





Development of the Conceptual Framework (Version 2.0) of the Multidimensional Digital Inclusiveness Index

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<i>Submitted</i>	21 December 2023	<p>The Multidimensional Digital Inclusiveness Index (MDII), initiated by CGIAR's Digital Innovation Initiative, has transformed from a theoretical concept to a practical tool for assessing digital inclusivity in various sectors. Its foundational document guides stakeholders in the Agri-Food, Water, and Land sectors, promoting collaboration and continuous improvement. The MDII is guided by eight principles, including accessibility, transparency, methodological rigor, adaptability, intersectionality, simplicity, flexibility, and clarity. It faces challenges such as complexity and diverse user needs, addressed through Artificial Intelligence (AI) integration, offline accessibility, and a participatory feedback approach. Evolving beyond an index, the MDII now offers multiple functions like certification, predictive analysis, and strategic guidance for digital innovation, using AI to meet future inclusiveness needs. The next steps for the MDII include conducting surveys to refine its framework, developing a comprehensive roadmap, and creating a prototype for stakeholder review.</p>
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<i>Flagship</i>	Inclusion Framework	
<i>Work Package</i>	Digital Inclusion	
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1. Background

1.1. Context and Evolution of the Multidimensional Digital Inclusiveness Index

The Multidimensional Digital Inclusiveness Index (MDII) emerges from a series of strategic efforts from the CGIAR Digital Innovation Initiative work led by the International Water Management Institute (IWMI), Alliance Bioversity-CIAT and International Rice Research Institute (IRRI) and to conceptualize and refine the theoretical version called the Digital Inclusivity Index.

This document draws from a rich repository of research and insights (Opola et al., 2023), serving as a cohesive reference that captures the growth and learnings of the MDII initiative to date.

In crafting this document, we recognize the pivotal role of previous benchmarks, notably The Women's Empowerment in Agriculture Index (WEAI), which has set a precedent for measuring critical dimensions of inclusion within the agri-Food, Water, and Land (aFWL) sector. The WEAI's comprehensive approach to assessing women's empowerment and gender parity provides a valuable framework from which the MDII can draw inspiration, especially in its commitment to nuanced, user-centric evaluation of digital tools and platforms.

Building upon this foundation, the MDII extends the conversation into the digital realm, acknowledging the transformative potential of digital innovations (DIs) in the aFWL system.

The digital divide, as highlighted by IWMI's recent work, underscores the urgency of integrating digital inclusivity into

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the aFWL narrative. The proposed working framework for the MDII, with its focus on accessibility, beneficial impact, usability of digital innovations, ethical and responsible innovation, co-creation and governance, facilitation of DI (digital innovations) adoption, and risks and harms, is particularly relevant for the aFWL sector, where digital innovations can significantly enhance food production, distribution, and consumption processes.

The aFWL system is a complex network of activities that are increasingly influenced by digital innovations such as the Internet of Things, drones, remote sensing, and social media platforms. However, the benefits of these DIs are not evenly distributed. The MDII seeks to ensure that digital solutions are not only accessible, usable, and safe but also provide tangible benefits to all actors within the aFWL system, particularly marginalized groups such as women, indigenous communities, and youth in rural areas.

The MDII's emphasis on participation and co-development resonates with the need for inclusive design and governance in aFWL digital innovations. By involving marginalized groups of people from the outset, the MDII aims to foster technologies that are more aligned with the needs and contexts of end-users, thereby enhancing the adoption and impact of digital solutions in the aFWL sector.

Moreover, the MDII's consideration of the potential negative consequences of digital innovation is critical for the aFWL system, where the risks of data misuse and exploitation can have far-reaching implications for food security and sovereignty.

In conclusion, the MDII represents a forward-thinking approach to digital inclusiveness, one that is acutely aware of the unique challenges and opportunities within the aFWL system. By weaving together, the threads of digital innovation, social inclusion, and aFWL system sustainability, the MDII strives to be a beacon for equitable and responsible transformation in the digital age.

