or private transport is unreliable. Local training at group premises, nearby farms or community locations is therefore strongly preferred.

Transport also interacts with care responsibilities. A long journey increases not only financial cost but the amount of time for which domestic and caregiving responsibilities must be transferred to another household member.

Stakeholders repeatedly identify the same problem. Rural women's organisations and training providers describe transport as one of the main obstacles preventing women in remote communities from benefiting from available programmes. One institutional respondent explicitly observed that the problem is not only the absence of opportunities but difficulty accessing existing opportunities.

Mobility barriers continue beyond training. The 27 interviews describe poor roads and difficult transport affecting water collection and the sale of perishable products. Group participation is also affected when women live far from collective premises.



Transport therefore affects at least four stages of the pathway which are training access; access to inputs and services; cooperative participation and market access.

This makes mobility a structural barrier rather than a minor logistical consideration.

Training decentralisation, use of community-based venues, clustering of participants geographically and targeted transport support should consequently be incorporated into implementation planning rather than added only after attendance problems emerge.

Barrier assessment: High priority, high confidence, strongly convergent across survey, women's interviews and stakeholder evidence.

7.7 Cultural norms, social expectations and household negotiation

The evidence does not support a simple conclusion that social norms are either the dominant barrier or irrelevant.

The baseline survey identifies cultural norms and social disapproval as barriers but places greater overall emphasis on credit, training, domestic workload, land and mobility.

The women's focus group provides particularly important evidence of heterogeneity. Traditions and social expectations received an average rank of **5.7**, but the distribution was strongly polarised: four women ranked the issue 8, indicating low importance, while two ranked it 1, indicating that it was one of their greatest barriers.

This is a clear example of why average values alone can be misleading in gender analysis.

The 27 interviews further show that many women perceive their agricultural contribution positively and that women's participation in groups is increasingly accepted. Some interviewees report that husbands have become more supportive of women's collective participation after observing its social and economic benefits.

The men's focus group also rated traditions and social expectations relatively low, with a mean of **6.1**, although individual rankings ranged from 3 to 8.

The important analytical conclusion is therefore **variation rather than absence**.

For many women, material and logistical barriers may be more pressing than explicit social opposition. For others, family expectations or household authority may remain decisive. Social barriers are likely to interact with age, marital status, household structure, locality and previous participation in organisations.

SHE-GROWS should therefore avoid both extremes: it should neither design the programme around a stereotype of universal cultural resistance nor assume that household and community dynamics are irrelevant.

Where household engagement is useful, it should reinforce women's ability to participate rather than convert women's participation into a decision controlled by others.

Barrier assessment: Moderate at aggregate level, but highly heterogeneous and potentially severe for specific participants. Evidence shows meaningful within-group divergence.

7.8 Confidence and collective-action barriers

The evidence suggests that lack of individual confidence is not a primary universal barrier, but readiness for formal collective economic activity should not be assumed.

The respondent-level survey provides a necessary corrective to the relatively confident focus-group discussion. Current membership in a cooperative, association or community organisation is low at 10.5 % overall and is similar among women (11.2 %) and men (10.0 %). Future cooperative readiness is much more positive among women: 59.5 % are rather or very ready to join compared with 27.8 % of men, although 45.0 % of the overall sample remains neutral or uncertain. Readiness is therefore promising but cannot be equated with governance experience or commitment of resources (Annex B, Tables B.11, B.16 and B.16c).

The 27 in-depth interviews provide even stronger positive evidence among women already involved in organised groups. Such groups serve as spaces for training, solidarity, equipment access, collective marketing and increased confidence. Women report that group participation can strengthen their ability to speak, decide and take initiative.

This difference is important because the qualitative interview sample contains many women already connected to women's groups and agricultural collectives. Their positive experiences cannot automatically be generalised to women who have little previous collective-action experience.

The men's focus group likewise revealed substantial variation in trust. One participant ranked lack of trust between people or towards institutions as the greatest obstacle, while another ranked it as the least important.

The principal barrier is therefore better described as uncertain collective readiness rather than lack of confidence.

Moving from informal solidarity or association membership to a formal cooperative introduces questions of governance, financial responsibility, contributions, leadership, conflict resolution and benefit sharing. These require explicit preparation.

Barrier assessment: Moderate priority overall. Individual confidence appears relatively strong among engaged women, but cooperative readiness and trust require structured development.

7.9 Institutional and administrative barriers

Institutional barriers arise less from the complete absence of organisations than from uneven accessibility, fragmentation, weak continuity and difficulty converting institutional support into practical implementation.

The survey reports access to extension or technical advisory services for 65.2 % of valid respondents, leaving 34.8 % without access. Rates are relatively similar among women (63.1 %) and men (66.9 %). This is an important institutional foundation, but it does not establish the availability of hydroponic-specific expertise or continuity of support (Annex B, Tables B.3 and B.16).

The qualitative interviews identify weaknesses in continuity. Training may be delivered as a one-off intervention without subsequent technical assistance, equipment or market linkage. Women also report limited formal certification of skills, which can restrict access to programmes requiring recognised qualifications.

Key informants add evidence concerning administrative complexity and coordination. Cooperative formation involves legal and administrative procedures that can discourage new groups where technical assistance is lacking, while stronger coordination between agricultural services, civil society, training actors and support programmes is repeatedly recommended.

Other stakeholder accounts are more critical, noting weak implementation, limited continuity and repeated promises that do not always translate into concrete support. These statements should be interpreted as institutional and community perceptions, but their recurrence across interviews makes them relevant to implementation design.

Women themselves describe institutional barriers to achieving their aspirations, including slow or complicated processes for obtaining access to land, buildings or programme support and limited visibility of women's initiatives within funding and policy decisions.

The barrier therefore occurs particularly during implementation, collective organisation and scaling. A participant may complete training successfully but be unable to access finance, legal guidance, institutional premises, equipment or technical follow-up.

The appropriate response is not simply to create another temporary service. SHE-GROWS should establish clear referral and support pathways, identifying which institution is responsible for technical advice, finance, cooperative administration, market access and follow-up, and ensuring that participants know how to use those pathways.

Barrier assessment: High strategic importance, moderate to high confidence, supported mainly by qualitative and stakeholder evidence.

7.10 Market and business barriers

Market access is one of the most significant structural risks to the economic logic of adoption.

Only 39.7 % of valid respondents report access to markets for selling agricultural products, while 60.3 % report no market access. Women in this survey sample report higher access than men, but the difference requires interpretation by activity type, locality and collective participation and should not be treated as evidence that women's commercialisation constraints are resolved (Annex B, Tables B.3 and B.16).

The in-depth interviews demonstrate that this problem already affects women's existing products. Women report difficulties commercialising honey, essential oils, processed figs and dairy products even after receiving relevant



production training. Limited permanent sales points and weak commercialisation support restrict the ability to translate technical skills into reliable income.

Women's groups similarly report dependence on fairs and occasional events because permanent sales outlets are lacking. Women therefore identify marketing, branding, digital sales, price negotiation and stronger institutional market linkages as priorities for collective economic activity.

This has a fundamental implication for hydroponics. Production is not equivalent to economic empowerment.

A technically successful hydroponic unit can still fail as a livelihood intervention if production is not connected to demand, appropriate crop choice, quality requirements, reliable buyers, transport and viable pricing.

The WP2 evidence does not yet provide a detailed hydroponic market study identifying specific crops, buyer demand, farm-gate prices, seasonal supply gaps or expected margins. These remain evidence gaps that must be addressed before commercial scale-up.

Accordingly, the project should avoid selecting crops solely according to technical suitability. Crop and system decisions should ultimately incorporate verified market demand, production costs, quality expectations, logistics and the expected distribution of benefits.

Women's control over income should also remain part of the gender analysis. Higher household revenue cannot automatically be assumed to translate into greater economic agency for women unless women participate meaningfully in financial decisions and benefit sharing.

Barrier assessment: High priority and high confidence as a general market constraint. Hydroponic crop-specific commercial feasibility remains to be verified.

7.11 Comparative barrier ranking and divergence

The gender-separated focus groups provide a useful comparative perspective on the barriers perceived by women and men. These rankings should not be treated as population statistics because the groups were small and qualitative. Their value lies in showing relative priorities, differences in perspective and within-group variation. The full ranking tables and interpretive notes are provided in Annex C, Tables C.2-C.4.

Barrier	Women's FG, mean rank	Men's FG, mean rank	Interpretation
Lack of money / investment capital	2.2	2.4	Very strong convergence. Finance is a central adoption barrier for both groups.
Lack of water / water scarcity	3.2	3.8	Strong convergence on environmental and resource constraints.
New or unfamiliar agricultural techniques	4.8	3.0	Men place greater emphasis on unfamiliarity with new techniques; women prioritise material constraints more strongly.
Lack of training / technical support	5.2	2.3	Largest clear difference in relative ranking. Men rate technical support as the strongest barrier, while women's views are much more variable.
Existing responsibilities / lack of time	5.0	6.0	Both groups rank it below economic and technical constraints on average, but women's interviews show that care burdens can be severe for specific participants.
Traditions and social expectations	5.7	6.1	Low average ranking in both groups, but substantial variation, especially among women.
Land or cultivation space	4.3	Not directly reported as a comparable mean in	Material constraint identified particularly clearly by women.

		the men's narrative	
Confidence / trust in collective action	6.3 for lack of confidence to work in a group/cooperative	5.8 Highly variable trust ranking	Neither group supports a simple assumption of universal mistrust, but readiness varies substantially.

Women's focus-group results show finance at 2.2, water at 3.2, land at 4.3, unfamiliar techniques at 4.8, time at 5.0, training and technical support at 5.2, traditions at 5.7 and group confidence at 6.3. The report also documents particularly strong dispersion for traditions and training support.

The men's group places training and technical support first at 2.3, finance second at 2.4, unfamiliar techniques at 3.0, climate and environmental issues at 3.5, and water scarcity at 3.8. Existing responsibilities and traditions receive mean ranks of 6.0 and 6.1 respectively.

Three conclusions emerge from the comparison.

First, economic and resource constraints show the strongest convergence. Both groups identify finance as a major barrier, and both recognise water and environmental conditions as important.

Second, men place substantially greater emphasis on technical knowledge and training support than the women in the focus-group ranking. This does not mean women do not need technical training. Women's interviews strongly support practical learning and follow-up. Rather, women appear to place investment capacity and physical resources ahead of training when forced to rank barriers.

Third, social barriers cannot be interpreted from averages alone. Traditions and social expectations rank relatively low in both groups, but the women's responses are sharply polarised, with two participants identifying traditions as a major barrier. Men's trust responses are similarly dispersed. These patterns demonstrate that social constraints are highly context-dependent.

Integrated barrier map

When the focus-group rankings are interpreted together with the baseline survey, 27 in-depth interviews and stakeholder evidence, the major barriers can be positioned along the participant pathway as follows:

Priority barrier	Main pathway stage affected	Gender-responsive mechanism	Evidence strength
Finance and investment	Resource mobilisation, implementation, scaling	Women's capacity to mobilise capital and influence investment decisions	High
Training, hydroponic knowledge and technical follow-up	Awareness, training, operation, continuity	Unequal access to practical and locally accessible training, plus technology-specific knowledge gap	High
Water and infrastructure	Investment and technical operation	Uneven water access, cost and reliability intersect with women's resource constraints	High for water; technical verification required for system-specific conditions
Mobility and transport	Training, collective participation, markets	Cost, distance, care responsibilities and remote residence restrict effective access	High
Land / suitable productive space	Investment and installation	Household access does not necessarily imply women's control over suitable space	Moderate to high
Time poverty and care responsibilities	Training and operation	Unequal unpaid-care responsibilities reduce time and mobility for some women	Moderate overall, high for affected subgroups
Institutional and administrative constraints	Implementation, cooperative development, scaling	Fragmented support, weak follow-up and administrative complexity	Moderate to high
Market and business constraints	Commercialisation and income	Production does not translate automatically into market access or women's control of benefits	High
Social expectations	Training, investment	Context-specific family/community	Moderate and



and household negotiation	and participation	support or resistance	heterogeneous
Collective-action confidence and trust	Cooperative participation and governance	Limited prior cooperative experience among much of the survey population despite stronger experience among organised women	Moderate and heterogeneous

The overall evidence therefore does not support an interpretation in which rural women's principal difficulty is lack of motivation, resistance to innovation or insufficient confidence. The stronger pattern is one of constrained conversion: women demonstrate agricultural knowledge, interest and willingness to learn, but the transition from interest to adoption can be interrupted by finance, water, technical support, mobility, time, institutional continuity and market access.

The central implication for SHE-GROWS is that training is necessary but not sufficient. A gender-responsive adoption strategy must connect training to suitable productive space, realistic finance, reliable technical and resource conditions, household-compatible participation arrangements, post-training support, collective structures where appropriate, and credible market pathways. The next section therefore shifts from constraints to the assets and enabling conditions already present in Béja and Jendouba that can be mobilised to reduce these barriers and strengthen women's participation.

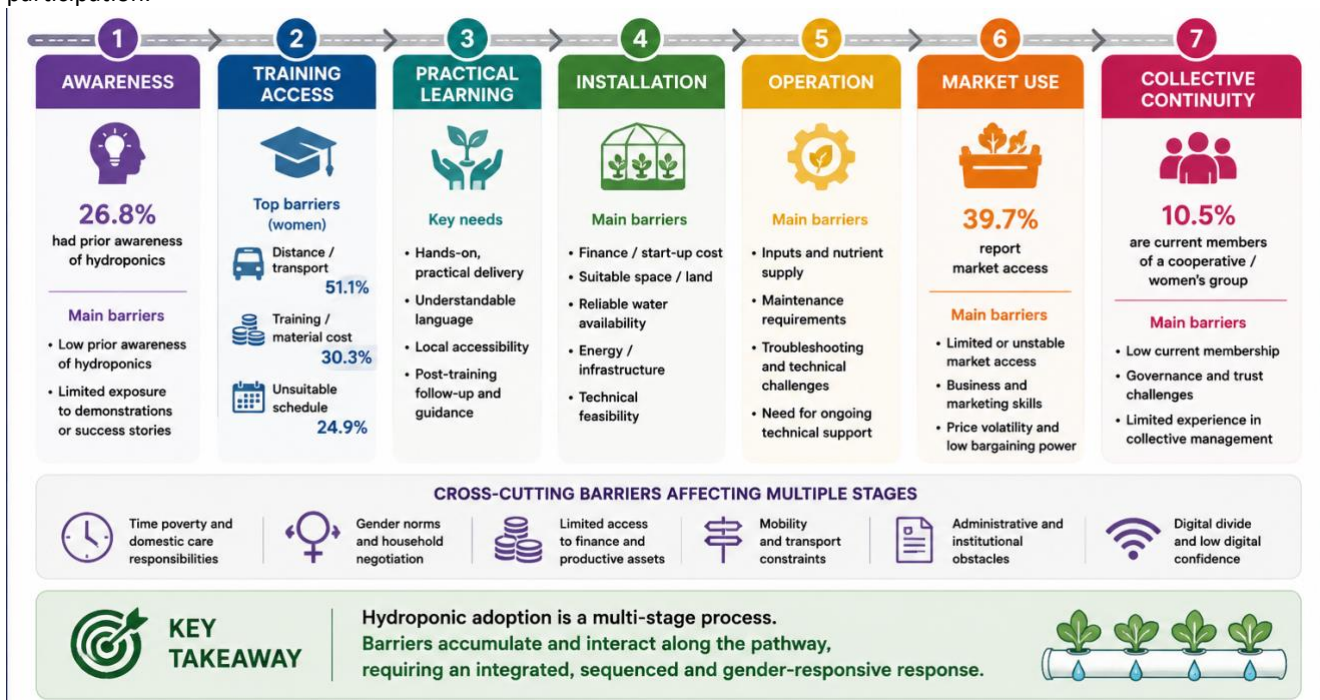


Figure 3. The barrier pathway: what interrupts hydroponic adoption?

8. Opportunities and Enabling Conditions for Women

The 27 in-depth interviews describe women who are simultaneously exposed to significant structural vulnerability and highly proactive. They farm, manage livestock, process agricultural products, seek training, experiment with adaptation strategies, participate in collective organisations and articulate concrete ambitions for improving production

and income. The interview analysis identifies strong willingness to learn, innovate and cooperate, but also makes clear that these capabilities need to be combined with equipment, finance, markets, institutional recognition and attention to care responsibilities.

The principal opportunity for SHE-GROWS therefore lies not in creating motivation from the beginning, but in converting existing motivation, agricultural knowledge and collective capacity into feasible participation and sustained application.

8.1 Strong interest in practical learning

One of the clearest enabling conditions identified through WP2 is strong interest in learning and acquiring skills that can be translated into practical livelihood improvements.

The survey confirms strong demand for learning despite limited prior awareness. Overall, 26.8 % of valid respondents had previous hydroponics awareness and 78.9 % are at least moderately interested in training. Women report substantially higher awareness than men (43.5 % versus 15.9 %) and higher at-least-moderate interest (83.7 % versus 76.0 %); 38.2 % of women are extremely interested. These are descriptive sample patterns, but they provide a strong basis for a women-centred sensitisation and training pathway (Annex B, Tables B.13-B.14 and B.16d-B.16e).

The women's focus group reinforces this conclusion. Participants expressed clear interest in hydroponic training, mutual learning and sharing experiences. Crucially, at least one participant explicitly emphasised that training should lead to a concrete project accompanied by follow-up and an active support network rather than ending with the training session itself.

The 27 interviews show the same orientation. Women actively seek training through women's groups, agricultural organisations and unions and express ambitions to experiment with new activities, including hydroponics, beekeeping, poultry and improved water-management practices.

Interest is therefore a genuine project asset, but it must not be confused with readiness to invest. The baseline itself describes the hydroponics profile as promising but early-stage, recommending awareness, demonstration and confidence-building before technical specialisation or investment-oriented activities.

The opportunity for SHE-GROWS is consequently to use existing curiosity and motivation as the entry point to a staged pathway from interest and informed understanding to practical experience, confidence and feasibility assessment until application.

This sequencing is preferable to beginning with technically complex modules or expecting participants to commit to investment before they have seen and operated a system.

8.2 Existing agricultural knowledge

A second major enabling condition is the substantial agricultural and livelihood knowledge already present among rural women.

The qualitative evidence shows that women are actively involved in crop production, livestock management, beekeeping, food processing, irrigation, marketing and household agricultural decision-making. They also use existing adaptation practices including crop diversification, drought-tolerant varieties, soil conservation and water-saving irrigation.

This matters because the relevant skills gap is not a lack of basic agricultural understanding. It is principally a technology-specific transition gap between existing farming knowledge and the technical requirements of hydroponic production.

Women also possess specialised expertise. In some households, interviewees report that women's knowledge in activities such as beekeeping or poultry gives them a leading role in related agricultural decisions.

Previous training has already contributed to livelihood diversification. Interviewees report experience with beekeeping, poultry production, dairy transformation, distillation, agricultural processing, project management, financial management and digital marketing. Practical demonstrations are particularly valued because women can immediately relate the learning to existing activities.

The implication for the curriculum is important. Training should not be designed as if participants were agricultural beginners.



Hydroponic concepts can instead be introduced by connecting new knowledge to familiar agronomic concepts. Existing understanding of irrigation, crop stress, seedling management, pests, production cycles, marketing and farm economics provides a practical foundation on which new competencies can be built.

Recognition of prior learning also has a gender dimension. Treating women's existing agricultural knowledge as informal or secondary can reproduce the very inequalities the project seeks to address. Training should therefore recognise women as existing farmers, producers and processors and use their experience as part of the learning process.

Peer discussions, problem-based exercises and comparison between hydroponic and current farming practices can allow participants to contribute knowledge rather than receive information passively.

8.3 Hydroponics as a water-management opportunity

Water scarcity creates one of the strongest contextual reasons for interest in alternative production systems.

The survey shows that most respondents perceive water scarcity as having a moderate to high impact on agricultural production, while drought, heat, reduced yields and other climate impacts are widely reported. The baseline consequently recommends that hydroponics be situated within a broader climate-resilience framework rather than promoted as a single solution.

The existing presence of drip irrigation and other water-management practices may also provide a conceptual bridge to hydroponic production. The baseline notes that the use of drip irrigation indicates some familiarity with water-saving approaches and may facilitate understanding of hydroponic concepts.

The women's interviews provide particularly strong qualitative evidence. Participants propose hydroponics alongside drip irrigation, rainwater harvesting, improved cisterns and other technologies when discussing how they would improve their farming and water access.

This creates an important opportunity for the project's framing. Hydroponics is more likely to be meaningful to participants when presented in relation to a problem they already recognise, namely how to maintain productive activity under increasingly constrained and unpredictable water conditions.

However, this opportunity must be presented carefully. Women's perceptions that hydroponics could help address water scarcity are meaningful evidence of perceived relevance, but they do not constitute a technical feasibility assessment.

SHE-GROWS should therefore avoid presenting hydroponics as automatically water-secure or universally suitable. Its opportunity lies in exploring whether appropriately selected systems can provide an additional water-management option under local conditions.

The training itself can use this as a learning opportunity by allowing participants to compare water use, recirculation, losses, maintenance requirements and production characteristics across conventional and hydroponic practices. The baseline explicitly recommends comparing water use with conventional practices where possible.

Hydroponics is therefore best positioned as one component of a broader climate-resilient production portfolio, alongside existing local adaptation strategies.

8.4 Local demonstration and hands-on learning

The strongest pedagogical opportunity emerging from the qualitative evidence is the preference for practical, visible and locally grounded learning.

Women interviewed under WP2 consistently value practical components of previous training. They report that demonstrations in areas such as cheese-making, beekeeping and distillation helped them apply new knowledge directly and understand more formal or scientific approaches alongside existing practices.

The women's focus group similarly called for practical training adapted to local realities, concrete hydroponic projects, technical guidance and regular follow-up.

Stakeholder consultations strongly reinforce this preference. Local actors repeatedly recommend practical, field-based or community-based training rather than predominantly theoretical provision. One consultation explicitly emphasises training delivered within or close to the community, followed by equipment or financial support that enables participants to apply what they have learned.

The opportunity is therefore to use the project pilot itself as a learning infrastructure.

A functioning demonstration unit can serve several purposes simultaneously:

- make an unfamiliar technology visible and concrete;
- allow participants to practice operations under supervision;
- demonstrate routine maintenance and troubleshooting;
- provide realistic information on labour, inputs and costs;
- create a setting in which participants can assess whether the technology suits their circumstances; and
- generate local evidence that can reduce uncertainty among participants, households and communities.

This is particularly important because 73.2 % of valid respondents report no prior hydroponic knowledge. Demonstration can therefore bridge the gap between unfamiliarity and informed decision-making without assuming that initial interest will automatically translate into adoption.

The pedagogical objective should not be to demonstrate only successful operation. Participants also need to see what can go wrong, what maintenance is required and what costs and skills are involved. A credible demonstration creates informed confidence, not unrealistic expectations.

8.5 Flexible and accessible VET

Training-format preferences support a flexible delivery model. Overall, 39.6 % prefer fully online or digital training, 28.0 % blended learning, 19.1 % fully face-to-face delivery and 13.3 % community-based training. Women are less likely than men to choose fully online training (34.1 % versus 43.2 %) and more likely to choose community-based delivery (17.3 % versus 10.3 %). This aligns with women's qualitative preference for training close to group premises, local unions or nearby farms and with the strong gender difference in transport barriers (Annex B, Tables B.8 and B.16b).

Preferred timing is also heterogeneous: 43.5 % favour afternoon sessions, 34.8 % weekends and 21.6 % mornings. These distributions should inform flexible scheduling rather than be converted into a single mandatory timetable (Annex B, Table B.9).

These findings should not be forced into a single "preferred" timetable. Instead, they indicate the value of flexible delivery architecture.

For example, introductory or theoretical content can be provided through short digital units where appropriate, while practical components are delivered locally and in person. Sessions can be repeated at alternative times where participant numbers justify this, and scheduling can be coordinated with agricultural seasons and care responsibilities.

The opportunity is therefore not simply to make the existing VET model more convenient. SHE-GROWS can demonstrate a model of gender-responsive rural VET in which accessibility is built into pedagogy, location, scheduling, language and follow-up.

This directly supports WP3 curriculum development and WP4 trainer preparation because accessibility becomes part of training quality rather than an external logistical issue.

8.6 Women-to-women peer support and mentorship

Women's existing collective structures represent one of the strongest social assets identified in the qualitative fieldwork.

The 27 interviews document women's groups and agricultural collectives that already function as platforms for training, solidarity, equipment access, experimentation, marketing and communication with institutions. Participants report that group involvement can increase self-esteem and social recognition and make women feel more able to speak, decide and take initiative.

The women's focus group also revealed strong interest in mutual aid, knowledge-sharing and continued networks following training.

This creates a clear opportunity for peer-based learning and mentoring.



Women with stronger agricultural experience, previous VET exposure, technical confidence or collective leadership experience can support participants who are entering the programme with less experience. Peer mentors can help translate technical language, reinforce learning after formal sessions, share practical troubleshooting experience and maintain motivation during the transition from training to application.

Nor should the project recruit exclusively through established women's groups. The qualitative sample contains many women already connected to collective structures, whereas only 10.5 % of valid survey respondents report current organisational membership. Recruitment should deliberately include women outside existing networks so that peer structures expand access rather than reproduce existing patterns of institutional connection.

This opportunity should nevertheless be designed carefully. Peer mentoring should not create an additional unpaid workload for a small number of already highly engaged women. Roles, time requirements, training and recognition should be explicit.

Existing women leaders can therefore act as bridges to less-connected participants, rather than becoming the only beneficiaries of project opportunities.

8.7 Household and male engagement

The qualitative evidence identifies supportive household relationships as an important enabling factor.

Most women interviewed describe agricultural decision-making as consultative, and some report increasing support from husbands for participation in women's groups after families observe the social and economic benefits of collective activity.

This suggests that household engagement can help reduce certain participation barriers, particularly where training attendance, childcare, labour allocation, use of land or investment decisions are negotiated within the household.

Male focus-group evidence is also broadly supportive of women's participation. Participants emphasised the importance of strengthening support for women involved in the project and raised issues including occupational protection, social protection and the need for awareness around new agricultural techniques.

The opportunity is therefore to use targeted household and community engagement as an enabling mechanism, particularly during sensitisation and pilot introduction.

However, the purpose of such engagement must be clearly defined. It should not suggest that women require male permission to participate. Nor should husbands or male community members become gatekeepers for women's access to training, resources or leadership.

Appropriate household engagement can instead communicate:

- what the training involves;
- expected time commitments;
- the practical and economic objectives of the activity;
- possible household benefits;
- the importance of shared arrangements for care and workload; and
- the value of supporting women's independent learning and economic participation.

The evidence therefore supports engagement without displacement of agency. Supportive household actors can help create enabling conditions, but women remain the principal participants and intended beneficiaries of the gender-responsive intervention.

8.8 Cooperative resource sharing

Collective structures offer a particularly relevant opportunity for reducing the cost and risk of adoption.

The qualitative interviews show that existing women's groups already facilitate access to equipment, preferential input schemes, training, marketing and institutional contacts. They also create opportunities for diversification into beekeeping, poultry, distillation and processed agricultural products.

Women themselves identify trust, solidarity and clearer organisational roles as important foundations for collective economic activity. They also call for stronger market linkages, equipment and material support.

These existing practices provide a strong conceptual foundation for the cooperative component of SHE-GROWS.

For hydroponics, cooperative or group-based organisation could potentially reduce several entry barriers through:

- shared pilot or demonstration systems;
- collective purchasing of inputs;
- shared tools or monitoring equipment;
- common access to technical advice;
- coordinated maintenance support;
- joint marketing and transport;
- shared packaging or storage where relevant; and
- distribution of investment risk across a collective structure.

The survey nevertheless shows that cooperative development must be gradual. Only 10.5 % of respondents are currently members of a collective organisation, and 45.0 % remain neutral or uncertain about joining a new sustainable agricultural cooperative. At the same time, positive readiness is substantially higher among women (59.5 %) than men (27.8 %), creating a strong opportunity for women-centred cooperative development if governance, benefits and responsibilities are made credible and transparent.

The opportunity is therefore not to presume that all participants should immediately join a cooperative. Instead, SHE-GROWS can demonstrate the practical value of collective action before requiring formal commitment.

Collective structures are most likely to become attractive when participants can see clearly what problem they solve: reducing costs, accessing equipment, reaching markets, sharing knowledge or increasing bargaining power.

8.9 Institutional partnerships

The valid survey dataset provides an additional institutional opportunity: 65.2 % report access to extension or technical advisory services. Because 34.8 % remain outside these services and hydroponic-specific capacity is not established, extension actors should be integrated into a wider referral network rather than assumed to provide complete follow-up on their own.

The research design explicitly identified agricultural extension services, women's organisations, VET providers and local authorities as actors to be engaged in refining training strategies and aligning the intervention with community priorities. Key-informant sampling also identified institutions such as ATFP, APIA, AFRJ, and local authorities as relevant actors in the institutional landscape.

Stakeholder interviews similarly show that public institutions, agricultural organisations, civil-society groups and training providers already possess relevant mandates and some existing resources. At the same time, they repeatedly identify coordination and continuity as areas requiring improvement.

The institutional opportunity is to connect existing organisations more effectively around the participant pathway. A functioning support ecosystem would require clear roles. For example, different actors may contribute to community mobilization; training; demonstration; technical advice; finance; cooperative administration; market linkage and mentoring and follow-up.

The project should avoid assuming that every institution can deliver all these services. Mapping actual mandates and capacities is more useful than producing a long stakeholder list.

The strongest opportunity is to create referral pathways so that participants know where to go when they move from one stage of adoption to another. A woman completing hydroponic training should not have to independently discover which institution can advise on finance, registration, extension support or markets.

This institutional coordination is particularly important for sustainability because the SHE-GROWS consortium itself cannot remain the sole source of technical and organisational support after project implementation ends.



8.10 Digital tools as support, not replacement

Digital formats are nevertheless attractive to many participants: 39.6 % of the total sample selects fully online training and 28.0 % blended training. Women are less likely than men to select fully online provision, which reinforces the case for a blended model with strong local practical components.

Digital communication is also relevant to hydroponic awareness. Among respondents already familiar with hydroponics, social media and the internet were important information sources alongside family, neighbours, extension services, television, radio and training.

The opportunity is therefore to use digital tools where they add value rather than requiring them as a condition of participation.

Appropriate functions could include short reinforcement modules, visual instructions, reminders, troubleshooting resources, peer communication, contact with mentors, marketing support and follow-up after practical training. The baseline pathway explicitly includes digital support groups during follow-up and scaling.

The 27 interviews also identify digital communication and social-media marketing as priority skills, linking digital competence not only to training delivery but to potential business development and market access.

Digitalisation should therefore serve two different purposes: learning support, by extending contact beyond face-to-face sessions and economic support, by helping women communicate, market products and participate in wider networks.

Neither function requires replacing practical field-based learning. Hydroponics remains a hands-on technical activity, and the evidence from women consistently values demonstration and practice.

Integrated opportunity map

When the evidence is considered across the participant pathway, the most important enabling conditions can be summarised as follows:

Enabling condition	Evidence already present in WP2	Principal pathway contribution	Opportunity for SHE-GROWS
Strong interest in learning	79 % of survey respondents at least moderately interested; women express motivation in qualitative research	Awareness and recruitment	Convert curiosity into informed commitment through sensitisation and demonstration
Existing agricultural knowledge	Extensive crop, livestock, processing, irrigation and adaptation experience	Learning and technical application	Build hydroponics training on existing knowledge rather than beginning from zero
Perceived relevance to water stress	Water scarcity strongly experienced; women identify hydroponics among possible adaptation options	Perceived relevance and motivation	Situate hydroponics within climate-resilience and water-management strategies
Preference for practical learning	Strong qualitative demand for hands-on training and demonstrations	Skills and confidence	Use pilot units, model farms and supervised practical sessions
Flexible VET options	Diverse format and scheduling preferences; strong demand for local accessibility	Training access and retention	Combine local practical sessions with flexible and selected digital components
Peer networks and women leaders	Existing groups provide training, solidarity, recognition and marketing	Retention, confidence and leadership	Develop peer mentoring and use experienced women as co-designers and champions
Supportive household relationships	Joint decision-making and evidence of growing male support in some communities	Participation and household application	Engage households where useful while protecting women's agency

Collective resource sharing	Existing groups already share equipment, training and marketing opportunities	Investment, operation and commercialisation	Test shared equipment, purchasing, technical support and market functions
Existing institutional actors	Extension, VET, women's organisations, agricultural bodies and local authorities already present	All stages, especially implementation and continuity	Develop coordinated referral and support pathways
Digital connectivity	64.5 % device access; online and blended formats attractive to many respondents	Awareness, follow-up and marketing	Use mobile tools for reinforcement, peer communication and market support without making them mandatory

Taken together, the opportunity analysis changes the interpretation of the WP2 evidence. Rural women should not be viewed primarily through a deficit lens. The fieldwork reveals knowledge, initiative, adaptive experience, social networks, collective structures and strong aspirations that can provide the foundation for successful participation.

The central opportunity for SHE-GROWS is therefore to connect these existing assets. Practical training can build on agricultural experience; demonstration can convert interest into informed confidence; local delivery can reduce mobility barriers; peer networks can extend learning beyond the classroom; collective structures can reduce individual investment risks; supportive household engagement can facilitate participation; digital tools can maintain contact; and institutional partnerships can provide continuity beyond the project.

At the same time, these enabling conditions do not by themselves establish that hydroponics is technically or economically viable for every participant or locality. Opportunity must remain conditional on feasibility. The next section therefore examines the technical, resource, economic and organisational conditions that must be satisfied before hydroponic adoption can reasonably be promoted as a sustainable livelihood option.

9. Conditions for Viable and Gender-Responsive Hydroponic Adoption

The WP2 evidence supports hydroponics as a potentially relevant climate-resilient training and livelihood option, particularly in a context where water scarcity, climatic variability and unstable agricultural incomes are already affecting rural households. It does not, however, provide sufficient evidence to conclude that hydroponic production is technically feasible, economically profitable or socially appropriate for every woman, household or locality in Béja and Jendouba. In accordance with the D2.1 analytical plan, this section therefore identifies the conditions that would need to be satisfied for hydroponic adoption to become realistic and gender-responsive, rather than presenting WP2 as a full engineering or bankability feasibility study.

This distinction is particularly important because WP2 identifies a favourable but early-stage adoption environment. In the final analytical dataset, 78.9 % of valid respondents express at least moderate interest in hydroponic training, while 73.2 % report no previous hydroponics awareness. Respondents principally expect professional skills, household food production, additional income and reduced water use from training. These findings establish perceived relevance, not technical feasibility, financial readiness or commercial viability (Annex B, Tables B.13-B.15).

The first requirement is therefore technical suitability under local conditions. The qualitative evidence clearly establishes water scarcity as a major constraint and shows strong interest in water-saving technologies. Women interviewed under WP2 identify hydroponics alongside drip irrigation, rainwater harvesting, improved cisterns and other measures when discussing future adaptation strategies. At the same time, the current evidence does not contain systematic measurements of the water quality available at prospective installation sites. Water quantity alone is insufficient for hydroponic production. Before a system is installed, the suitability of the available source should be assessed in terms relevant to the selected production system, including its reliability and, where appropriate, parameters such as pH, electrical conductivity, salinity, alkalinity and other characteristics that may affect nutrient management and crop performance. These are technical requirements that follow from the type of technology envisaged by the project, but they have not yet been empirically established through WP2 and should therefore be treated as pre-installation verification needs rather than findings of the needs assessment.

The same applies to electricity and pumping requirements. Some hydroponic configurations depend on continuous or regular water circulation, aeration or other electrically powered components. The interviews include proposals for



solar-powered pumping for wells, indicating that energy requirements should be considered alongside water access. WP2 does not systematically assess electricity reliability, power costs or backup requirements. These conditions should therefore be verified before system selection, particularly where system failure during power interruptions could affect crops.

Climate and temperature management also require attention. Women already report drought, heat stress, irregular rainfall and changing agricultural conditions, while the baseline survey identifies heat, drought, declining yields and pest or disease pressures as important climate impacts. Hydroponics should consequently not be treated as independent of local climate. The performance of a system will depend partly on its physical setting and on whether temperature, solar exposure and crop-specific environmental requirements can be managed under local conditions. The technical design of the pilot should therefore consider not only water efficiency but also the conditions required to maintain reliable crop growth.

The choice of hydroponic system should follow this site-specific assessment. The approved project proposal foresees the installation of NFT, DWC and vertical growing systems, together with environmental control equipment, growing materials, tools and safety equipment for training purposes. WP2, however, does not provide the engineering, agronomic or economic evidence necessary to conclude that one of these technologies is inherently the best system for rural women in Béja or Jendouba. Selection should therefore be based on criteria such as water and energy conditions, crop choice, investment and operating costs, maintenance complexity, local availability of components, participant skills, time requirements and the intended purpose of the installation. A system suitable for demonstration and training may also differ from the system that would ultimately be most appropriate for an individual household or cooperative enterprise.

A second condition concerns the availability and affordability of inputs and technical services. The WP2 interviews demonstrate that women already experience difficulties converting agricultural training into sustained practice when essential equipment is absent. Participants report shortages of equipment for activities such as processing and poultry production, and some groups depend on borrowing equipment from neighbouring organisations. The same risk would apply to hydroponics if training introduces a technology for which nutrients, substrates, seedlings, pumps, pipes, monitoring equipment or replacement components are difficult or costly to obtain locally.

For this reason, the viability assessment should consider the entire input and maintenance chain, rather than only the initial installation. A technically functional pilot can become unsustainable if a relatively minor component fails and no replacement is available, if nutrients must be sourced through costly or unreliable channels, or if participants remain dependent on project experts for every technical problem. Stakeholder consultations also identify shortages of specialised trainers and emphasise the need for qualified technical guidance and continued mentoring. Local repair capacity, technical advisory services and clear troubleshooting pathways should therefore be considered part of system viability.

A third condition is compatibility with women's available labour and time. Hydroponics is sometimes presented as land-efficient or water-efficient, but these characteristics do not mean that the technology is labour-free. Depending on the system, participants may need to monitor water and nutrient conditions, inspect plants, manage seedlings, maintain pumps and pipes, address crop health problems and undertake harvesting and cleaning activities.

Gender-responsive system design should consequently make routine labour requirements visible before adoption. Training should provide realistic information on monitoring frequency, maintenance and seasonal workload, and pilot testing should record the actual time required for routine system operation. Where group or cooperative models are envisaged, responsibilities should be clearly allocated rather than assuming that women will absorb routine maintenance informally.

A fourth condition is financial viability at the level at which adoption is expected to occur. Finance was the strongest-ranked barrier in the women's focus group (mean rank 2.2) and one of the two strongest in the men's group (2.4). Although 69.7 % of valid respondents report access to credit or microfinance, access is lower among women than men (63.6 % versus 73.8 %) and does not demonstrate affordability, suitability or control over investment decisions.

The financial question should therefore extend beyond the cost of purchasing a hydroponic unit. It should include initial infrastructure, installation, water supply, pumping, environmental protection where required, seedlings, nutrients,

substrate where relevant, replacement components, packaging, transport, maintenance and other recurrent expenses. These costs should then be compared with realistic production and revenue scenarios rather than assumed yields or idealised demonstrations.

A gender-responsive financial model should favour staged adoption and risk reduction. Demonstration units, shared systems, starter support, group purchasing, equipment-sharing arrangements or carefully structured financing may be more appropriate during early implementation than expecting individual participants to finance complete systems immediately. Such decisions should be based on transparent costing and should allow women to make informed choices about whether participation is economically appropriate for them.

A fifth condition is credible market linkage. Only 39.7 % of valid respondents report market access. Women in the sample report higher access than men, but the survey does not establish crop-specific demand, margins, buyer reliability or women's control over sales income. The qualitative interviews similarly document commercialisation difficulties for products such as honey, essential oils, processed figs and cheese. Hydroponic commercial viability must therefore be tested at crop, location and buyer level before scaling.

Hydroponic crop selection should therefore not be based exclusively on what can technically be grown. It should also consider what can realistically be sold, to whom, at what quality, at what time of year, at what price and with what transport and packaging requirements. The present WP2 dataset does not provide crop-specific market analysis sufficient to determine which hydroponic crops would be commercially optimal in Béja or Jendouba. Buyer demand, seasonal market gaps, production costs and achievable prices therefore remain areas requiring further verification before commercial scaling.

This is also a gender issue. Increased production does not automatically translate into women's economic empowerment. The project should examine whether women participate in pricing, selling and financial decisions and whether income generated through the activity remains under their meaningful influence. Commercial viability and women's economic agency should therefore be assessed together.