1.2. Overview of the Multidimensional Digital Inclusiveness Index (MDII)

The Multidimensional Digital Inclusiveness Index (MDII) is conceived as an evaluative framework developed to assess and enable the inclusion and inclusivity of digital innovations across the aFWL sector.

This tool is designed to identify and overcome the digital divide that prevents the full inclusion of marginalized communities in the digital landscape. By providing a

comprehensive framework to assess digital tools and platforms, the MDII ensures that technological advancements contribute positively to all stakeholders in the aFWL system, particularly those who have been historically underserved. Its application ensures that the benefits of digital technological advancements are equitably distributed, thus supporting a more inclusive growth within the global aFWL system.

Vision for the MDII

The MDII envisions a future where digital innovations catalyze a transformative impact on the aFWL sector, bridging divides and fostering a universally accessible digital ecosystem. This vision encapsulates the collective aspirations of the international research community and aligns with the strategic goals of IWMI and CGIAR to create sustainable, inclusive aFWL systems through digital excellence.

Mission for the MDII

Building upon the foundational work of IWMI and CGIAR colleagues, the mission of the MDII is to decrease the digital divide in aFWL systems. The MDII is a tool of empowerment, designed to evaluate and increase the inclusion and inclusivity of digital innovations, thereby ensuring equitable access and benefits for all users, with an emphasis on traditionally underserved communities.

1.3. The need to go beyond “Agrifood” and classifying Food, Water and Land systems

To effectively evaluate Digital Innovation Products (DIPs) in the agrifood sector, the Multidimensional Digital Inclusion Index (MDII) should adopt a broader focus, encompassing the inter-connected nature of Food, Water, and Land (FWL) systems. This expanded scope aligns with the CGIAR's categorization of Action Areas and Initiatives, providing a comprehensive framework for assessment.

- 1) **Systems Transformation:** This Action Area, featuring initiatives like the CGIAR Initiative on Digital Innovation and the Initiative on Foresight, stresses the importance of multi-sectoral policies for FWL systems. The MDII, by integrating this perspective, can assess DIPs for their potential to drive transformative change across these interconnected systems.
- 2) **Resilient Agri-food Systems:** With initiatives focusing on crops, livestock, aquatic foods, and farming systems, this area highlights the need for sustainable productivity and resilience in agrifood systems. The MDII, by incorporating these elements, can evaluate DIPs for their contribution to resilience and sustainability in FWL

contexts.

- 3) Genetic Innovation: This area, with initiatives like the CGIAR Initiative on Accelerated Breeding and the Initiative on Genebanks, underscores the importance of genetic resources and breeding for crop improvement. By considering these aspects, the MDII can assess how DIPs support or integrate with genetic innovations, contributing to enhanced aFWL systems.

By grounding the MDII in these Action Areas and corresponding initiatives, we ensure a comprehensive and nuanced evaluation of DIPs, reflecting their diverse impacts and roles in the aFWL systems. This approach not only enhances the accuracy of the MDII but also aligns it with global efforts toward sustainable and resilient aFWL systems.

1.4. The Need for Digital Inclusion in the aFWL System

Digital inclusion within the aFWL system is not merely a matter of technological advancement but a fundamental requirement for equitable development.

The MDII recognizes that without deliberate measures to include all users, technological innovations risk exacerbating existing inequalities.

By prioritizing digital inclusion, the MDII aims to:

- Bridge the Digital Divide: Address the gap in access to digital tools between different communities, especially those in remote or underserved regions.
- Empower Marginalized Users: Ensure that digital innovations are designed with the needs of marginalized users in mind, promoting user agency and empowerment.
- Enhance Livelihoods: Leverage digital technologies to improve the livelihoods of smallholder farmers and other stakeholders within the aFWL system.
- Support Sustainable Development: Contribute to sustainable development goals by making digital resources more widely available and effective.

The need for digital inclusion is therefore integral to the mission of the MDII, guiding its approach to assess and inform the development of digital innovations in agriculture.