A sixth condition concerns safety, ergonomics and accessibility. The men's focus group specifically raised occupational safety and social protection for women participating in the project, including insurance and protection mechanisms adapted to rural working conditions. The project proposal similarly provides for safety equipment and protective gear within the hydroponics training infrastructure.

Safe participation should therefore cover not only general workplace safety but the practical handling of nutrients and other inputs, electrical and water equipment, lifting or repetitive tasks, cleaning procedures and appropriate protective equipment. Training infrastructure should also accommodate differences in physical ability and educational background. Where participants have accessibility needs, system height, workstation design, movement around installations and teaching materials should be adapted accordingly. These requirements are consistent with a gender-responsive VET approach even though WP2 does not provide sufficient data to quantify the prevalence of specific accessibility needs.

The final and arguably decisive condition is continuity of support after training. This finding appears consistently across the women's focus group, in-depth interviews and stakeholder consultations. Women value practical training but repeatedly criticise previous interventions that ended without equipment, follow-up, markets or assistance with implementation. The women's focus group explicitly called for ongoing technical guidance, monitoring and concrete projects rather than isolated training sessions. The 27 interviews similarly identify one-off training, limited equipment and weak post-training support as important weaknesses of previous initiatives. Stakeholders also recommend local practical training combined with financial assistance and continuous technical guidance.

For SHE-GROWS, post-training support should therefore be considered part of the adoption model rather than an optional additional service. Participants require a defined pathway for technical questions, troubleshooting, extension support, mentoring, peer assistance and referral to finance or institutional services. This is particularly important during the first production cycles, when confidence and technical competence are still developing.

The conditions identified through WP2 can be consolidated as follows:

Condition for adoption	What must be established before or during implementation	Current WP2 evidence
Technical suitability	Reliable water supply, appropriate water quality, suitable climatic conditions, electricity and	Strong evidence of water and climate pressure; site-specific water quality, electricity and



	pumping requirements, system reliability, crop-management capacity	engineering conditions not yet verified
Appropriate system choice	Match between NFT, DWC, vertical or other training configurations and site, crop, cost, maintenance and participant conditions	NFT, DWC and vertical systems planned in the project; WP2 does not justify selecting one as universally preferable
Inputs and services	Affordable nutrients, substrates, seedlings, pumps, pipes, spare parts, monitoring equipment, repair and technical expertise	Strong evidence that equipment shortages and discontinuous technical support undermine previous training; hydroponic-specific supply chain requires verification
Labour and time compatibility	Realistic assessment of monitoring and maintenance workload and compatibility with women's agricultural, household and care responsibilities	Strong qualitative evidence of gendered time and care constraints
Financial feasibility	Transparent start-up and recurrent costs, realistic financing, staged investment and risk-sharing	Strong evidence that investment capital is a leading barrier; existing credit access does not establish affordability
Market feasibility	Appropriate crop selection, product quality, demand, pricing, packaging, transport and buyers	Strong evidence of general market-access constraints; crop-specific hydroponic market analysis remains incomplete
Safety and accessibility	Safe handling, protective equipment, occupational safety, ergonomics and inclusive training infrastructure	Safety raised directly in qualitative evidence and included in planned project infrastructure
Continuing support	Mentoring, troubleshooting, extension, peer support and clear institutional referral pathways	Very strong convergence across women, interviews and stakeholders

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he resulting conclusion is that viable adoption requires the simultaneous alignment of technical, economic, gender, market and support conditions. None should be treated in isolation. A technically efficient system may fail if inputs are unaffordable. Affordable equipment may remain unused if women cannot devote the necessary time. Successful production may not improve livelihoods if markets are absent. Strong training may not translate into adoption if finance and suitable space are unavailable. Conversely, interest, agricultural knowledge and supportive institutions can be converted into sustainable adoption when these conditions are deliberately connected.

WP2 therefore supports a progressive and evidence-based approach to hydroponic adoption. The first objective should be to build informed understanding and practical competence through locally accessible demonstration and training. The second should be to verify technical and resource conditions under actual pilot conditions. The third should be to document real labour, input, maintenance and operating requirements. The fourth should be to connect viable production models with realistic financing and markets. Scaling should follow only after these conditions have been demonstrated sufficiently in practice.

This approach is also the most consistent with the gender-responsive purpose of D2.1. Women's empowerment should not be measured simply by the number of women exposed to hydroponic technology or enrolled in training. It should be reflected in their capacity to make informed choices, access and control the resources required for implementation, operate systems safely and confidently, participate in economic decisions, benefit from resulting income and obtain support when technical or institutional problems arise.

Hydroponics can therefore become a meaningful component of the SHE-GROWS intervention, but only when the technology is adapted to women's realities rather than expecting women to adapt to the technology. The conditions identified here provide the bridge between the barrier and opportunity mapping in Sections 7 and 8 and the cooperative, institutional and implementation architecture examined in the following sections.

10. Cooperativism, Women's Leadership and Institutional Support Ecosystem

Cooperativism occupies a cross-cutting position within the SHE-GROWS analytical framework because it connects individual skills and agency with access to productive resources, markets, institutional support and longer-term economic sustainability. The WP2 Research Design therefore asks not simply whether cooperatives exist, but what social and institutional infrastructure for collective action is already present and how it can be mobilised for cooperative development. The framework specifically identifies current associative life, trust and willingness for collective economic activity, institutional actors and the legal and regulatory environment as core areas of analysis.

The evidence reveals an important duality. At the level of the broader survey sample, participation in formal collective structures is low. At the same time, the qualitative interviews demonstrate that where women's groups and agricultural collectives are active, they can function as important platforms for training, solidarity, equipment access, institutional contact, confidence-building and collective marketing. These two findings are not contradictory. They indicate that collective-action capacity exists locally but is unevenly distributed and cannot be assumed across the target population.

The quantitative baseline demonstrates a considerable gap between existing formal participation and potential future collective action. Only 108 of 1,031 valid respondents (10.5 %) report current membership in a cooperative, association or community organisation. Membership is similarly low among women (11.2 %) and men (10.0 %), suggesting that future cooperative development cannot rely only on prior organisational experience (Annex B, Tables B.11 and B.16). Figure 4 synthesises the report's central hydroponics conclusion: WP2 confirms relevance and interest, but viable adoption depends on a set of technical, economic and institutional conditions that must be verified.

10.1 Current collective-action context

Among those who do participate, the most visible structures include agricultural cooperatives, savings or microcredit groups and women's associations. These are predominantly livelihood-oriented organisations rather than abstract civic structures, making them potentially relevant entry points for future productive initiatives where governance is transparent and benefits are tangible.

The 27 in-depth interviews provide a substantially different, but methodologically complementary, perspective. The qualitative sample contains many women already participating in women's groups, agricultural development collectives and farmer organisations. Within these structures, women describe access to training in activities such as beekeeping, distillation, poultry farming, irrigated agriculture, project management and digitalisation; mutual support during difficult periods; access to shared equipment and preferential input schemes; and opportunities for collective marketing and participation in fairs and events.

Group membership is also associated with less tangible but important benefits. Interview participants report increased confidence, social recognition and a stronger ability to speak, make decisions and initiate activities. Groups can also act as gateways between rural women and institutions by making training and other opportunities more visible and accessible.

These findings should not be generalised to all rural women. The qualitative sampling deliberately included women with experience in agricultural and collective structures, while the survey captures a much broader respondent population. The contrast between the two datasets is therefore analytically useful: existing groups demonstrate what collective organisation can achieve, while the survey shows that most potential participants are not yet connected to such structures.

Collective action also has clear limitations. Women report that distance from group premises can restrict participation, particularly when transport costs and care responsibilities interact. Existing groups may lack machinery, processing or packaging equipment, hydroponic modules and other resources necessary to turn training into productive activity. Many depend on temporary fairs rather than permanent sales points, and women report a need for stronger material support from institutions.

These limitations are important because they demonstrate that creating or joining a group does not automatically solve women's structural constraints. A cooperative without adequate equipment, market connections, finance or institutional support may simply collectivise existing barriers rather than remove them.



Trust must similarly be interpreted with nuance. In the women's focus group, lack of confidence to work in a group or cooperative received a relatively low average priority, with a mean rank of 6.3. However, the men's focus group showed substantial variability in trust towards people and institutions, ranging from identification as the greatest obstacle by one participant to the least important by another. The evidence therefore does not support a generalised narrative of either widespread mistrust or universal collective confidence.

10.2 Cooperative readiness for hydroponics

The survey provides the clearest quantitative indication of prospective cooperative readiness. Overall, 228 respondents (22.1 %) are very ready and 187 (18.1 %) rather ready to join a new sustainable agricultural cooperative, while 464 (45.0 %) remain neutral or uncertain. Only 32 (3.1 %) are not at all ready. Gender disaggregation shows a markedly stronger positive orientation among women and is presented in Annex B, Table B.16c.

This is a strategically important finding. Approximately two fifths of the surveyed sample express positive readiness, but the largest single group remains undecided. The appropriate project objective is therefore not simply to recruit members but to move participants from uncertainty towards informed commitment where collective action provides demonstrable value.

Qualitative evidence suggests that such value is most likely to be recognised when cooperation solves concrete problems. Women already value groups because they can improve access to training, equipment, institutional networks, mutual support and markets. They also identify trust and solidarity, clearer organisational roles, marketing skills and stronger institutional linkages as conditions that help collective initiatives succeed.

The women's focus group similarly supported the creation of collective working frameworks, including groups or cooperatives, but connected this preference explicitly to mutual aid, experience-sharing, concrete projects, technical guidance and continuing support. This indicates that collective organisation is attractive when it is linked to practical functionality, rather than presented as an institutional objective in itself.

For hydroponics, several potential cooperative functions are particularly relevant. A collective model could allow participants to share investment in demonstration or productive systems, purchase inputs jointly, access technical expertise collectively, coordinate maintenance, organise transport and marketing, or negotiate with institutions and buyers from a stronger position. However, the WP2 evidence does not establish which of these functions prospective members prefer sufficiently to justify selecting a single cooperative model at this stage.

The project should therefore distinguish between cooperative readiness and cooperative membership. Readiness requires participants to understand what they would be committing to, what resources or labour they would contribute, what responsibilities they would assume, how decisions would be made and what benefits they could reasonably expect.

The baseline itself recommends gradual trust-building through transparent rules, clear benefit-sharing arrangements, governance training and visible early successes rather than assuming that collective action will emerge spontaneously.

This is directly consistent with the later SHE-GROWS work plan. WP5 foresees eight Sustainable and Cooperative Management Workshop sessions covering cooperative principles, governance, financial management, marketing, collective business planning and participatory decision-making. The project then foresees legal establishment of the cooperative, including internal regulations, defined roles and governance protocols, with UTAP leading the formalisation process.

Formal registration should come after participants understand the economic and organisational model, rather than serving as the starting point.

Administrative support will also be necessary. Stakeholder evidence indicates that cooperative registration and legal procedures can be difficult for rural groups without technical guidance and that stronger institutional coordination is needed to support sustainable collective structures.

Cooperative readiness should consequently be evaluated against more than willingness to sign a membership form. Before participants commit resources or labour, the emerging cooperative should have a credible purpose, transparent

economic logic, understood governance arrangements, defined responsibilities, accessible technical support and a realistic pathway to markets.

10.3 Women's leadership and meaningful participation

A gender-responsive cooperative cannot be assessed solely through the percentage of female members. Representation is necessary, but it is not equivalent to participation, influence or empowerment.

The qualitative evidence provides a favourable starting point. Women's groups and agricultural collectives already create spaces in which women acquire knowledge, gain confidence, interact with institutions and participate in collective selling. Interview participants report that group membership can strengthen self-esteem and social recognition and make women more able to speak, decide and take initiative.

Women with specialised agricultural knowledge can also exercise substantial decision-making authority. The interviews show that where women possess stronger technical expertise, for example in activities such as beekeeping or poultry, their knowledge can enable them to lead decisions even within otherwise consultative household arrangements. This suggests that competence, recognised expertise and practical responsibility can reinforce women's authority.

The cooperative component of SHE-GROWS therefore offers an opportunity to extend women's agency from participation in production towards participation in governance and enterprise management.

Meaningful participation should be assessed through several interconnected dimensions:

Dimension	Gender-responsive interpretation
Representation	Women are adequately represented among members and within governance and leadership positions.
Voice	Women participate actively in discussions and can influence decisions rather than merely attending meetings.
Technical authority	Women's acquired agricultural and hydroponic expertise is recognised in production and operational decisions.
Economic influence	Women participate in decisions concerning expenditure, pricing, investment, reinvestment and use of cooperative income.
Access to benefits	Training, productive opportunities, income and other benefits are distributed transparently and equitably.
Leadership development	Women have access to mentoring, governance skills and opportunities to assume increasing responsibilities.
Accountability	Internal rules define responsibilities, decision-making procedures, transparency requirements and mechanisms for addressing disagreement or grievances.
Accessibility of participation	Meeting schedules, locations and workloads do not systematically exclude women with transport or care constraints.

These dimensions are consistent with the project design. WP5 explicitly foresees training in cooperative governance, financial management, marketing and participatory decision-making, while the legal establishment task requires internal regulations, defined member roles and governance protocols.

The qualitative evidence nevertheless identifies an important gap. While the interviews provide rich evidence of women's experiences in groups and their increased confidence, WP2 does not provide systematic quantitative evidence on women's current representation in governing bodies, control over collective revenues, distribution of benefits or participation in formal cooperative financial decisions across Béja and Jendouba. These should therefore not be presented as established outcomes. Instead, they should become indicators for WP5 implementation and monitoring.

This distinction is important because a cooperative can formally satisfy a gender participation target while reproducing unequal decision-making internally. Women's membership should therefore be monitored together with leadership positions, meeting participation, influence over financial and production decisions, access to training and equipment, and benefit distribution.

Care and mobility constraints must also be considered within cooperative governance. The same factors that restrict training attendance can restrict participation in meetings, collective work or marketing activities. The 27-interview analysis therefore recommends that collective-action strategies recognise care and mobility realities rather than expecting women to absorb cooperative responsibilities on top of existing agricultural and household workloads.



Women's leadership should consequently be developed through practical responsibility, recognised expertise, mentoring and institutional access, not only through formal titles.

10.4 Institutional ecosystem and roles

The WP2 Research Design treats the institutional environment as an integral component of cooperative development. Stakeholder engagement and key-informant interviews are the primary evidence sources for this dimension, and the research framework explicitly identifies UTAP, APIA, ATFP, AFRJ and local authorities among the relevant institutional actors.

The evidence indicates that the target territories are not institutionally empty. Agricultural organisations, women's organisations, training providers, extension structures, public agencies and local authorities already possess relevant mandates, networks and expertise. The central problem is therefore less the absence of actors than the need to **connect** their functions around a coherent participant and cooperative pathway.

Stakeholder evidence repeatedly calls for stronger cooperation among public institutions, technical services, civil-society organisations and development initiatives. This concern is particularly important given the qualitative evidence that previous programmes may provide training without sufficient continuity, equipment, financing or implementation support.

The institutional ecosystem should therefore be organised according to function rather than treated as a static list of stakeholders.

Actor	Relevant contribution to the SHE-GROWS response
Elmentiez	Local VET delivery, access to participants, contextualisation of training, trainer preparation, implementation of pilot activities and local follow-up. Within WP2 it serves as field lead for quantitative and qualitative data collection, while later work packages place it centrally in trainer capacity-building and pilot delivery.
Grow It Yourself (GIY)	Hydroponics expertise, stakeholder engagement, technical guidance and practical system operation. Within WP2 GIY leads stakeholder mapping and consultations and supports documentation of agricultural practices and climate-adaptation cases.
UTAP	Farmer and rural networks, participant mobilisation, access to local agricultural actors, knowledge of agricultural conditions and market dynamics, institutional networking and support to cooperative formalisation. The project assigns UTAP responsibility for the cooperative legal establishment under T5.4.
EFA El Soto	Leadership of the gender-responsive curriculum, competency and certification framework, quality alignment and recognised certification pathways. WP3 is led by EFA El Soto and explicitly uses WP2 findings to define competencies and gender-focused training requirements.
OpenCom	WP2 methodological leadership, research framework and validation, integration of gender-responsive evidence, digital approaches and broader dissemination and quality functions.
Libverda	Hydroponics, water-management and VET expertise, with contributions to training design, trainer capacity and technical exchange.
ATFP	Alignment with Tunisia's vocational-training framework, adaptation of training materials to labour-market skill requirements and potential institutional uptake and scaling.
APIA	Agricultural investment and entrepreneurship expertise, connection to funding opportunities and business-development support for participants seeking to convert skills into viable enterprises.
AFRJ	Grassroots mobilisation of rural women, particularly in underserved areas, support to inclusion, mentorship, cooperative participation and community ownership.
Extension services and local authorities	Local technical continuity, links with agricultural programmes and infrastructure, coordination with communities, referrals and potential support to locally embedded implementation. Their engagement is explicitly foreseen under WP2 stakeholder consultation.

These contributions should be interpreted as project-defined and potential institutional functions, not as evidence that every service is already fully operational or accessible to all women in the target territories. WP2 repeatedly identifies gaps between the existence of institutions and effective access to their services.

The key implementation requirement is therefore to transform the ecosystem into a functional referral network.

A participant may enter SHE-GROWS through a women's organisation or local network, receive training through the VET system, require hydroponic technical assistance, subsequently need support for investment, then require help with cooperative formalisation and finally need connections to markets. If these services operate independently, the participant remains responsible for navigating a fragmented institutional landscape. If they are connected, the institutional ecosystem becomes an enabling mechanism.

The project proposal itself supports this integrated logic. Its sustainability strategy envisages institutionalisation of the curriculum through VET providers, an operational cooperative, continuing links with ATPF, APIA and AFRJ, engagement with market actors and long-term partnerships beyond the project period.

This does not remove the need for accountability. Responsibilities should be sufficiently explicit that participants understand who provides which form of assistance, under what conditions and for how long. Referral arrangements should avoid repeated assessments, contradictory advice or situations in which women complete one stage of the pathway but cannot identify support for the next.

The institutional ecosystem should also remain anchored in women's organisations and existing local collective structures. The qualitative evidence recommends treating established women's groups not simply as beneficiaries or channels for recruitment, but as local partners and co-designers capable of contributing practical knowledge, legitimacy and continuing community presence. A consolidated actor-and-role map is provided in Annex D.

Taken together, the WP2 evidence suggests that the cooperative component of SHE-GROWS should be understood as a supported economic and governance process rather than the simple establishment of a legal entity. Existing collective structures provide valuable experience and social capital, but wider formal participation remains low. Interest in future cooperation exists, but uncertainty remains substantial. Women's groups demonstrate that collective action can strengthen skills, confidence, access to equipment and market visibility, while also showing that groups cannot compensate indefinitely for absent finance, infrastructure, markets or institutional coordination.

The gender-responsive objective is therefore not merely to establish a cooperative containing women. It is to establish conditions in which women can enter voluntarily, participate consistently, influence decisions, assume leadership, control and benefit from economic outcomes, and obtain the institutional support required to sustain collective production and marketing.

This interpretation also aligns closely with the planned downstream activities. SHE-GROWS foresees cooperative governance and financial-management training, participatory decision-making, a collective business plan, legal formalisation and ultimately an operational hydroponic cooperative. WP2 adds the critical evidence-based condition that this process must be gradual, transparent, economically meaningful and grounded in women's actual capacities and constraints rather than driven only by the requirement to create a cooperative by the end of the project.