1.5. Alignment with Sustainable Development Goals (SDGs)

The MDII is strategically designed to support and advance key Sustainable Development Goals (SDGs) through actionable metrics and inclusive digital innovation. By providing a clear

evaluative framework, the MDII enables stakeholders to:

- 1) Tackle Poverty and Hunger (Goals 1 & 2): Assess and guide digital innovations that increase agricultural productivity, market access, and income generation for the rural poor. Direct impact on targets 1.4, 1.5, 2.3, 2.4 and 2.a.
- 2) Promote Gender Equality (Goal 5): Ensure that digital tools are equally accessible and beneficial to women, supporting their active participation in the aFWL economy. Direct impact on targets 5.a and 5.b.
- 3) Foster Innovation and Infrastructure (Goal 9): Advocate for digital infrastructure that reaches marginalized communities, spurring innovation that is both inclusive and sustainable. Direct impact on targets 9.5., 9.a, 9.b and 9.c.
- 4) Reduce Inequalities (Goal 10): Identify and address digital disparities that can lead to social and economic exclusion. Direct impact on targets 10.1., 10.2. and 10.3.

1.6. The Aspirations of the MDII as a Multi-Purpose

The MDII is designed with the foresight to become an integral tool for evaluating and promoting digital inclusiveness within the aFWL system. This means the MDII aims to assess impact, but at the same time, create impact over time due to its feedback nature.

While it is set to directly support IWMI and the broader CGIAR initiatives, it also aims for global applicability, such as WaPOR, and potentially enhancing GESI projects and others committed to equitable digital transformation.

The MDII also has the following long-term aspirations:

- Cultivate Inclusive Innovation: Support the creation of digital tools through assessment in the development and deployment stage that are inherently inclusive, ensuring that innovations meet the needs of diverse user groups, especially traditionally marginalized communities.
- Enable Comprehensive Assessments: Establish benchmarks to assess the reach and impact of digital innovations, with an emphasis on empowering marginalized populations.
- Influence Inclusive Policies: Deliver data-driven insights to shape policies that effectively address the digital divide within the aFWL sector.
- Foster Continuous Adaptation and Learning: Evolve as a

responsive framework that incorporates user feedback and adapts to emerging trends and challenges.

In addition to these roles, the MDII development should aspire to:

- **Embrace Future-Thinking:** Collect descriptive data that goes beyond immediate inclusivity concerns, such as the type of innovation, demographics, aFWL systems, types, innovation devices used, and others. This approach aims to facilitate future mapping and advanced analytics for comprehensive research and informed decision-making.
- **Integrate AI Capabilities:** Incorporate AI features in its final iteration to expedite data extraction and categorization, thus enhancing the index's ability to predict digital exclusion risks. This integration will also aid in providing actionable insights to improve MDII scoring for various innovations.

1.7. Scope of the MDII

Building upon the concepts outlined earlier, the MDII's scope is expansive, designed to account for the intersectionality of user groups and the multifaceted nature of aFWL systems worldwide.

It should be designed with a clear focus to be comprehensive, accommodating the varying contexts of stakeholders, inclusive of diverse demographics, and adaptable to different agricultural practices and innovations. This ensures that the Index recognizes the overlapping and interdependent systems of discrimination or disadvantage that affect marginalized communities, understanding the layered complexities these users face. The MDII will be sensitive to the needs of women, youth, persons with disabilities, the digitally illiterate, and those without internet access and be adaptable to both specific innovations and broader organizational and policy innovations at the national level.

2. Terminology

This section is dedicated to the explication of terminologies and semantics, crucial for the MDII's deployment and interpretation. It serves a dual purpose: firstly, to forge a consensus on the definition of key concepts, ensuring all stakeholders have a collective understanding; secondly, to provide clarity and precision in the usage of terms, thereby facilitating effective communication and alignment across diverse entities.

The terminology embodies a comprehensive yet concise articulation of concepts. This standardization of language is

instrumental in laying a robust foundation for the MDII, while simultaneously fostering a spirit of collaboration and minimizing the potential for misinterpretation or divergent adaptations by various stakeholders.

2.1. aFWL Systems and Innovation

- **aFWL System:** The entire continuum of food production, processing, distribution, consumption, and disposal, including the natural resources such as land and water that are linked to it.
- **Digital Innovation Product:** A manifestation of a digital advancement designed specifically for the aFWL sector, such as agricultural drones or farm management software.