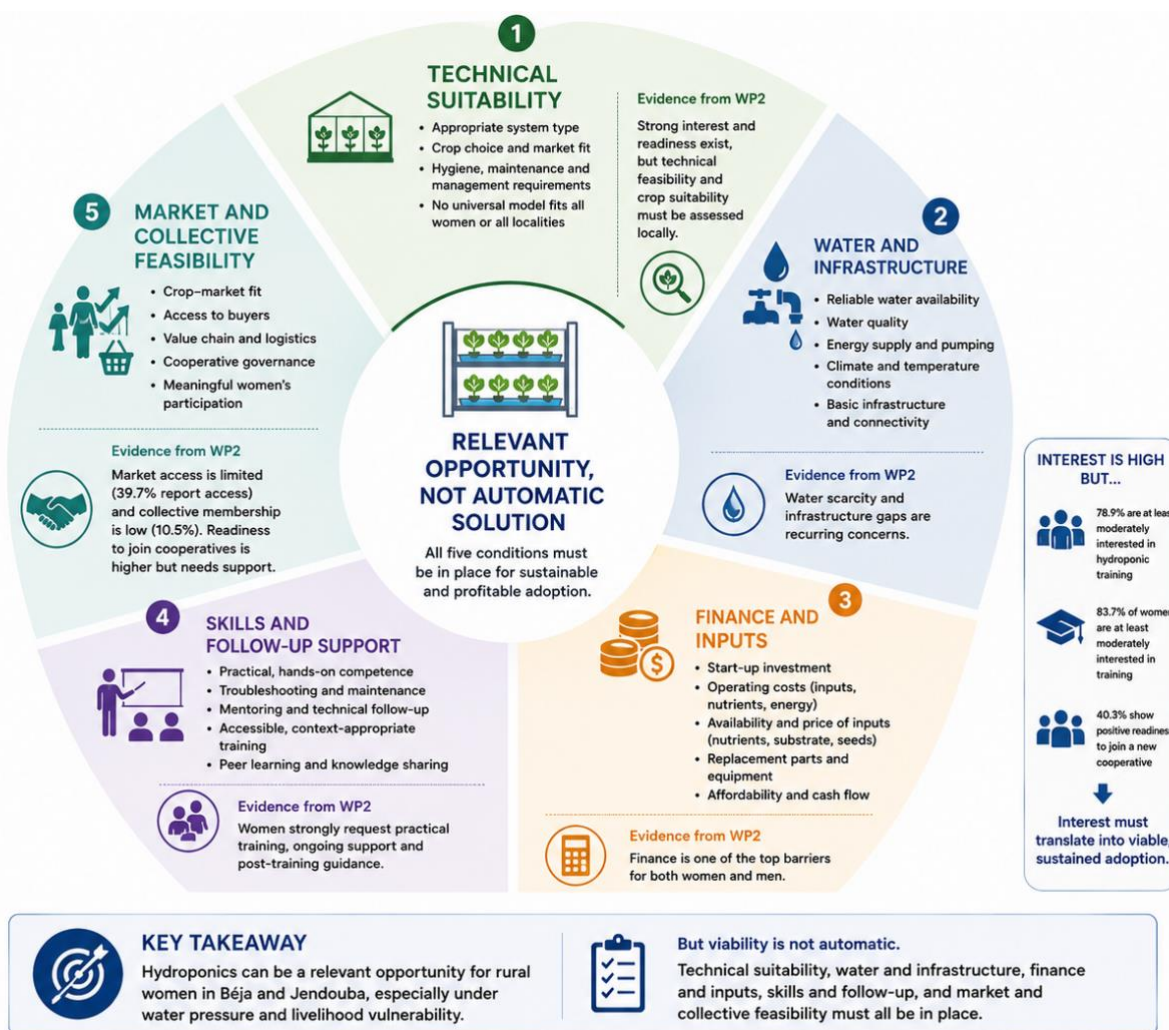


Figure 4. From interest to viability: the conditions that must be met before hydroponics can work

11. Integrated Barrier and Opportunity Mapping

The preceding analysis demonstrates that women's capacity to adopt hydroponic agriculture cannot be explained by any single barrier. The WP2 evidence instead points to a layered adoption process in which economic, technical, environmental, household, institutional and market conditions interact. A participant may overcome one constraint and still be unable to progress if another remains unresolved. Training can address a knowledge gap but cannot by itself provide investment capital; access to finance cannot compensate for an unsuitable production site; a functioning system cannot generate livelihood benefits without market access; and formal cooperative membership cannot guarantee women's meaningful participation in decisions or benefits. The matrix draws on the evidence inventory in Annex A, the gender-disaggregated survey tables in Annex B, focus-group rankings in Annex C and the institutional map in Annex D.

For this reason, the integrated mapping below translates the findings of Sections 5 to 10 into a decision tool linking each principal constraint to the stage of the adoption pathway at which it becomes most consequential, the gender mechanism through which it operates, and the corresponding opportunity or project response.

Evidence strength is interpreted using the triangulation protocol established in Section 4.4. High/convergent findings recur across independent evidence streams. Moderate/complementary findings are supported by several sources but provide different dimensions rather than direct replication. Heterogeneous findings show meaningful variation between participants or groups and should not be generalised uniformly. Evidence gap/verification required indicates that the issue is important for implementation but has not yet been sufficiently measured through WP2.

The "most affected group" column should similarly be read cautiously. It identifies profiles for whom the available qualitative evidence suggests that a barrier may be particularly consequential. It does not provide population prevalence by subgroup, because complete gender-by-governorate and intersectional cross-tabulations are not available for all survey variables.

Barrier or constraint	Evidence from WP2	Most affected / exposed group	Adoption stage most affected	Gender-responsive mechanism	Opportunity / project response	Evidence strength
Limited investment capital and financial risk	Finance was the strongest-ranked barrier in the women's FG, mean 2.2, and one of the strongest in the men's FG, mean 2.4. Interviews describe unstable incomes, burdensome financing and use of personal assets for agricultural investment. Reported access to credit does not establish affordability or suitability.	Women with limited liquidity, unstable agricultural income, existing financial obligations or limited influence over household investment	Resource mobilisation → implementation → scaling	Access to household or formal finance may not correspond to women's effective ability to mobilise and control productive investment	Transparent costing; staged investment; starter support; adapted financing; risk-sharing; shared equipment; collective purchasing; referral to investment/business-support actors such as APIA	High - convergent
Low hydroponics awareness and technology-specific knowledge	73 % of survey respondents report no previous hydroponics knowledge, although interest is much higher. The research design therefore identifies awareness and hydroponic knowledge as an explicit training gap.	Participants with no previous exposure to hydroponics, including experienced farmers unfamiliar with controlled production systems	Awareness → informed interest → training	Existing agricultural competence does not automatically provide hydroponic knowledge; unfamiliarity can increase perceived technical and financial risk	Sensitisation before specialisation; simple explanations of costs, maintenance and realistic benefits; visible demonstrations; comparison with familiar agricultural practices	High - convergent
Insufficient practical training and technical follow-up	Men ranked training/technical support as their strongest barrier. Women and interviewees repeatedly request practical, local training, equipment for practice and continued mentoring. Previous training is criticised when it ends without follow-up or application support.	New hydroponic learners, participants with limited access to specialised technical services, women in remote localities	Training → skills acquisition → operation → continuity	Training access and continuity can be reduced by mobility, time and service-access constraints; technical dependence can persist after course completion	Demonstration-led VET; supervised practice; troubleshooting; practical assessment; mentoring; field visits; local facilitators; post-training technical referral mechanisms	High - convergent
Water scarcity	Water scarcity is perceived	Women farming	Feasibility →	Women's	Position hydroponics within a	High -

and unreliable water access	as a recurrent production constraint in the survey and is strongly documented in women's interviews. It ranked second in the women's FG at 3.2. Women already respond through diversification, drought-tolerant crops, irrigation adjustments and other water-saving strategies.	in rain-fed, poorly irrigated or water-constrained locations and households purchasing or transporting water	investment → system operation	productive activity may depend on household water allocation, transport labour and ability to finance irrigation or pumping	wider water-resilience package; verify water availability before installation; integrate water-management competencies; combine with rainwater harvesting and efficient irrigation where relevant	convergent
Unverified water quality, electricity and system-specific technical conditions	WP2 establishes strong water and climate pressure but does not provide systematic site-level assessment of water chemistry, electricity reliability, pumping requirements or technical suitability for specific hydroponic configurations. The D2.1 plan explicitly identifies these as conditions requiring assessment.	Any participant or collective moving from training to installation	Pre-investment feasibility → system choice	Poor technical fit may expose financially constrained participants to disproportionate investment risk	Pre-installation site assessment; verify water quantity and quality, energy requirements, temperature conditions and reliability; validate system choice before recommending investment	Evidence gap - technical verification required
Land, space and effective control of productive assets	Land/cultivation space had a mean barrier rank of 4.3 in the women's FG. Survey-level land access is high, but household access does not establish women's individual control or suitability of the site. Qualitative evidence indicates that formal authority over land and major investments may remain with husbands or older family members.	Women without secure control over suitable productive space, younger women in parental households and participants whose land lacks reliable water or infrastructure	Resource access → installation	Household possession of land may coexist with limited female authority over land allocation and investment	Assess access to suitable and controlled productive space, not land ownership alone; consider shared or cooperative installations where individual sites are unsuitable	Moderate to high - complementary
Time poverty,	Interviews show that	Women with	Training access →	Productive and	Flexible scheduling; local	High -

childcare and care responsibilities	childcare and care of elderly or dependent relatives can directly limit training participation. Survey findings also identify domestic burden, scheduling and childcare-sensitive planning as relevant.	young children, dependent relatives, heavy domestic workloads, female household heads and women combining several livelihood activities	attendance/retention → system operation	training responsibilities are added to existing unpaid household and care work	delivery; childcare-sensitive planning; scheduling around agricultural and school calendars; realistic assessment of system-management workload	convergent, severity heterogeneous
Mobility, distance and transport	Transport and distance recur in women's interviews and stakeholder consultations as obstacles to training and participation. Existing women's groups also report distance from group premises as a constraint combined with family responsibilities and transport costs.	Women in remote rural communities, women with care responsibilities and participants without reliable transport	Training access → institutional access → collective participation → marketing	Mobility constraints increase both monetary and time costs and can interact with household expectations and care obligations	Decentralised delivery; clustered local sessions; community or farm-based training; transport support where justified; local mentoring and referral points	High - convergent
Input, equipment and maintenance constraints	Women's groups report shortages of equipment and limited capacity to convert acquired skills into productive activities. Existing groups sometimes rely on shared equipment or preferential input schemes.	Women and groups with limited investment capacity and weak access to specialised suppliers	Practical application → operation → continuity	Limited individual resources can make equipment failure or recurrent input costs more consequential	Map local suppliers and maintenance services; shared equipment; group purchasing; starter packages where justified; teach input sourcing and preventive maintenance	High for general equipment constraints; hydroponic supply chain requires verification
Weak market access and commercialisation pathways	Only 40 % of survey respondents report market access. Women's groups report reliance on fairs and temporary sales opportunities and difficulties scaling production because	Women producing for sale, remote producers and groups without established buyer networks	Enterprise development → commercialisation → income → scaling	Women's productive contribution does not automatically translate into income or control over resulting	Market mapping; crop choice linked to demand; costing and pricing; packaging; collective sales; buyer engagement; transport planning; digital marketing; institutional market linkages	High - convergent

	of weak market visibility and permanent outlets.			benefits		
Hydroponic crop-specific market feasibility not yet established	WP2 establishes general market constraints but does not provide sufficient evidence on buyer demand, seasonal prices, margins or market requirements for specific hydroponic crops	Participants progressing from demonstration to commercial production	Business planning → investment → scaling	Women with limited capital may bear disproportionate consequences of producing crops without reliable demand	Conduct crop- and location-specific market validation before commercial scaling; test demand and production economics through pilots	Evidence gap - market verification required
Institutional fragmentation and insufficient continuity	Interviews and stakeholder consultations repeatedly call for stronger coordination between public institutions, technical services, civil society and projects. Previous training is weakened when technical, equipment, finance and market support are disconnected.	Women with weaker institutional connections, first-time trainees and participants outside established organisations	Training → implementation → finance → cooperative formation → scaling	Participants with less time, mobility and institutional familiarity face greater difficulty navigating fragmented services	Establish clear referral pathways linking training, technical assistance, finance, cooperative/legal support and markets; assign institutional responsibilities and follow-up points	High strategic importance - complementary qualitative evidence
Social expectations and household negotiation	Cultural constraints rank relatively low on average but show marked heterogeneity. In the women's FG, traditions/social expectations averaged 5.7 but were ranked as the greatest obstacle by two women and the least important by four. Men's average assessment was also low.	Women in households or communities where participation, mobility or use of resources is socially constrained	Training participation → resource allocation → implementation	Household and community norms may affect women's ability to travel, invest time, allocate land or commit household resources, but not uniformly	Context-specific household/community sensitisation; communicate project benefits and workload realistically; engage supportive household actors without transferring authority away from women	Heterogeneous / divergent
Limited prior integration into formal collective structures	Only 10.5 % of survey respondents report current membership in collective organisations, while 89.5 % do not. Qualitative	Women outside associations, cooperatives or organised agricultural	Collective organisation → market engagement → scaling	Women outside networks may have less access to information, equipment, peer	Use existing women's groups as bridges while recruiting beyond them; gradual exposure to collective activity; peer mentoring;	High evidence for participation gap; complementary

	interviews, by contrast, demonstrate substantial benefits for women already involved in groups.	networks		support and institutional contacts	practical demonstration of collective benefits	evidence on benefits
Uncertainty about cooperative participation, governance and trust	22 % of survey respondents are very ready and 18 % rather ready to join a sustainable agricultural cooperative, while 45 % remain neutral or uncertain. Only 3 % are not ready at all.	Participants with little prior collective experience or uncertainty about contributions and benefits	Cooperative readiness → formal membership → governance	Uncertainty may relate to trust, clarity of benefits, governance and perceived risk rather than rejection of collective action	Start with pilot groups and visible benefits; governance training; transparent membership criteria; defined contributions and responsibilities; clear benefit-sharing; conflict-management mechanisms	High for uncertainty; reasons require qualitative interpretation
Risk of nominal rather than meaningful women's participation	Interviews show that collective membership can strengthen women's confidence and decision-making, but WP2 does not provide systematic evidence on women's control over cooperative revenues or governance positions across the territories.	Women entering new mixed or formal cooperative structures	Governance → leadership → benefit distribution	Numerical inclusion does not guarantee voice, financial influence or equitable benefit sharing	Monitor women's representation, voice, leadership roles, technical authority, influence over investment/pricing and access to benefits; leadership mentoring; transparent grievance procedures	Moderate - positive qualitative evidence, governance outcome to be monitored
Digital exclusion or limited digital confidence	The baseline identifies digital and blended learning as viable options but warns against digital-only delivery because device access and digital confidence are not universal.	Participants without devices, reliable connectivity or confidence using smartphones for learning	Awareness → training → follow-up → marketing	Digital-only provision can reinforce existing geographic or educational inequalities rather than overcome them	Mobile-friendly and low-bandwidth resources; introductory digital support; printed and visual alternatives; digital tools as reinforcement rather than prerequisite	High - survey supported

The integrated mapping confirms that the principal challenge is not a lack of motivation or interest among women, but the constrained conversion of capabilities into productive opportunity. Women may possess agricultural experience, complete training and express strong interest in hydroponics, yet still be unable to progress if finance, suitable productive space, reliable water, equipment, accessible technical support or viable markets are unavailable. Several constraints also operate across multiple stages of the adoption pathway: mobility affects training, institutional access and markets; finance influences installation, operation and scaling; and weak institutional coordination can interrupt progression from training to productive application. Effective support should therefore address combinations of barriers rather than isolated constraints.

A gender-responsive interpretation also requires moving beyond measures of nominal access. Household access to land does not necessarily imply women's control over suitable productive space; access to credit does not establish affordability or authority over investment decisions; availability of training does not guarantee accessibility; cooperative membership does not ensure voice or leadership; and participation in production does not necessarily translate into control over resulting economic benefits. At the same time, the evidence does not support treating women as a homogeneous group or assuming that cultural resistance and lack of confidence are universally dominant. Social and household constraints are important for some women but vary substantially, while economic, technical, mobility and institutional barriers recur more consistently. Gender therefore operates through the interaction between these structural conditions and women's time, mobility, resource control and decision-making authority.

Finally, the mapping distinguishes established WP2 findings from conditions that still require verification. WP2 demonstrates water scarcity, financing constraints, training-access barriers, limited market connectivity and the need for continuing technical and institutional support, but it does not establish site-specific water quality, electricity reliability, system-specific energy requirements, availability and cost of all hydroponic inputs, or crop-specific profitability. These technical and economic conditions should be assessed during pilot preparation and implementation before decisions on system selection or scaling are made. Section 12 therefore translates the verified WP2 findings and identified evidence gaps into requirements for the Gender-Responsive Hydroponics and Sustainable Entrepreneurship Curriculum.

12. Implications for the Gender-Responsive Hydroponics and Sustainable Entrepreneurship Curriculum

The central purpose of WP2 is not only to diagnose barriers but to ensure that those findings are translated into the design of the downstream SHE-GROWS training programme. This link is explicit in the project architecture. WP3 requires the consortium to review WP2 findings, identify the key competencies, educational needs and gender-focused training requirements emerging from the needs assessment, and convert them into specific learning outcomes, performance indicators and progression pathways for the curriculum on Hydroponic Agriculture and Sustainable Entrepreneurship.

The WP2 evidence strongly supports an integrated competency model rather than a narrowly technical hydroponics course. Rural women already possess agricultural knowledge and practical experience, but the adoption pathway identified in Sections 7 to 11 shows that technical competence alone is insufficient. Participants also need to understand water and climate risks, evaluate costs and investment decisions, access markets, participate effectively in cooperative structures, negotiate productive decisions, use appropriate digital tools and know where to obtain technical or institutional assistance.

The 27 in-depth interviews reach the same conclusion. Women identify priority skills in water-efficient and hydroponic techniques, livestock and processing, marketing and digital sales, project management and cooperative governance. They also emphasise that training should be practical, locally accessible, understandable and followed by mentoring. The baseline survey similarly recommends that the intervention integrate water efficiency, women's inclusion, financial feasibility, digital accessibility, market access and cooperative trust-building rather than limiting the programme to technical hydroponics.

The implication is that the curriculum should enable participants to progress through the full adoption pathway, from understanding hydroponics to deciding whether it is appropriate, operating a system safely, evaluating its economic viability, organising production, participating in collective structures and sustaining the activity over time.

12.1 Entry-level and accessibility requirements



WP2 reveals a heterogeneous learner population. Women in the qualitative fieldwork range from participants with limited formal schooling to women with vocational qualifications and university degrees, while many already possess substantial agricultural knowledge acquired through farming, livestock production, processing, informal training or participation in women's groups. The curriculum should therefore avoid using formal educational attainment as a proxy for agricultural competence.

The final analytical export confirms limited formal exposure to both hydroponics and VET. Only 26.8 % of valid respondents report prior hydroponics awareness and only 20.1 % report previous vocational or non-formal training. The curriculum should therefore begin with sensitisation explaining what hydroponics is, what it can and cannot do, what routine management it requires and what costs or limitations may be involved, while recognising participants' existing agricultural knowledge (Annex B, Tables B.6 and B.13).

This creates two simultaneous curriculum requirements: the course should not assume previous hydroponic knowledge, but it should recognise and build upon prior agricultural knowledge.

An initial diagnostic or orientation stage would therefore be preferable to applying a uniform assumption about learner starting points. This can identify differences in literacy, prior agricultural experience, digital confidence and technical familiarity without excluding participants who have strong practical knowledge but fewer formal qualifications.

Accessibility should be considered part of curriculum design rather than an implementation issue external to learning. WP4 itself requires trainer preparation to reflect participants' educational backgrounds, aspirations, accessibility needs and preferred learning styles.

WP2 provides several concrete implications. Learning content should be available in understandable local language, supported by visual and practical materials rather than relying heavily on text. A training-centre stakeholder specifically recommends short, simple and practical instruction using clear language suited to rural women's educational backgrounds rather than long, predominantly theoretical courses.

The curriculum should also be modular enough to accommodate attendance constraints. Women's interviews show preferences for nearby training venues and schedules aligned with care responsibilities, school calendars and agricultural workloads. Consequently, important competencies should not depend on attendance at a single long block that is difficult to recover if missed.

Digital learning can support flexibility but should not become an entry requirement. The baseline finds that digital access and confidence are not universal and recommends a blended model combining mobile content with practical community sessions, printed or visual materials and local coaching.

The entry-level design should therefore follow five principles:

1. no assumption of prior hydroponic knowledge;
2. explicit recognition of existing agricultural and livelihood skills;
3. simple and understandable language;
4. multiple learning formats, including visual, practical and digital reinforcement;
5. accessibility in timing, location and learning progression.

These conditions would allow the curriculum to accommodate both relatively experienced farmers and women entering technical agriculture from different educational or employment backgrounds without lowering the quality of the expected learning outcomes.

12.2 Technical hydroponics competencies

Technical hydroponics competencies remain the core occupational component of the programme, but WP2 suggests that they should be taught through a competency-based progression from understanding to independent problem-solving.

The baseline recommends that practical training include seedling management, nutrient solution management, system maintenance, crop selection, hygiene and troubleshooting. WP4 subsequently requires training materials to

develop both factual and theoretical understanding and the cognitive and practical skills needed to solve specific problems in hydroponic farming.

Based on the barriers and feasibility conditions identified in WP2, the technical curriculum should enable participants to understand:

the basic principles of soilless cultivation and the differences between hydroponics and conventional soil-based production;

- the functions and main components of the hydroponic systems demonstrated through the project;
- establishment and management of seedlings;
- crop selection according to production and local market considerations;
- water circulation and basic water-quality awareness;
- nutrient preparation and safe nutrient management;
- monitoring of relevant operating parameters;
- irrigation and system scheduling;
- crop health, hygiene and preventive management;
- routine cleaning and maintenance;
- recognition of equipment failure and common system problems;
- basic troubleshooting and decisions concerning when specialised technical assistance is required; and
- safe harvesting and post-harvest handling where relevant.

The project foresees exposure to NFT, DWC and vertical growing systems. However, as established in Section 9, WP2 does not provide sufficient technical evidence to designate one of these technologies as universally preferable for women in Béja or Jendouba. Training should therefore teach participants to compare systems according to requirements and context, rather than teaching one technology as inherently appropriate.

A participant completing the technical component should ideally be able not only to operate the training system but also to answer a more important question: is this type of system suitable for the productive conditions available to me or my group?

That requires basic understanding of water requirements, energy needs, maintenance complexity, investment costs, input availability, crop suitability and labour requirements.

This would transform technical education from procedural instruction into informed technical decision-making.

The strong preference for practical learning in WP2 means that competency development should occur directly around functioning systems. Women report that practical demonstrations in previous agricultural training made new knowledge easier to understand and apply, while both women's focus-group discussions and stakeholder interviews call for demonstrations and continued technical guidance.

A meaningful technical competency should therefore be demonstrated through performance, not solely through the ability to reproduce theoretical information.

12.3 Climate and water competencies

Climate and water management should not be treated as a peripheral sustainability topic. They are among the main reasons why hydroponics is relevant to the target territories in the first place.

The WP2 evidence documents widespread concern about water scarcity, drought, heat, climatic variability and declining production stability. Women also demonstrate considerable existing adaptation knowledge, including crop diversification, drought-tolerant varieties, soil conservation, drip irrigation, rainwater harvesting and adjustments in crop management.

The curriculum should therefore position hydroponics within a broader climate-resilience framework, not as a technology detached from existing agricultural adaptation.

The case-based evidence in Section 5.6 reinforces this approach: women already combine local water-management knowledge and climate-adaptation practices with selective adoption of new technologies. Hydroponic competencies should therefore be taught in relation to these existing practices, enabling participants to assess where hydroponics may add value under their own production conditions.

Participants should develop competence in:



- understanding how water scarcity and climate variability affect existing production systems;
- comparing conventional and hydroponic water-management approaches;
- understanding recirculation and water-efficiency principles;
- recognising that hydroponics still requires a reliable water source;
- basic awareness of water quality and why parameters such as salinity, pH and electrical conductivity matter;
- understanding how temperature and climatic conditions influence system performance and crop choice;
- identifying water losses and opportunities for improved efficiency;
- integrating hydroponics with other adaptation strategies rather than presenting it as their replacement; and
- interpreting basic resource-use information to support production decisions.

The baseline explicitly recommends framing hydroponics around water savings, stable production and drought adaptation and, where possible, comparing water use with conventional agricultural practices.

This comparative approach is particularly appropriate for adult learners because it allows women to relate unfamiliar hydroponic principles to farming systems they already understand.

The curriculum should also avoid overly promotional messaging. Participants should understand both potential benefits and operational dependencies. A water-efficient system is not automatically feasible where water quality is unsuitable, electricity is unreliable, maintenance is unaffordable or input supply is interrupted.

Climate and water competency should therefore produce informed adaptation capacity, not simply positive perceptions of hydroponics.

12.4 Entrepreneurship competencies

The WP2 evidence provides a strong justification for entrepreneurship to be integrated throughout the technical curriculum rather than taught as a short module at the end.

Agriculture provides the main household income for 81.7 % of valid survey respondents, while market constraints, high input costs and unstable income already affect rural livelihoods. Only 39.7 % report access to agricultural markets, and qualitative interviews document women who have completed agricultural or processing training but continue to struggle to commercialise honey, cheese, essential oils, processed figs and other products.

The curriculum must therefore make a clear distinction between learning to produce and learning to create livelihood value from production.

Entrepreneurship competencies should include:

- basic cost identification and costing;
- separation of start-up and recurrent expenditure;
- simple budgeting and cash-flow awareness;
- estimation of unit production costs;
- financial risk and borrowing decisions;
- identification of local input suppliers;
- basic business-model development;
- production planning;
- market mapping;
- identification of potential buyers and customer segments;
- crop choice in relation to market demand;
- pricing;
- quality and consistency requirements;
- packaging and product presentation;
- transport and logistics;
- sales and negotiation;
- basic record-keeping;

- digital communication and marketing; and
- comparison between individual and collective business models.

The qualitative interviews directly support this integrated approach. Women identify marketing, digital skills, project and financial management and cooperative governance alongside technical agriculture as priority areas, reflecting a demand for training that covers the complete cycle from production to sale.

Financial literacy deserves particular emphasis because investment capital is one of the strongest barriers identified by women. Training should enable participants to distinguish between technical feasibility and financial feasibility and to understand the consequences of financing choices before taking on debt.

The curriculum should not imply that all trained participants must become entrepreneurs or establish hydroponic businesses. Some may use skills for household food production, employment, collective production or gradual livelihood diversification. Entrepreneurship education should therefore enable participants to evaluate alternatives rather than prescribe self-employment as the only successful outcome.

The baseline's proposed pathway is useful here: business and household application should follow practical skill acquisition and include costing, sourcing, production planning, household use, small-scale sales and market access.

12.5 Cooperative competencies

The evidence from Section 10 demonstrates that cooperative development requires explicit competencies and cannot be expected to emerge automatically from technical training.

Formal collective membership in the survey population is low, and 45.0 % of valid respondents remain neutral or uncertain about joining a new sustainable agricultural cooperative. At the same time, qualitative evidence from women already active in groups shows significant benefits from solidarity, equipment sharing, training access and collective marketing.

Cooperative education should therefore focus first on helping participants understand what collective organisation can realistically do, what it requires from members and how it differs from informal collaboration.

Priority competencies include:

- principles and purposes of cooperativism;
- different forms of collective economic activity;
- member rights and responsibilities;
- governance structures;
- roles and allocation of responsibilities;
- participatory decision-making;
- transparency and accountability;
- meeting procedures;
- collective financial management;
- membership contributions and shared costs;
- benefit-sharing;
- shared purchasing;
- shared equipment management;
- collective production where relevant;
- collective marketing and buyer negotiation;
- basic legal and administrative requirements;
- conflict prevention and conflict-management mechanisms; and
- preparation and interpretation of a collective business plan.

These competencies align directly with the project's planned WP5 Sustainable and Cooperative Management Workshop, which includes cooperative principles, governance, financial management, marketing, collective business planning and participatory decision-making.

WP3 also specifically requires the development of a cooperative manual covering organisational structures, governance and financial planning, as well as networking with existing cooperatives and regional stakeholders.



WP2 adds a particularly important gender-responsive requirement: cooperative training should distinguish membership from meaningful participation.

Participants should understand that equitable governance involves not only numerical inclusion of women but women's ability to speak, vote, access information, hold responsibilities, influence expenditure and pricing decisions, and benefit fairly from collective income.

Cooperative exercises should therefore simulate real governance decisions rather than only teach definitions. Scenarios could include deciding how shared equipment is allocated, resolving a disagreement about workload, setting a sales price, deciding how profits are reinvested or determining responsibilities when a member cannot fulfil a task because of family or care obligations.

Such exercises would make cooperative competencies directly relevant to the circumstances identified in WP2.

12.6 Gender and agency competencies

Gender responsiveness should not be confined to the composition of the participant group or to a separate awareness session. It should influence the curriculum's learning outcomes, pedagogy and definition of successful participation.

The WP2 evidence does not portray women as lacking motivation or agency. Women already participate in agricultural decisions, seek training, manage productive activities and lead particular areas where they possess technical expertise. At the same time, their ability to act can be constrained by unequal care burdens, mobility, household resource allocation and limited influence over land or major investments.

The purpose of gender and agency competencies should therefore be to strengthen women's capacity to act within the productive and institutional environments identified by WP2.

Relevant competencies include:

- communication and negotiation;
- participation in household and productive decision-making;
- self-advocacy in institutional settings;
- informed financial decision-making;
- leadership;
- participation in meetings and cooperative governance;
- recognition and articulation of one's own technical expertise;
- understanding equitable participation and benefit-sharing;
- identifying barriers to participation and possible support pathways;
- peer mentoring and support;
- constructive conflict management;
- confidence in interacting with trainers, extension agents, institutions and buyers; and
- understanding the relationship between productive responsibility and control over resulting benefits.

These competencies should be integrated through practical exercises rather than taught exclusively as abstract "gender theory."

For example, a costing exercise can include decisions about who controls investment and income. A cooperative exercise can examine whether women's participation is substantive or symbolic. A production-planning exercise can consider labour availability and care responsibilities. A market simulation can include negotiation with buyers. A system-management exercise can rotate technical leadership so that women gain recognised operational authority.

This approach is consistent with WP4, which explicitly requires trainers to develop gender-mainstreaming skills that foster leadership, equitable participation and inclusive hydroponic learning environments.

Gender-sensitive curriculum design should also avoid deficit framing. WP2 shows that many of the strongest barriers are structural, including finance, mobility, water, markets and institutional continuity. Training should not imply that these constraints can be overcome simply through greater personal confidence or motivation.

Agency development should instead combine individual capability with knowledge of available support systems and collective strategies.

12.7 Learning methodology

The strongest pedagogical message from WP2 is that the curriculum should be practice-centred, participatory, locally understandable and connected to application.

Women repeatedly report that training is most useful when it includes practical demonstrations and when knowledge can be applied immediately. They are more critical of one-off training that ends without equipment, follow-up or a pathway to implementation. Stakeholders similarly recommend short, clear, field-based instruction adapted to learners' backgrounds.

The dominant learning approach should therefore combine:

- Demonstration, where trainers show system components, procedures and expected outcomes using real equipment.
- Guided practice, where participants perform tasks themselves with supervision.
- Problem-based learning, where participants diagnose practical scenarios such as nutrient problems, interrupted water circulation, crop stress, unexpected costs or market difficulties.
- Peer learning, where women draw on existing farming knowledge and exchange locally relevant solutions rather than interacting only with the trainer.
- Scenario-based learning, where household, financial, market and cooperative decisions are integrated into technical exercises.
- Visual and low-text materials, where diagrams, photographs, process cards and short instructions complement formal written material.
- Blended reinforcement using mobile-friendly content, digital reminders and peer communication to support learning between practical sessions without replacing face-to-face practice.
- Field and demonstration learning, where participants observe operating units and compare practices under realistic conditions.
- Reflection and application, where learners identify how each competency would apply to their household, farm, group or employment context.

The baseline survey supports blended provision but explicitly warns that digital-only learning could exclude less connected or less confident participants.

Learning should also be sequential. This progression should not necessarily correspond to isolated modules. Instead, it provides a pedagogical logic. Participants first need to understand the technology, then practise it, then evaluate application, then consider collective and market pathways, and finally receive support during implementation.

Crucially, the curriculum should include realistic failure and troubleshooting scenarios. If participants are exposed only to perfectly functioning demonstration systems, the training may increase enthusiasm without developing resilience. Learning should include maintenance errors, input shortages, crop problems, market uncertainties and financial trade-offs so that participants are prepared for actual implementation.

12.8 Assessment and certification implications

The WP2 evidence suggests that assessment should measure usable competence, not primarily theoretical recall.

This aligns directly with WP3, which requires development of an assessment methodology, module-specific criteria, grading rubrics, minimum performance standards and assessment guidelines. The certification framework must also align with European VET standards and Tunisia's vocational system and establish transparent validation procedures for trainers and participants.

Qualitative fieldwork gives certification additional importance. Women report that limited formal recognition of previously acquired skills can restrict access to credit or institutional programmes that require documented competencies.

Assessment should therefore be designed both to verify learning and to give the resulting credential credible practical value.



For technical hydroponics competencies, participants should demonstrate tasks such as preparing or checking a system, managing seedlings, interpreting basic water or nutrient information, carrying out maintenance, recognising problems and explaining appropriate corrective actions.

For entrepreneurship competencies, assessment could require a simplified production budget, costing exercise, market map or small business scenario.

For cooperative competencies, participants could demonstrate decision-making through group exercises, governance scenarios or preparation of selected elements of a collective business plan.

For climate and water competencies, learners could compare production options and explain how water constraints influence system choice and management.

For gender and agency competencies, assessment should not attempt to "score confidence" as a personality characteristic. It should instead assess observable competencies such as participation in a decision-making exercise, negotiation, communication, leadership of a technical task or ability to identify an appropriate institutional referral pathway.

Assessment formats should also be accessible. Where written literacy differs substantially, practical demonstrations, structured oral explanations, observation checklists, images, scenarios and supported digital tools may provide more valid evidence of occupational competence than lengthy written examinations.

This approach is consistent with WP4's requirement to develop assessment tools and grading criteria mapped to practical and cognitive competencies and with the project's intended EQF Level 4 orientation.

The curriculum should also recognise the importance of validation by the target community. WP3 explicitly foresees focus-group validation with rural participants, prioritising women and underrepresented voices, to assess curriculum clarity, practicality and cultural fit and to revise modules, assessment tools and certification arrangements accordingly.

This validation stage is particularly important because some design questions cannot be settled by WP2 alone. The needs assessment identifies what participants require, but the actual curriculum will need to test whether the proposed content volume, terminology, exercises, assessment methods and learning sequence are understandable and realistic.

Translation of WP2 findings into curriculum requirements

The main evidence-to-curriculum relationships can therefore be summarised as follows:

WP2 finding	Curriculum implication	Competency or design response
73 % report no prior hydroponic knowledge	Do not assume technical familiarity	Introductory sensitisation, system principles, realistic costs and maintenance
Strong existing agricultural experience among women	Avoid treating participants as agricultural beginners	Recognition of prior knowledge; comparison between current farming and hydroponics
Strong water and climate pressure	Connect hydroponics to actual livelihood problems	Water efficiency, climate adaptation, water-quality awareness and resource management
Finance is a leading barrier	Technical training must include investment literacy	Costing, budgeting, financing, recurrent costs and risk assessment
Weak market access	Production skills alone are insufficient	Market mapping, crop-market fit, pricing, packaging, sales and buyer engagement
Practical training strongly preferred	Competencies should be demonstrated rather than merely described	Hands-on sessions, demonstration units and supervised practice
Previous training often lacks follow-up	Course completion should not mark the end of learning support	Mentoring, field visits, troubleshooting and referral mechanisms
Transport and care responsibilities affect participation	Accessibility must shape delivery	Local venues, flexible schedules, modular learning and childcare-sensitive organisation
Digital access is uneven	Digital tools should reinforce	Mobile-friendly modules plus face-to-face

	rather than replace practical learning	practice and non-digital alternatives
Cooperative participation is low and readiness uncertain	Collective organisation must be learned gradually	Trust-building, governance, roles, benefit-sharing, conflict management and collective business planning
Existing women's groups provide strong peer support	Use social learning as a curriculum resource	Peer mentoring, group exercises and women-led demonstrations
Women's agency is present but resource control can be unequal	Gender should be embedded across technical and business modules	Negotiation, leadership, financial decision-making, voice and equitable control of benefits
Skills recognition matters	Assessment should produce credible and usable evidence of competence	Competency-based practical assessment and recognised certification

The overall implication for WP3 is clear: the SHE-GROWS curriculum should be designed as a gender-responsive pathway from technical knowledge to effective livelihood capability.

Its success should not be judged only by whether participants can explain hydroponic principles. A stronger outcome would be that participants can understand when hydroponics is appropriate, operate and troubleshoot a system, manage water responsibly, calculate costs, assess financial risk, identify market opportunities, participate meaningfully in cooperative decisions and know how to obtain technical or institutional support.

This interpretation remains fully consistent with WP3's formal objectives to develop a gender-inclusive curriculum, define competency-based learning outcomes, establish assessment and certification frameworks, support cooperative development and validate the programme through expert and community feedback.

The curriculum should therefore convert the WP2 evidence into competence, not simply content. Technical hydroponics, climate adaptation, entrepreneurship, cooperative management and gender-responsive agency should be taught as interconnected dimensions of the same adoption process. This approach provides the strongest basis for ensuring that the training developed in WP3 can subsequently be delivered effectively by trainers under WP4 and applied realistically by participants during the WP5 pilot.

13. Implications for Trainers, Pilot Implementation and Cooperative Development

The WP2 findings have direct implications for how SHE-GROWS prepares trainers, recruits participants, delivers the WP5 pilot and develops the planned cooperative. The project architecture already contains the necessary components: WP4 strengthens trainer and institutional capacity, while WP5 moves from participant selection to practical hydroponics training, sustainable entrepreneurship and cooperative establishment. The objective is therefore not to redesign these work packages, but to ensure that their implementation reflects the gender-responsive evidence generated through WP2.

Four operational principles emerge. First, trainer competence must extend beyond technical knowledge to inclusive adult learning, gender-responsive facilitation and referral to wider support services. Second, recruitment must reach women beyond already organised or institutionally connected groups. Third, the pilot must emphasise direct practical competence, troubleshooting and continuing support rather than one-off theoretical instruction. Fourth, cooperative development must proceed gradually from informed participation and governance capacity towards an economically credible and equitable collective model. Detailed actions, responsibilities, timing, indicators and risk-control measures are specified in Section 14.

13.1 Trainer preparation and pedagogy

WP4 should assess trainer readiness across four complementary domains: technical competence, pedagogical competence, gender-responsive facilitation and referral/support competence. This is consistent with the project's requirement that trainer preparation respond to participants' educational backgrounds, accessibility needs and preferred learning styles, while developing practical hydroponics demonstration and gender-mainstreaming capacities.



Pedagogically, trainers should be prepared to work with heterogeneous groups in which formal educational attainment does not necessarily correspond to agricultural competence. WP2 documents substantial practical knowledge among women involved in crop production, livestock, irrigation, processing and other livelihood activities. Training should therefore use understandable language, visual explanation, demonstration and supervised practice, while allowing participants' existing agricultural and climate-adaptation knowledge to contribute to the learning process.

Gender-responsive facilitation requires more than achieving female attendance. Trainers should ensure that women actively perform technical tasks, use equipment, make operating decisions and participate in troubleshooting rather than remaining observers during practical sessions. Participation should be monitored within the learning process itself, particularly where differences in confidence, education or prior experience could result in some participants dominating demonstrations or equipment use.

Trainers should also be capable of teaching realistic system operation, including common problems and decisions about when specialist assistance is required. At the same time, some constraints identified by WP2, such as finance, equipment, market access, cooperative procedures or extension needs, lie outside the trainer's direct mandate. Trainers should therefore understand the institutional support and referral ecosystem described in Annex D and be able to direct participants towards appropriate technical, VET, financial, cooperative and institutional support. This prevents successful training from becoming disconnected from the next stage of the adoption pathway.

13.2 Recruitment and participant selection for WP5

Recruitment is the first stage at which the project's gender-responsive approach becomes operational. T5.1 foresees broad dissemination, community information activities and participant selection, while the project requires the selection of 60 rural participants with at least 50% women. WP2 indicates that this numerical threshold should be treated as a minimum condition for inclusion rather than as sufficient evidence of gender responsiveness.

Recruitment should use multiple channels. Existing women's groups, agricultural organisations, UTAP networks and local actors are important entry points, but reliance on established organisations alone risks primarily reaching women who are already better connected to institutions and training opportunities. The wider survey shows that formal collective membership is low, reinforcing the need to reach women outside organised groups, including those in more remote areas.

Selection criteria should be transparent, accessible and directly related to participation in the pilot. Motivation, interest in sustainable agriculture, capacity to engage in practical learning and relevance to livelihood or employment aspirations are appropriate considerations. However, previous hydroponic knowledge, formal agricultural qualifications, high digital competence, individual land ownership or existing cooperative membership should not become unnecessary entry barriers. Low hydroponics awareness is one of the needs that the project is designed to address, and participants may ultimately apply their skills through employment, shared facilities or cooperative production rather than through individually owned systems.

Pre-enrolment information should also support informed participation by explaining the practical requirements, workload, maintenance responsibilities, cooperative dimension and realistic opportunities and limitations of hydroponics. Recruitment monitoring should then examine not only whether the 50% female target is reached, but also which women are being reached and which remain absent. Where feasible and ethically appropriate, locality, distance, age, prior training, collective membership and relevant accessibility constraints should be monitored alongside gender.

13.3 Pilot delivery

The WP5 pilot is where the assumptions developed through WP2 and the curriculum are tested under real implementation conditions. T5.2 already combines theoretical modules, practical installation and maintenance, crop-management training, competency assessment and certification. WP2 strongly supports this structure, provided that practical application remains central.

Technical concepts should be connected as closely as possible to direct practice, and every participant should perform core tasks rather than simply observe trainers or more experienced learners. Practical sessions should include system operation, maintenance and realistic troubleshooting so that participants experience not only ideal demonstrations but also the types of decisions required when equipment, crops or operating conditions do not perform as expected. Women should participate fully in installation, monitoring, maintenance and troubleshooting so that technical authority is developed through practice rather than implicitly assigned to others.

Attendance, retention and competence should be monitored separately. Repeated absence or dropout should be examined by gender and reason, particularly where transport, scheduling, care responsibilities, agricultural workloads or accessibility constraints are involved. Likewise, satisfaction should not be treated as equivalent to competence. Assessment should distinguish understanding of hydroponic principles, ability to perform practical tasks safely and correctly, and ability to apply those skills or obtain appropriate support outside the training environment.

Post-training mentoring is essential because discontinuity after training is a recurring weakness in the qualitative evidence. Structured technical check-ins, supervised practice, troubleshooting and peer or institutional referral should therefore accompany the pilot. The pilot should also function as a learning cycle for the project by documenting actual labour requirements, maintenance issues, recurrent inputs, technical-support requests, water-management conditions, equipment problems and relevant operating costs. These observations should inform subsequent curriculum refinement, business planning and decisions about replication or scaling rather than assuming that demonstration performance automatically establishes long-term feasibility.

13.4 Cooperative development

The planned cooperative represents an important sustainability mechanism for SHE-GROWS, but WP2 indicates that legal establishment should be the outcome of a gradual process rather than an administrative objective pursued independently of participant readiness. T5.3 already provides for cooperative-management training, while T5.4 foresees formal establishment and governance arrangements. The evidence supports this sequencing because current collective participation is low and substantial uncertainty remains regarding future cooperative participation.

Before formalisation, participants should develop a shared understanding of the cooperative's economic purpose, membership responsibilities, governance arrangements, labour and financial contributions, shared assets, decision-making procedures and distribution of benefits. Trust, transparency and informed commitment are particularly important where participants may be expected to share productive resources or assume joint financial and operational responsibilities.

Gender responsiveness should be assessed through meaningful participation rather than numerical membership alone. Women's representation should be accompanied by opportunities to speak and vote, occupy technical and governance roles, influence production and marketing decisions, participate in financial management and benefit equitably from the resulting economic activity. Formal titles alone are insufficient indicators of empowerment if substantive influence remains unequal.

Finally, cooperative formalisation should follow evidence of a credible productive and commercial basis. The business plan should draw on pilot experience, realistic production and maintenance costs, access to inputs, transport requirements, financing options, buyer information and verified market opportunities. Existing women's groups and institutional partners can contribute experience, mobilisation and support, but the final cooperative should operate through transparent rules suited to the SHE-GROWS activity and remain accessible to newly trained participants rather than simply reproducing existing organisational structures. Continuing links with technical, financial, legal and market-support institutions should be established through the referral ecosystem described in Annex D.

Taken together, these four implementation areas reflect a single principle: access, learning, application and empowerment are distinct outcomes. Recruitment does not guarantee attendance, attendance does not guarantee practical competence, competence does not guarantee the resources needed for adoption, and cooperative membership does not guarantee meaningful influence or economic benefit. WP4 and WP5 should therefore support progression across the entire pathway, while Section 14 specifies the prioritised actions, responsibilities, indicators and risk-control measures required to do so.



14. Prioritised Recommendations and Implementation Matrix

The purpose of this section is to translate the evidence generated through WP2 into a limited number of prioritised and operational recommendations for the subsequent SHE-GROWS work packages. The recommendations are therefore not generic proposals for rural development. Each responds directly to a barrier, opportunity or evidence gap identified through the baseline survey, focus groups, in-depth interviews and stakeholder consultations and is linked to a responsible actor, an implementation stage and a monitoring or risk-control mechanism. Figure 5 translates the WP2 findings into an implementation pathway for the subsequent work packages, identifying the actions most necessary for effective and gender-responsive delivery.

This approach follows the D2.1 analytical plan, which requires each recommendation to be directly traceable to evidence and assigned to an actor, timing, indicator and risk-control measure. The plan distinguishes three levels of priority: P1, essential for participation, safety or basic feasibility; P2, necessary for successful adoption and retention; and P3, supporting sustainability, replication and scale.

The matrix should be read alongside the formal project indicators rather than as a replacement for them. SHE-GROWS already commits, among other objectives, to selecting 60 rural participants with at least 50 % women, delivering the pilot training and cooperative-management activities and establishing an operational cooperative. The indicators below are recommended implementation indicators derived from WP2 to help determine whether these formal outputs are being achieved in a genuinely gender-responsive and viable manner.

Priority	Evidence-based issue	Recommended action	Responsibility and timing	Recommended indicator and risk control
P1	Transport, distance and mobility constrain effective access to training. Women and stakeholders repeatedly identify transport cost, distance and unreliable mobility as barriers, particularly when combined with care responsibilities.	Deliver practical sessions as close as feasible to target communities; cluster participants geographically; use community, group or farm-based venues where appropriate; provide targeted transport solutions where distance remains unavoidable.	Elemtiez, with UTAP, AFRJ and local partners. Integrate into WP4 delivery planning and apply before and throughout WP5.	Indicator: female enrolment, attendance, completion and dropout analysed by locality/distance where feasible. Risk: remote women remain underrepresented despite achieving the overall female target. Control: strengthen local mobilisation, decentralise selected sessions and provide transport support where justified.
P1	Women may be formally eligible but excluded by schedules, domestic workload and care responsibilities. WP2 shows that care constraints are heterogeneous but potentially decisive for participation.	Schedule training and cooperative activities around participant availability, agricultural workloads and school calendars; use modular delivery; test childcare-sensitive arrangements where feasible; avoid creating unsustainable additional workloads.	Elemtiez and WP4/WP5 delivery partners, with consultation of women's groups. Before timetable finalisation and throughout pilot delivery.	Indicator: attendance and completion by gender; documented reasons for absence/dropout; participant assessment of timetable accessibility. Risk: repeated absence or withdrawal by women with greater care burdens. Control: schedule adjustment, catch-up opportunities and locally adapted arrangements.
P1	Investment capital is one of the strongest barriers to adoption. The evidence indicates that training without a realistic financing pathway may not translate into application.	Integrate realistic start-up and recurrent costing into the curriculum; identify available investment-support mechanisms; establish referral pathways to agricultural investment and finance support; assess shared or cooperative equipment models; avoid promoting debt before technical and market feasibility are established.	Elemtiez, EFA El Soto and Libverda during WP3/WP4 curriculum development; APIA and UTAP for investment and referral support; WP5 before business commitments.	Indicator: proportion of participants able to identify realistic financing options and produce a feasible cost plan; number referred to appropriate support. Risk: trained women remain unable to apply skills or assume inappropriate financial risk. Control: staged investment, shared assets and alternative financing pathways.
P1	Hydroponic adoption must be technically feasible under actual local conditions. WP2 establishes water scarcity but does not provide site-specific evidence on water quality, electricity, system reliability or all other technical conditions required for installation.	Complete a pre-installation technical assessment for pilot sites covering water availability and relevant quality parameters, energy/pumping needs, climate exposure, system requirements, maintenance conditions, suitable space and local access to replacement components. Select systems only after this assessment.	GIY, with Elemtiez, Libverda and relevant technical actors, before final pilot-system selection and installation.	Indicator: documented technical suitability assessment completed for each pilot installation. Risk: inappropriate system selection or avoidable technical failure. Control: no installation or scaling recommendation without minimum technical criteria being verified.
P1	Low hydroponics awareness	Begin participant engagement with	Elemtiez and GIY, supported by	Indicator: change in basic hydroponics

	can create unrealistic expectations or discourage participants if the technology appears too complex. Seventy-three percent of survey respondents report no prior knowledge of hydroponics.	sensitisation and simple demonstrations covering what hydroponics is, what it requires, its realistic advantages, costs, workload and limitations. Do this before advanced training or investment decisions.	UTAP and AFRJ during recruitment and early WP5 training.	knowledge between entry and post-sensitisation assessment; proportion of participants able to identify both benefits and requirements. Risk: enrolment based on unrealistic expectations or early loss of interest. Control: transparent orientation and demonstration before commitment.
P1	Numerical female enrolment does not guarantee inclusion of the most constrained women. Existing women's groups are valuable entry points, but the broader survey shows low formal collective membership.	Recruit through multiple channels and explicitly reach beyond established associations. Use transparent and accessible application procedures. Do not unnecessarily require previous hydroponic knowledge, formal agricultural qualifications, land ownership, high digital competence or cooperative membership.	Elemtiez, GIY and UTAP, with AFRJ and local actors, during T5.1 selection and enrolment. T5.1 requires broad dissemination and at least 50 % female enrolment.	Indicator: at least 50 % female enrolment, plus descriptive monitoring of locality, prior group membership and relevant vulnerability markers where feasible. Risk: target achieved mainly through already-connected women. Control: targeted rural outreach and review of applicant profiles before final selection.
P2	Training is less effective when theoretical, one-off or disconnected from equipment and follow-up. Women consistently request practical training, pilot units and continued mentoring.	Make hands-on practice the dominant methodology for technical modules; ensure every participant performs core tasks; integrate installation, crop management, maintenance and troubleshooting; establish structured post-training mentoring and technical follow-up.	Elemtiez and GIY, with EFA El Soto and Libverda, during WP4 trainer preparation and WP5 pilot implementation.	Indicator: practical competency gain from pre/post assessment; proportion of learners successfully completing required practical tasks; number of follow-up contacts or sessions. Risk: knowledge decay and dependence on trainers. Control: scheduled mentoring, troubleshooting sessions and peer-support mechanisms.
P2	Digital tools offer flexibility but can exclude participants if they replace rather than complement practical learning. Digital device access and confidence are uneven.	Use blended delivery: mobile-friendly reinforcement, visual and printed guides, practical community sessions and local coaching. Ensure key learning outcomes can be achieved without continuous digital access.	OpenCom and Elemtiez, with WP4 partners, during material and platform development and pilot delivery.	Indicator: access and use of digital resources by gender; availability of equivalent non-digital support for essential content. Risk: digital exclusion. Control: printed/visual alternatives, introductory digital support and face-to-face practical provision.
P2	Market access is already weak, and production gains may not result in income gains. Only 40 % of respondents report market access, and women describe commercialisation	Integrate market analysis into entrepreneurship training and verify crop-specific market opportunities before commercial scaling. Develop realistic costing, buyer mapping, pricing, packaging and logistics plans.	Elemtiez, UTAP and EFA El Soto, with APIA and market stakeholders, during WP3 curriculum design and WP5 business/cooperative planning.	Indicator: completed market map and buyer assessment; viable production-cost and pricing calculations; progress toward the project's market-linkage target. The proposal targets at least three market linkages/economic opportunities through the cooperative. Risk:

	difficulties even after previous training. The baseline explicitly recommends market mapping, pricing, packaging, collective sales and buyer engagement.	Engage buyers and market actors before production is expanded.		technically successful production with no viable sales channel. Control: validate demand before scale-up.
P2	Cooperative readiness is not automatic. Formal membership is low and uncertainty about future participation remains high.	Build cooperative readiness progressively through practical examples, governance training and transparent information on costs, roles and benefits. Agree rules on membership, contributions, voting, benefit-sharing, financial transparency, conflict resolution and withdrawal before legal establishment.	UTAP for formalisation, with Elemtiez, OpenCom, GIY and EFA El Soto through T5.3 and T5.4. The project already foresees cooperative governance, financial management, marketing, participatory decision-making and legal registration.	Indicator: agreed governance rules; documented member understanding of roles and benefits; cooperative business plan approved before full operationalisation. Risk: nominal cooperative with weak trust or unclear responsibilities. Control: gradual formalisation, transparent rules and facilitated governance exercises.
P2	Women's cooperative membership does not necessarily imply leadership, voice or control over benefits. WP2 provides positive evidence of women's agency but lacks systematic evidence on governance power or control of cooperative revenues.	Track meaningful women's participation, not only membership. Build opportunities for women to chair meetings, lead technical activities, participate in financial and market decisions and hold formal governance responsibilities. Include leadership and negotiation practice in cooperative training.	UTAP and Elemtiez, supported by AFRJ and OpenCom, throughout cooperative development and monitoring.	Indicator: proportion of governance roles held by women; participation in key votes and technical responsibilities; women's involvement in pricing, investment and benefit-distribution decisions. Risk: token representation. Control: transparent decision records, rotating responsibilities and leadership mentoring.
P2	Institutional fragmentation risks interrupting the pathway from training to application. WP2 identifies strong demand for continuity and better coordination among training, technical, financial and community actors.	Establish a simple participant referral pathway identifying who provides technical advice, VET/certification support, investment guidance, cooperative/legal assistance, women's mobilisation and market linkage. Communicate it clearly to trainers and participants.	Elemtiez as local VET/WP4-WP5 lead, with GIY, UTAP, ATFP, APIA, AFRJ and relevant extension/local actors. Define before WP5 and maintain through follow-up.	Indicator: documented referral map; number/type of referrals; percentage of trainees who know where to seek technical or business assistance. Risk: participants complete training but cannot progress to implementation. Control: named institutional contact points and follow-up tracking.
P2	Existing technical and agricultural knowledge among women is an underused training asset. Participants possess substantial practical experience even where formal qualifications differ.	Use recognition of prior learning, peer demonstrations, problem-based exercises and local examples. Involve experienced rural women and existing women's groups in co-design and selected peer-support roles.	EFA El Soto, Elemtiez and Libverda during curriculum and trainer preparation; AFRJ and women's groups during validation and implementation.	Indicator: curriculum documentation showing use of prior knowledge and participatory methods; participant feedback on relevance; peer-learning activities implemented. Risk: training perceived as disconnected or overly theoretical. Control: community validation and adaptation of examples/materials.

P2	Training alone will not overcome structural barriers. The 27 interviews conclude that effective interventions need knowledge transfer combined with equipment, markets, adapted finance, institutional recognition and attention to care burdens.	Treat training, practical infrastructure, finance referral, market preparation, cooperative support and mentoring as an integrated adoption package. Explicitly identify which needs the project can meet directly and which require external referral.	All relevant WP3-WP5 partners, coordinated through WP leads.	Indicator: proportion of trained participants with a documented next-step pathway after certification, such as employment, further practice, cooperative participation, technical application or entrepreneurship preparation. Risk: certification becomes the endpoint. Control: post-training progression plan and follow-up.
P3	Pilot evidence should be used to refine the model before replication. WP2 identifies several technical, economic and inclusion questions that cannot be resolved before real implementation.	Use the WP5 pilot as a learning cycle. Record maintenance issues, labour/time requirements, technical-support requests, resource needs, attendance patterns, participant experience and implementation barriers. Use evidence to revise curriculum, trainer guidance and cooperative procedures.	Elemtiez, GIY, OpenCom and relevant WP leads, throughout WP5 and before final replication/sustainability decisions.	Indicator: documented pilot lessons and modifications adopted; comparison of planned versus observed implementation requirements. Risk: scaling assumptions are based on demonstration rather than operating evidence. Control: formal pilot review before replication.
P3	Sustainability depends on institutionalising knowledge and maintaining support beyond the funded pilot.	Embed the curriculum and inclusion practices within VET provision; maintain trained-trainer capacity; link the cooperative and participants to permanent Tunisian institutions, market actors and women's organisations; retain accessible learning and technical resources.	Elemtiez, AFTP, EFA El Soto, OpenCom and associated partners, progressively through WP4-WP6 and project sustainability activities. The proposal explicitly links sustainability to trainer capacity, institutionalisation, cooperative development and strategic partnerships.	Indicator: continued availability of curriculum/resources and trained trainers; active institutional links supporting the cooperative or future cohorts; documented continuation arrangements. Risk: services end with project funding. Control: institutional ownership, trainer multiplication and formalised external partnerships.

The priority structure indicates that SHE-GROWS should address participation and feasibility conditions before expecting adoption outcomes. Transport, care-compatible participation, finance, recruitment inclusion, informed awareness and technical site suitability are classified as P1 because failure in any of these areas can prevent participants from entering the pathway or can expose them to unnecessary technical or financial risk. These measures should therefore be resolved before, or at the latest during, the early stages of the WP5 pilot.

P2 recommendations concern the quality and durability of adoption. Practical training, continuing technical support, accessible blended learning, market preparation, cooperative governance, women's substantive participation and institutional referral pathways determine whether participants can convert the opportunity provided by SHE-GROWS into usable competence and sustained productive engagement. This reflects the baseline recommendation that training be organised as a progression from sensitisation and practical skills to business application, cooperative readiness and continuing follow-up.

P3 recommendations concern the ability of the project to learn, institutionalise and scale responsibly. Replication should follow evidence from the pilot rather than assumptions regarding system performance or participant readiness. Likewise, sustainability should not depend indefinitely on the project consortium. The project design itself links long-term impact to institutional VET capacity, trained trainers, cooperative development, partnerships and continuing access to project knowledge.

A further implication concerns monitoring. SHE-GROWS already includes formal quantitative targets, including 60 selected rural participants with at least 50 % women, eight Sustainable and Cooperative Management Workshop sessions and the establishment of one operational cooperative. The project proposal also includes a target of at least three market linkages or economic opportunities facilitated through the cooperative. These indicators remain important, but WP2 demonstrates that output indicators should be complemented by gender-responsive process and outcome indicators.

For example, recording that 50 % of participants are women establishes representation, but does not show whether women attended consistently, performed technical tasks, passed practical assessments, influenced cooperative decisions or gained access to subsequent economic opportunities. Similarly, recording that a cooperative has been legally established does not demonstrate that its governance is transparent, that its production model is financially feasible or that women's participation is meaningful.

The implementation logic should therefore assess progress across a sequence of outcomes:

access → participation → retention → practical competence → application readiness → collective decision-making → market participation → sustained benefit.

This progression is consistent with the central finding of D2.1: the barriers affecting women are not confined to entry into training. They operate at different stages of the adoption pathway and can interrupt the transition from knowledge to actual economic opportunity.

The prioritised recommendations also make clear that responsibilities must be shared but not diffuse. Elemtiez has a central operational role as the Tunisian VET provider and lead of WP4 and WP5; GIY contributes hydroponic technical expertise; UTAP provides community access and has a formal role in cooperative establishment; EFA El Soto and Libverda contribute curriculum, VET and technical expertise; OpenCom supports methodological, digital and monitoring functions; and associated partners such as AFTP, APIA and AFRJ provide important links to vocational systems, investment and rural women's networks. The research design itself establishes that WP2 evidence should feed directly into WP3 curriculum development, WP4 trainer capacity-building and WP5 pilot training, cooperative models and market-access strategies.

The central recommendation is therefore not to add isolated activities to the existing project design, but to adapt the way existing activities are implemented in response to WP2 evidence. Recruitment should be more inclusive, training more practical and accessible, financing and markets more explicitly integrated, technical feasibility verified before investment, cooperative formation made gradual and transparent, women's influence monitored rather than assumed, and post-training support treated as part of the intervention rather than an optional follow-up.

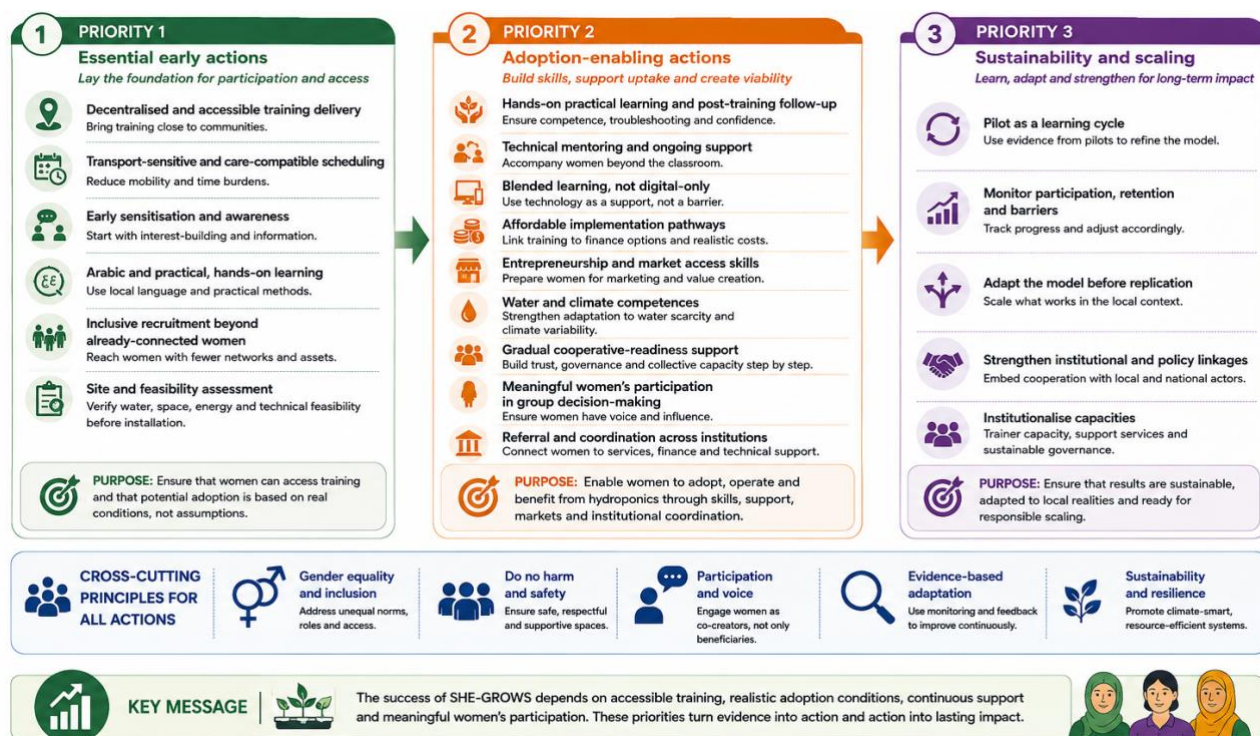


Figure 5. What SHE-GROWS must do next: priority action pathway for WP3, WP4 and WP5

15. Conclusions

This Gender-Responsive Mapping Report concludes that hydroponics can constitute a relevant opportunity for rural women in Béja and Jendouba only when it is embedded in a wider enabling system. WP2 does not support a technology-first model in which training or installation alone is expected to generate empowerment. The evidence instead identifies a layered adoption constraint linking technical feasibility, finance, productive resources, household conditions, mobility, training quality, markets, collective governance and institutional continuity.

Hydroponics is therefore most realistic when five conditions are met together: the site and system are technically suitable; costs and financing are transparent and proportionate to participant risk; training is practical, locally accessible and followed by troubleshooting support; crop choice is connected to credible markets; and women can participate meaningfully in decisions over resources, labour, cooperative governance and resulting benefits. WP2 does not identify a universally optimal hydroponic system or crop portfolio. Water quality, electricity and pumping requirements, local input supply, recurrent costs and crop-specific market demand require verification during pilot preparation.

The barriers requiring the strongest mitigation before adoption are finance and investment risk, water and infrastructure constraints, technology-specific competence, mobility and training accessibility, access and control over suitable productive resources, market access and discontinuity of institutional support. Social and cultural constraints are important for some women but are heterogeneous rather than universally dominant. Gender-responsive implementation should therefore respond to actual constraints without assuming a single profile of the rural woman.

The project architecture remains appropriate, but implementation should change in specific ways because of the gender analysis. WP3 should translate the evidence into an integrated competency-based curriculum covering technical hydroponics, climate and water management, entrepreneurship, financial literacy, markets and cooperative governance. WP4 should prepare trainers for inclusive adult learning, hands-on demonstration, troubleshooting and referral. WP5 should recruit beyond already connected groups, use decentralised practical delivery, monitor attendance and dropout

barriers, provide structured post-training support and build the cooperative progressively through transparent governance and demonstrated economic value.

Women's empowerment should be assessed through progression rather than enrolment alone: access → participation → competence → application → decision-making power → sustained economic and social benefit. Numerical representation in training or cooperative membership is necessary but insufficient if women cannot influence technical, financial and governance decisions or benefit equitably from the resulting activity.

The findings should be interpreted within the limits of the evidence. The survey is descriptive and self-reported, used a mixed online and field-assisted administration approach, and the analytical sample is not population-representative. Qualitative findings explain mechanisms but do not provide prevalence estimates. The purposive interview sample contains many women already linked to groups and organisations, which strengthens insight into collective action but limits generalisation. These limitations are explicitly addressed through triangulation and the evidence hierarchy used throughout D2.1.

The evidence base is also weighted towards men where it is quantitatively largest. Men account for 61 % of the survey sample, and the men's focus group (eleven participants) is larger than the women's (six). The twenty-seven in-depth interviews, predominantly with women, carry much of the women's-voice load and substantially offset this imbalance, but the thinnest single component of the evidence, the six-woman focus group, bears on precisely the population WP5 most depends upon. Women's qualitative evidence should therefore be reinforced at the inception of WP5.

Taken together, WP2 provides a clear evidence-to-action foundation for SHE-GROWS. Rural women in the target territories demonstrate motivation, agricultural knowledge and strong interest in learning, but sustainable hydroponic adoption depends on whether the project connects those capabilities to feasible technology, accessible training, realistic finance, markets, collective governance and continuing support. The central implementation principle is therefore to adapt the technology and support system to women's diverse realities, rather than expecting women to adapt to a predetermined technology pathway.

Annexes

Annex A. WP2 evidence-source inventory.

A.1 Purpose of the evidence inventory

This annex provides an audit trail of the empirical and methodological evidence used to prepare D2.1, *Gender-Responsive Mapping Report: Barriers and Opportunities for Women in Hydroponic Adoption in Tunisia*. It identifies the principal evidence streams, their methodological function, sample coverage, contribution to the five WP2 analytical dimensions and relevant limitations.

The survey platform recorded 1,038 submissions, exceeding the target of 1,000. The final respondent-level analytical export used for gender-disaggregated analysis contains 1,031 valid records. The qualitative design achieved 27 in-depth interviews against a target of at least 20 and 10 key-informant interviews against a target of at least 10, in addition to the two focus groups and stakeholder engagement.

Table A.1. WP2 evidence-source inventory

Evidence source	WP2 task	Scope and sample	Main analytical contribution	Use in D2.1	Principal limitation / interpretation rule
WP2 Research Design and Methodology Framework	T2.1	Methodological framework for Béja and Jendouba	Defines research question, analytical dimensions, sampling, ethics, triangulation and downstream links	Provides the analytical structure for Sections 3-4 and interpretation of all empirical evidence	Methodological source, not empirical evidence
Baseline Survey: Territorial Diagnosis for Sustainable and Hydroponic Agriculture Development	T2.2	1,038 survey submissions; 1,031 valid records in the final respondent-level analytical export	Socio-demographics, agriculture, water, climate, gender and agency, productive resources, training, digital access, cooperativism and hydroponics readiness	Principal quantitative evidence across Sections 5-12	Descriptive and self-reported; mixed online and field-assisted administration. Results are not population estimates, and administration-mode effects cannot be assessed separately from the available analytical export.
Women's focus group, Sh.Gw	T2.4	6 women, Ain Draham-Jendouba, 13 April 2026	Women's direct perceptions of financial, environmental, technical, social and collective-action barriers; co-design priorities	Direct gender evidence for Sections 6-8, 10-14	Small purposive group. Barrier ranks describe this group only and cannot be treated as prevalence estimates
Men's focus group, Sh.Gm	T2.4	11 men, Jendouba, 25 April 2026	Complementary male perceptions of barriers, environmental conditions, women's participation and support needs	Used primarily for triangulation and comparison with women's direct evidence	Male perceptions complement but do not override women's accounts of their own constraints
In-depth interviews	T2.4	27 interviews with rural	Lived experience, livelihoods, agency,	Principal qualitative	Purposive sample. Strong presence of

		women and agricultural practitioners in Béja and Jendouba	household decision-making, resource access, training, climate adaptation, aspirations, collective action and markets	evidence throughout Sections 5-14	women already linked to agricultural groups means collective participation cannot be generalised to the wider population
Case-based qualitative evidence	T2.4	Four anonymised case-based syntheses derived from the 27 IDIs; no additional participants	Local water-management practices, climate adaptation, livelihood responses, training-to-application pathways and innovation readiness	Section 5.6; supports Sections 8, 12 and 13	Illustrative rather than representative; some vignettes synthesise recurring evidence from several interviews and must not be represented as single-person biographies
Key-informant interviews	T2.3/T2.4 interface	10 key informants representing agricultural organisations, rural women's organisations, technical services and VET structures	Institutional capacity, rural training access, finance, hydroponic potential, cooperative development, administrative procedures and coordination	Institutional and implementation evidence, particularly Sections 8-10 and 13-14	Institutional and expert perspectives; not population prevalence. Institutional interviews are not double-counted as separate stakeholder participants.
Stakeholder engagement and institutional mapping	T2.3	Authorities, agricultural organisations, women's organisations, VET actors and technical services	Institutional roles, coordination needs, training provision and local support ecosystem	Supports institutional map and downstream referral pathway	Some consultation evidence overlaps with the KII stream and should not be double-counted as additional interview participants
WP2 Planning Document	WP2 management	Project-level planning source	Defines tasks, indicators, responsibilities and expected outputs	Used for compliance and KPI assessment	Project-planning evidence, not field evidence
SHE-GROWS Application Form, Part B	Grant framework	Approved project framework	Formal WP2 objectives, WP3-WP5 linkages, partner responsibilities and deliverables	Used to ensure recommendations remain within approved project architecture	Project commitments must be distinguished from findings generated by WP2

The evidence inventory combines a large descriptive survey with experiential and institutional qualitative evidence. Survey patterns are therefore interpreted together with IDIs, KIIs, focus groups and stakeholder engagement rather than treated as stand-alone population estimates.

A.2 WP2 data-collection KPI achievement

Table A.2. Achievement against WP2 research indicators

Indicator	WP2 target	Achieved	Achievement against minimum target	Status
Quantitative surveys	1,000	1,031	103.1 %	Exceeded
In-depth	≥20	27	135.0 %	Exceeded

interviews				
Key-informant interviews	≥10	10	100.0 %	Achieved
Distinct data-collection methods	≥3	At least 4 clearly documented methods	≥133.3 %	Exceeded
Qualitative insights integrated	≥90 %	Extensive integration throughout D2.1	Not independently quantifiable from the available reporting documentation	Extensive integration demonstrated, but numerical achievement cannot be verified from the available audit documentation.

WP2 met or exceeded all verified numerical data-collection targets. Survey collection reached 103.1 % of the target, the 27 in-depth interviews reached 135 % of the minimum target, and the 10 key-informant interviews achieved 100 % of the minimum target. At least four clearly distinct data-collection methods were implemented, exceeding the requirement for three.

The four clearly distinct methods are the baseline survey, in-depth interviews, key-informant interviews and focus groups. Stakeholder consultations constitute an additional engagement and mapping stream, not counted as a fifth data-collection method because their institutional respondents overlap with those of the key-informant interviews. This stream retains a distinct analytical function, producing the stakeholder and institutional map in Annex D rather than duplicating the KII evidence.

Annex B. Survey variable list and gender-disaggregated statistical tables.

B.1 Statistical interpretation

The survey platform recorded 1,038 submissions. The final respondent-level analytical export available for D2.1 contains 1,031 valid records, and respondent-level tables therefore use N = 1,031 unless a question-specific valid denominator is stated. Exact frequencies and percentages are reported directly from the analytical export. The analysis is descriptive and should not be interpreted as a statistically weighted estimate of the rural population of Béja and Jendouba. Approximately half of the survey was self-completed online and approximately half was field-assisted, with EUSurvey used as the common data-capture platform. Field outreach helped reduce potential digital exclusion, although possible differences between online and field-recruited respondents cannot be separately quantified from the available analytical export. Multiple-response questions are explicitly identified and percentages are calculated against valid respondents unless otherwise stated.

Gender comparisons use 393 women and 629 men as denominators. The 9 respondents who preferred not to disclose gender remain in overall totals but are not included in the binary women-men comparison. Gender gaps are descriptive percentage-point differences and should not be interpreted as causal effects.

B.2 Survey variable framework

Table B.1. Principal variables and analytical use

Analytical domain	Variables / indicators	Relevance for D2.1	Priority disaggregation
Socio-demographic characteristics	Gender, age, education, household-head status, governorate/locality	Population profile and vulnerability	Gender; governorate; age; household headship
Livelihoods	Main household income source, agricultural dependence, livelihood activities	Economic dependence and exposure	Gender; household headship
Agricultural practices	Main activities, irrigation, water sources	Existing knowledge and production context	Gender; governorate
Water and climate	Water scarcity, climate impacts, adaptation practices	Climate vulnerability and hydroponic relevance	Gender; governorate

Productive resources	Land, inputs, credit, extension, digital devices, markets	Ability to convert training into adoption	Gender; household headship
Gender and agency	Agricultural decision-making, perceived barriers to women's participation	Access, control and household negotiation	Gender; household headship; age
Training	Previous participation, barriers, preferred format and schedule	WP3/WP4 training design	Gender; age; locality
Digital readiness	Device access and smartphone confidence	Blended-learning feasibility	Gender; age; education
Cooperativism	Existing membership and readiness to join	Collective-action baseline	Gender; current membership
Hydroponics	Awareness, interest and expected outcomes	Recruitment, sensitisation and curriculum design	Gender; age; governorate

The survey structure follows a progression from respondent profile and agricultural conditions to gender and resource access, training, collective action and hydroponics readiness.

B.3 Gender composition

Table B.2. Gender distribution of the survey sample

Gender	Percentage of valid analytical records	n
Men	61.0 %	629
Women	38.1 %	393
Prefer not to disclose	0.9 %	9
Total	100 %	1,031

The final analytical export contains 629 men (61.0 %), 393 women (38.1 %) and 9 respondents (0.9 %) who preferred not to disclose gender. The 9 non-disclosed responses remain in overall totals but are excluded from women-men comparisons.

B.4 Socio-economic and productive-resource indicators

Table B.3. Selected baseline indicators

Indicator	% of valid respondents	n	Gender-responsive interpretation
Household head	49.4 %	509	Household-head status should be cross-tabulated with gender because formal household position may affect investment and decision-making
Not household head	50.6 %	522	Important for analysing influence without formal headship
Agriculture main household income	81.7 %	842	Agricultural intervention directly affects household livelihood security
Agriculture not main income	18.3 %	189	Indicates livelihood diversification
Access to agricultural land	86.4 %	891	Access should not be interpreted as ownership, control or technical suitability
No agricultural land access	13.6 %	140	Shared/cooperative production may be particularly relevant
Difficulty accessing agricultural inputs	53.1 %	547	Major implementation barrier
Adequate input access	46.9 %	484	Does not necessarily imply hydroponic-specific inputs are available
Access to credit/microfinance	69.7 %	719	Access does not demonstrate affordability or women's control of credit
No credit/microfinance access	30.3 %	312	Significant financially excluded group

Access to extension/advisory services	65.2 %	672	Important opportunity for post-training support
No extension/advisory access	34.8 %	359	Alternative referral/support routes required
Digital-device access	64.5 %	665	Supports blended training
No digital-device access	35.5 %	366	Too large a group to justify digital-only delivery
Market access	39.7 %	409	Minority of sample can readily commercialise products
No market access	60.3 %	622	Strong justification for business and market components

The final analytical export records land access at 86.4 %, difficulty accessing agricultural inputs at 53.1 %, credit or microfinance access at 69.7 %, extension/advisory access at 65.2 %, digital-device access at 64.5 % and agricultural market access at 39.7 %. These aggregate indicators are complemented by the gender-disaggregated results in Table B.16.

B.5 Agricultural decision-making

Table B.4. Person responsible for agricultural decisions in the household

Decision arrangement	%	n
Respondent alone	17.7 %	183
Spouse	16.1 %	166
Together / jointly	32.5 %	335
Another household member	9.1 %	94
Not applicable	24.5 %	253

Water-scarcity impact was answered by 1,012 respondents. Percentages in Table B.5 therefore use N = 1,012.

B.6 Water-scarcity impact

The survey asked respondents to rate the impact of water scarcity on agricultural production during the previous three years using a scale from 0 to 5.

Table B.5. Perceived water-scarcity impact

Rating	%	n
0	0.2 %	2
1	6.4 %	65
2	50.0 %	506
3	29.3 %	297
4	9.7 %	98
5	4.3 %	44

Most respondents therefore locate the impact in the moderate to high part of the scale, confirming that water pressure is a recurrent feature of the agricultural context.

B.7 Training participation and accessibility

Table B.6. Previous participation in vocational or non-formal training

Training experience	%	n
Previous participation	20.1 %	207
No previous participation	79.9 %	824

Only 20.1 % report previous vocational or non-formal training, while 79.9 % report none. This strengthens the case for accessible entry-level VET and careful learner orientation. The qualitative interview sample contains more training-experienced women because it was purposively recruited and should not be treated as representative of the wider survey sample.

Table B.7. Barriers to training participation

Reported barrier	% of valid respondents	n selecting barrier
Distance to training centre / transportation cost	34.0 %	350
Unsuitable schedule / conflict with domestic or work responsibilities	31.8 %	328
Lack of childcare during training hours	20.2 %	208
Cost of training/materials	17.9 %	185
Family or social disapproval	13.2 %	136
Training content not suited to needs	7.1 %	73
Language of instruction not accessible	6.1 %	63
Lack of information on training opportunities	4.9 %	51
No significant barrier	2.9 %	30
Other	0.5 %	5

This was a multiple-response question, so percentages do not sum to 100 %. Distance/transport and unsuitable scheduling are the most frequently selected barriers overall. Gender-disaggregated results in Table B.16a show that distance/transport and training/material costs are especially prominent among women in the achieved sample.

B.8 Preferred training modality

Table B.8. Preferred training format

Format	%	n
Fully online / digital	39.6 %	408
Blended	28.0 %	289
Fully face-to-face	19.1 %	197
Community-based	13.3 %	137
Total	100 %	1,031

The apparent preference for online learning should be interpreted alongside the finding that 35.5 % lack digital-device access. A blended rather than exclusively online pathway is consequently more defensible.

Table B.9. Preferred training schedule

Schedule	%	n
Morning	21.6 %	223
Afternoon	43.5 %	449
Weekends only	34.8 %	359
Total	100 %	1,031

B.9 Smartphone readiness

Table B.10. Comfort using a smartphone for online training

Comfort level	%	n
1, very low	0.7 %	7
2	13.0 %	133
3, moderate	54.8 %	561
4	15.1 %	155
5, very high	16.4 %	168
Total	100 %	1,024

The distribution is strongly centred on moderate confidence rather than very high confidence, reinforcing the need for simple interfaces and introductory digital support.

B.10 Cooperativism and collective-action potential

Table B.11. Membership in a collective organisation

Membership	%	n
Member	10.5 %	108

Not a member	89.5 %	923
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Formal collective participation is therefore currently low.

Table B.12. Readiness to join a new sustainable agricultural cooperative

Readiness level	%	n
Not at all ready	3.1 %	32
Rather not ready	11.6 %	120
Neutral / uncertain	45.0 %	464
Rather ready	18.1 %	187
Very ready	22.1 %	228
Total	100 %	1,031

Overall, 415 respondents (40.3 %) are rather or very ready to join a new sustainable agricultural cooperative, while 464 (45.0 %) remain neutral or uncertain. Cooperative development should therefore focus on trust, governance clarity and demonstrated economic value rather than assume immediate collective readiness.

B.11 Hydroponics awareness and interest

Table B.13. Awareness of hydroponic agriculture

Awareness	%	n
Already aware	26.8 %	276
No prior knowledge	73.2 %	755

Table B.14. Interest in hydroponic agriculture training

Interest	%	n
Not at all interested	4.6 %	47
Slightly interested	16.6 %	171
Moderately interested	45.6 %	470
Very interested	13.6 %	140
Extremely interested	19.7 %	203
Total	100 %	1,031

The combined proportion that is moderately, very or extremely interested is 78.9 % (813 of 1,031 valid respondents).

The respondent-level data therefore show a strong potential audience for hydroponics training, while the concentration of responses in the moderate-interest category reinforces the need for demonstration and feasibility information before expecting investment or adoption.

Table B.15. Expected outcomes of hydroponics training

Expected outcome	Mean relevance score reported
Learn a new professional skill / employment	3.77
Produce food for the household	3.65
Generate income / sell production	3.09
Reduce water use in agriculture	3.02
Create or join a cooperative	1.45

The survey indicates that skills, household food production, income and water management are stronger immediate motivations than cooperative formation.

B.12 Gender-disaggregated statistical analysis

The final respondent-level export enables direct gender cross-tabulation for the central D2.1 indicators. The tables below report counts and within-gender percentages for 393 women and 629 men. The 9 respondents who preferred not

to disclose gender remain in overall totals but are excluded from women-men comparisons. These results are descriptive and should not be interpreted as causal gender effects.

Table B.16 summarises the principal gender-disaggregated indicators, followed by focused tables on training barriers, preferred training format, cooperative readiness, hydroponics awareness, training interest and territorial composition.

Table B.16. Gender-disaggregated profile of key indicators

Gender gap = percentage among women minus percentage among men, in percentage points (pp).

Indicator	Women n (%)	Men n (%)	Gender gap, pp	Interpretation
Household head	196 (49.9 %)	310 (49.3 %)	+0.6	Virtually no gender difference in reported household-head status within the survey sample.
Agriculture is the main household income source	342 (87.0 %)	494 (78.5 %)	+8.5	Women respondents are more frequently located in households highly dependent on agriculture.
Access to agricultural land	323 (82.2 %)	561 (89.2 %)	-7.0	Women report lower land access than men. This reinforces the need to distinguish household access from women's effective control over productive space.
Difficulty accessing agricultural inputs	154 (39.2 %)	390 (62.0 %)	-22.8	In this sample, men report substantially greater difficulty accessing inputs. This unexpected pattern should be interpreted descriptively and triangulated with qualitative evidence.
Access to credit or microfinance	250 (63.6 %)	464 (73.8 %)	-10.2	Women report lower financial-service access by about 10 percentage points. Access still does not demonstrate affordability or control over investment decisions.
Access to extension / technical advisory services	248 (63.1 %)	421 (66.9 %)	-3.8	The gender difference is modest, although more than one third of women still lack access.
Access to digital devices	287 (73.0 %)	371 (59.0 %)	+14.0	Women in the sample report higher digital-device access. This supports blended approaches but does not justify digital-only delivery.
Access to agricultural markets	226 (57.5 %)	177 (28.1 %)	+29.4	Market access is much higher among surveyed women than men. This large difference deserves interpretation by governorate, activity type and collective membership before causal conclusions are drawn.
Previous vocational / non-formal training	80 (20.4 %)	124 (19.7 %)	+0.6	Previous training participation is almost identical by gender in the raw export.
Current membership in a cooperative, association or community organisation	44 (11.2 %)	63 (10.0 %)	+1.2	Formal collective membership is similarly low among women and men.
Positive readiness to join a new sustainable agricultural cooperative¹	234 (59.5 %)	175 (27.8 %)	+31.7	Women demonstrate markedly stronger positive cooperative readiness in this survey.
Prior awareness of hydroponics	171 (43.5 %)	100 (15.9 %)	+27.6	Hydroponics awareness is substantially higher among surveyed women.
At least moderate interest in hydroponics training²	329 (83.7 %)	478 (76.0 %)	+7.7	Interest is high for both groups but particularly high among women.

¹ Positive cooperative readiness = “rather ready” + “very ready”.

² At least moderate interest = “moderately interested” + “very interested” + “extremely interested”.

The table gives a considerably stronger gender analysis than the aggregate survey results alone. It shows that the survey does not support a simple assumption that women systematically have poorer access across every domain. Women report lower access to credit and somewhat lower land access, but higher digital access, market access, hydroponics awareness and cooperative readiness. These patterns should therefore be interpreted through the broader mixed-methods evidence rather than converted directly into causal claims.

Table B.16a. Training-access barriers by gender

The question allowed respondents to select multiple barriers, so percentages below are calculated as the proportion of women or men selecting each option. They therefore do not sum to 100 %.

Training barrier	Women n (%)	Men n (%)	Gender gap, pp
Distance to training centre / transportation cost	201 (51.1 %)	144 (22.9 %)	+28.3
Cost of training / materials	119 (30.3 %)	64 (10.2 %)	+20.1
Unsuitable schedule conflicting with domestic/agricultural work	98 (24.9 %)	227 (36.1 %)	-11.2
Lack of childcare during training hours	52 (13.2 %)	155 (24.6 %)	-11.4
Family or social disapproval	29 (7.4 %)	107 (17.0 %)	-9.6
Training content not suited to needs	25 (6.4 %)	48 (7.6 %)	-1.3
Lack of information on training opportunities	23 (5.9 %)	28 (4.5 %)	+1.4
Language of instruction not accessible	14 (3.6 %)	48 (7.6 %)	-4.1
No significant obstacle	15 (3.8 %)	14 (2.2 %)	+1.6
Other	4 (1.0 %)	1 (0.2 %)	+0.9

This disaggregation materially strengthens the gender-responsive interpretation. For women, the two most distinctive constraints are distance/transport and training/material costs, whereas men more frequently report scheduling conflicts and childcare. The result concerning childcare should be reported rather than suppressed, but interpreted cautiously because the question captures respondent perceptions of barriers affecting themselves or others in their community and is not a direct measure of each respondent's personal care burden.

The most policy-relevant finding for SHE-GROWS is that more than half of surveyed women identify distance or transport cost as a barrier to training, compared with less than one quarter of men. This strongly supports decentralised or community-based practical delivery.

Table B.16b. Preferred training format by gender

Preferred format	Women n (%)	Men n (%)	Gender gap, pp
Fully online / digital	134 (34.1 %)	272 (43.2 %)	-9.1
Blended	107 (27.2 %)	180 (28.6 %)	-1.4
Fully face-to-face at a training centre	84 (21.4 %)	112 (17.8 %)	+3.6
Community-based in village / neighbourhood	68 (17.3 %)	65 (10.3 %)	+7.0
Total	393 (100 %)	629 (100 %)	

Women are less likely than men to select fully online provision and more likely to prefer community-based or face-to-face delivery. This finding reinforces the recommendation that SHE-GROWS use blended provision with strong local practical components, rather than designing around the overall sample's apparent preference for online learning.

Table B.16c. Cooperative readiness by gender

Readiness to join a new sustainable agricultural cooperative	Women n (%)	Men n (%)	Gender gap, pp
Not at all ready	16 (4.1 %)	16 (2.5 %)	+1.5
Rather not ready	36 (9.2 %)	82 (13.0 %)	-3.9
Neutral / uncertain	107 (27.2 %)	356 (56.6 %)	-29.4
Rather ready	60 (15.3 %)	124 (19.7 %)	-4.4
Very ready	174 (44.3 %)	51 (8.1 %)	+36.2

Positive readiness: rather + very ready	234 (59.5 %)	175 (27.8 %)	+31.7
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This is one of the clearest gender differences in the questionnaire. Almost three fifths of women are positively ready to join a new sustainable agricultural cooperative, compared with approximately 28 % of men. Moreover, 44.3 % of women report being *very ready*, compared with only 8.1 % of men.

This finding is particularly relevant for WP5, but it should not be interpreted as proof that cooperative establishment will be straightforward. Existing collective membership remains only 11.2 % among women, meaning that stated readiness is substantially greater than current organisational experience. This reinforces the recommended progression from interest to trust-building, governance training and informed commitment before formalisation.

Table B.16d. Hydroponics awareness by gender

Hydroponics awareness	Women n (%)	Men n (%)	Gender gap, pp
Yes	171 (43.5 %)	100 (15.9 %)	+27.6
No	222 (56.5 %)	529 (84.1 %)	-27.6
Total	393	629	

The aggregate baseline conceals a very substantial gender difference. Nearly 44 % of surveyed women had already heard of hydroponics, compared with only 16 % of men. Nevertheless, a majority of women still had no prior awareness, so introductory sensitisation remains necessary.

Table B.16e. Interest in hydroponics training by gender

Interest level	Women n (%)	Men n (%)	Gender gap, pp
Not at all interested	14 (3.6 %)	31 (4.9 %)	-1.4
Slightly interested	50 (12.7 %)	120 (19.1 %)	-6.4
Moderately interested	116 (29.5 %)	352 (56.0 %)	-26.4
Very interested	63 (16.0 %)	74 (11.8 %)	+4.3
Extremely interested	150 (38.2 %)	52 (8.3 %)	+29.9
At least moderately interested	329 (83.7 %)	478 (76.0 %)	+7.7

Women are not only somewhat more likely to express at least moderate interest, but their responses are concentrated much more strongly at the highest level of interest. 38.2 % of women are extremely interested, compared with 8.3 % of men. Among men, the largest category is moderate interest at 56.0 %.

For SHE-GROWS, this provides strong empirical justification for maintaining women as the principal target of the intervention while still involving men where household, community or cooperative support is relevant.

Table B.16f. Territorial composition by gender

Governorate	Women n (%)	Men n (%)	Gender gap, pp
Jendouba	312 (79.4 %)	486 (77.3 %)	+2.1
Béja	67 (17.0 %)	94 (14.9 %)	+2.1
Other governorate	14 (3.6 %)	49 (7.8 %)	-4.2
Total	393	629	

The female and male samples are therefore broadly similar in their distribution between Jendouba and Béja. This reduces, although does not eliminate, the possibility that the largest gender differences simply reflect very different territorial compositions.

Annex C. Focus-group participant profiles and barrier-ranking tables.

The two focus groups provide complementary but analytically distinct evidence. The women's group provides direct evidence of women's own priorities and lived constraints, while the men's group provides information on how male community members perceive the conditions affecting adoption and women's participation. Their rankings should therefore remain separate.

The ranking scale used in both sessions is 1 = greatest obstacle and 8 = least important obstacle. Lower mean scores consequently indicate greater perceived severity.

C.1. Focus-group profiles

Table C.1. Session-level participant profile

Characteristic	Women's focus group	Men's focus group
Session code	Sh.Gw	Sh.Gm
Gender composition	Women	Men
Number of participants	6	11
Date	13 April 2026	25 April 2026
Location	Ain Draham-Jendouba	Jendouba
Language	Tunisian dialectal Arabic	Tunisian dialectal Arabic
Main analytical role	Direct evidence of women's barriers, interests and co-design priorities	Complementary male perceptions of adoption barriers and women's participation
Discussion format	Facilitated discussion, obstacle ranking and co-design	Facilitated discussion, obstacle ranking and recommendations
Important methodological note	Small group; individual perceptions showed substantial heterogeneity	Some participants had prior hydroponics knowledge; participation intensity varied

The women's post-session report confirms the six-person Ain Draham session and dialectal-Arabic facilitation. The men's report confirms 11 participants and the Jendouba session characteristics.

Individual age, occupation, education and household characteristics are not reported in the focus-group post-session reports available for D2.1. They should only be added to this annex if an anonymised participant-profile sheet or attendance database is available. These characteristics should not be reconstructed from the discussion.

C.2. Women's barrier-ranking results

Table C.2. Women's focus-group obstacle ranking

Barrier	Participant rankings	Mean rank	Interpretation
Lack of money / investment capital	1, 1, 1, 2, 2, 6	2.2	Strongest average barrier
Lack of water	3, 3, 2, 3, 3, 5	3.2	Second strongest barrier
No land or cultivation space	4, 4, 6, 4, 4, 4	4.3	Important material constraint
New agricultural techniques	5, 5, 4, 7, 7, 1	4.8	Moderate average barrier with noticeable heterogeneity
Lack of time / domestic responsibilities	7, 5, 5, 5, 5, 3	5.0	Moderate overall, potentially severe for specific women
No training or technical support	8, 2, 7, 6, 6, 2	5.2	Highly heterogeneous
Traditions and social expectations	8, 8, 8, 1, 1, 8	5.7	Strongest polarisation, severe for two participants and minimal for four
Lack of confidence to work in group/cooperative	6, 6, 3, 8, 8, 7	6.3	Lowest average priority

The source data and means are reported directly in the women's post-session report. The report specifically cautions that traditions/social expectations and access to training display substantial between-participant variation.

This dispersion is analytically important. The women's group does not support a conclusion that cultural constraints are either universally dominant or universally unimportant. It instead indicates heterogeneity in household and community context.

The women's co-design discussion emphasised practical training adapted to local realities, continuing support, groups or cooperatives for mutual aid, concrete hydroponic projects, technical guidance and regular monitoring.

C.3. Men's barrier-ranking results

Table C.3. Men's focus-group obstacle ranking

Barrier	Mean / reported distribution	Interpretation
Lack of training and technical support	2.3	Strongest average barrier
Lack of money / investment capital	2.4	Very strong financial constraint
Limited knowledge of new agricultural techniques	3.0	Strong technology-specific knowledge constraint
Climate change / environmental issues	3.5	Important environmental concern
Water scarcity	3.8	Important resource constraint
Existing responsibilities / being too busy	6.0	Comparatively low average priority
Traditions and social expectations	6.1	Lowest average priority, but rankings varied from 3 to 8
Lack of trust between people / towards institutions	Range includes 1 to 8; mean not provided in source	Very heterogeneous perceptions; no mean should be invented

The men's report identifies training/support, finance and new agricultural techniques as the three strongest average barriers and climate/environment and water as additional major constraints. Responsibilities and traditions received the weakest average priority. Trust was particularly heterogeneous, with individual rankings spanning from 1 to 8.

Table C.4. Interpretation of differences between the two groups

Theme	Women's group	Men's group	D2.1 interpretation
Finance	Strongest barrier, 2.2	Second strongest, 2.4	Strong convergence
Water	Second, 3.2	Important, 3.8	Convergence
Training / technical support	5.2, highly variable	Strongest, 2.3	Divergence in relative priority
New techniques	4.8	3.0	Men place greater average emphasis on technical unfamiliarity
Time / responsibilities	5.0	6.0	Lower average priority in both, but women's direct evidence should guide gender interpretation
Traditions / social expectations	5.7 with extreme polarisation	6.1, generally lower	Average scores conceal heterogeneity among women
Collective trust/confidence	6.3 for women's group confidence item	Trust ranks from 1 to 8 among men	Collective readiness is heterogeneous rather than uniformly low

These rankings should not be pooled into a single male-female average. The groups have different sample sizes, and the purpose of comparison is to identify convergence and divergence, not produce a combined population estimate.

Annex D. Stakeholder and institutional map.

The WP2 Research Design identifies cooperativism and institutional infrastructure as a cross-cutting analytical dimension. The institutional evidence includes 10 key-informant interviews together with stakeholder engagement and mapping. Relevant actors include agricultural organisations, VET providers, women's organisations, extension services, local authorities and investment-support bodies. Individual respondents are not named in this sensitive deliverable; institutional roles are retained only where necessary for interpretation.

The map below deliberately distinguishes between actors evidenced in the WP2 consultation material and actors identified by the approved project as important downstream partners. This avoids implying that every organisation listed in the project design was necessarily interviewed during T2.3.

Table D.1. Stakeholder and institutional support map

Actor / actor category	Status in WP2 evidence	Relevant mandate or contribution	Principal barriers / gaps identified	Potential SHE-GROWS role
UTAP, regional structures in Jendouba and Béja	Directly represented in stakeholder evidence and project partnership	Farmer representation; agricultural information; mobilisation; training and technical assistance; links with institutions; cooperatives	Water scarcity; finance; training access; transport; limited innovative-technology awareness; administrative burden; need for stronger coordination	Community mobilisation; technical/agricultural referral; cooperative support; market networking; cooperative formalisation
Rural women's organisations / associations	Direct stakeholder evidence; AFRJ also identified as associated project partner	Women's mobilisation; livelihood support; training; advocacy; community legitimacy; identification of women's needs	Distance and transport; finance; fragmented opportunities; limited coordination; unequal access to training	Outreach to remote women; co-design; mentoring; peer support; cooperative participation and leadership support
Agricultural development associations / civil-society organisations	Direct stakeholder evidence	Agricultural development; local training; rural outreach; livelihood initiatives	Irregular programmes; limited resources; competition or weak collaboration between organisations; lack of permanent support	Local practical training; outreach; shared resources; local follow-up and referral
VET providers / Northwest training structures	Direct stakeholder evidence and formal project role	Vocational training; trainer expertise; skills development	Training does not always reach remote populations; transport; insufficient specialised trainers; overly theoretical delivery	Accessible practical VET; local training; trainer development; competency assessment; referral
Elemtiez Institute for Training	SHE-GROWS beneficiary and local VET lead	WP2 field lead; WP4 and WP5 lead; training implementation and local institutional anchoring	Must accommodate heterogeneous education, mobility, care and digital-access conditions identified by WP2	Curriculum localisation; trainer preparation; recruitment; pilot delivery; monitoring; post-training referral
Grow It Yourself (GIY)	SHE-GROWS partner and T2.3 stakeholder lead	Hydroponics and technical expertise; stakeholder mapping and consultations	Need for context-specific rather than generic technology transfer	Hydroponic demonstration; technical feasibility assessment; troubleshooting; pilot support
Agricultural	Explicitly	Technical advice;	Uneven access; need for	Demonstration support;

extension and technical advisory services	targeted in T2.3; frequently cited by stakeholders as important support actors	farmer support; continuity after training	stronger coordination; 35 % of survey respondents report no access to extension/advisory services	technical referrals; follow-up visits; validation of agricultural messages
Local and regional authorities	Explicit stakeholder category in research design	Local coordination; infrastructure and rural-development support; connection to public programmes	Need for better coordination and context-sensitive support	Local enabling environment; venue/infrastructure support; integration with territorial programmes
ATFP, Tunisian Agency for Professional Training	Project-design / associated partner actor	Alignment with Tunisian VET framework; labour-market relevance; institutional scaling	Effective uptake depends on coordination between curriculum development and national VET structures	Curriculum alignment; institutional recognition; longer-term integration and replication
APIA, Agricultural Investment Promotion Agency	Project-design / associated partner actor	Agricultural investment, entrepreneurship, business development and funding guidance	Finance remains a leading adoption barrier; credit access does not ensure suitable hydroponic financing	Investment guidance; business-development referral; financing pathways; links with agribusiness
AFRJ, Association Femme Rurale Jendouba	Associated partner identified in project design	Rural women's mobilisation, inclusion, mentorship and community ownership	Remote and underserved women may not be reached through mainstream channels	Recruitment, mentoring, cooperative participation, community feedback and advocacy
Government agricultural agencies and technical services	Repeatedly identified by stakeholder respondents as relevant	Public agricultural programmes, regulation and technical support	Administrative fragmentation; weak referral pathways; complex procedures	Technical, administrative and institutional referral depending on mandate
Existing cooperatives and agricultural collectives	Qualitative and stakeholder evidence	Shared learning, equipment, market access, solidarity and collective economic organisation	Governance, trust, equipment, market and administrative constraints	Peer learning; cooperative networking; governance examples; shared purchasing and marketing
Financial and microfinance actors	Indirectly evidenced through survey and stakeholder discussion	Credit and financial services	Affordability, suitability, collateral and risk for small-scale investment remain unresolved	Finance literacy partnerships; staged investment options; referral after feasibility assessment
Market actors, buyers and agribusinesses	Identified as necessary through market-access evidence and project design	Product demand, purchasing, standards, pricing and market linkage	Only 40 % of survey respondents report market access; hydroponic crop-specific demand remains unverified	Market validation; buyer engagement; pricing information; cooperative market linkages
Climate and environmental groups	Explicitly foreseen in T2.3	Climate adaptation and resource-management expertise	Need to integrate hydroponics into broader adaptation rather than treat it as a stand-alone solution	Climate-resilience inputs; water-management awareness; sustainability guidance

Stakeholder consultations consistently indicate that the region does not lack organisations altogether. The more persistent issue is fragmentation between training, technical assistance, finance, cooperative support and markets.



Stakeholders identify agricultural institutions, UTAP, extension services, government agencies and civil-society organisations as relevant, while repeatedly calling for stronger coordination among them.

A particularly important example concerns cooperative development. Stakeholder evidence indicates that a legal framework exists, but administrative procedures can discourage new groups unless technical and administrative guidance is available. Women's organisations also report that training opportunities may remain inaccessible because of transport, distance and limited resources and that stronger coordination among organisations is needed.

For implementation purposes, the institutional map should therefore be transformed into a referral pathway rather than remain a descriptive stakeholder list:

community outreach and inclusion → VET and certification → hydroponic technical support → finance and business development → cooperative/legal support → market linkage → continuing extension and mentoring.

Operational contact details and named institutional focal points are maintained in the consortium's internal project records and are not reproduced in this sensitive deliverable. This preserves confidentiality while retaining the institutional functions required for implementation and referral.