2.2. Types of Users and Stakeholders

- **Evaluators:** Individuals or entities that assess the effectiveness, inclusivity, and impact of digital aFWL innovations within the MDII, ensuring technologies serve all user groups appropriately.
- **Innovators:** Creators of digital innovations, including institutions, who need to assess inclusivity in their design and reach.
- **Institutions and Non-Governmental Organizations (NGOs):** Public or private bodies, which can also be innovators, responsible for policy, regulation, and the promotion of digital inclusivity at various levels, from local to international.
- **Intermediaries:** Organizations or individuals that act as connectors between innovators and end-users, facilitating the adoption and implementation of digital innovations.
- **Marginalized Users:** The direct beneficiaries of digital innovation, often overlooked in design processes, including women, youth, disabled users, illiterate farmers, and those without internet access.
- **User/Target Groups:** Distinct segments within the MDII that encompass a spectrum of stakeholders, each with varying needs and influences in the digital aFWL ecosystem. Can be Innovators, Institutions, Intermediaries or Marginalized Users.

2.3 Metrics, Measures, and Technical Terms

- **Descriptive Data:** Data detailing innovation types, user demographics, aFWL systems, and devices, crucial for AI-enhanced mapping and analytics within MDII to identify and mitigate digital exclusion risks.

- **Digital Inclusiveness Index (MDII):** A composite metric that evaluates the inclusivity level of digital technologies in the aFWL sector, composed of 7 dimensions, sub-dimensions, and indicators for evaluation.
- **Index Data:** Quantitative metrics for the MDII that assess digital inclusivity in the aFWL sector, including connectivity rates, affordability, literacy levels, and user engagement statistics.
- **Minimum Viable Product (MVP):** The most basic yet operational version of the MDII, which encompasses essential features to measure digital inclusivity and solicit initial user feedback.
- **Prototyping:** The development of an initial visual model of the MDII tool, enabling data collection, inclusivity scoring, and visualization, including identifying exclusion risks and mitigation strategies.
- **Units of Analysis:** The scales at which digital inclusivity is measured within MDII, ranging from individual innovations to bundled solutions and extensive national policies.
- **Use Cases:** Specific scenarios that demonstrate the application of the MDII in various aFWL sector contexts, highlighting the practical challenges and opportunities in enhancing digital inclusivity.
- **Digital Innovation:** Process of converting manual data and processes into digital formats and applying this to solve various social, economic, and environmental challenges. It also includes the rules and regulations put in place to facilitate and govern these digital solutions. In food, land, and water systems, digital innovation includes: 1) data-driven precision agriculture in food, utilizing IoT sensors, satellite imagery, and mobile apps for real-time crop monitoring, efficient resource use, and yield optimization; (2) smart water management in water systems, employing automated control systems, sensor networks, and predictive analytics apps for effective water distribution and conservation; and (3) GIS (Geographic Information System) and remote sensing technologies in land systems, integrated with mobile applications for enhanced land use planning, soil health monitoring, and sustainable management practices.
- **Digital Ethics Frameworks:** Structured guidelines that ensure the ethical deployment of digital innovations, addressing data governance, privacy, and societal impact.
- **Human-Centered Design (HCD):** A problem-solving approach that integrates the human perspective in all stages, particularly relevant in design and management frameworks.
- **Intersectionality:** Consideration of how overlapping social identities (such as race, gender, class, and disability) can intersect to create unique experiences of advantage or disadvantage in the use of digital technologies and services in the aFWL sector.
- **Grassroots Innovation:** Innovations originating at the local level to address specific community challenges within the aFWL sector, typically developed outside of formal R&D channels.
- **Participation:** The involvement of users in shaping, designing, and managing digital aFWL innovations, ensuring their initiatives, needs and perspectives are integrated.

2.4 User Roles

Users are the ones that interact with the MDII Platform. They can be:

- 1) **Requesters:** Organizations or individuals that would like their digital innovation to be reviewed.
- 2) **Evaluators:** Organizations or individuals that collect and analyze information during the review, e.g., Expert evaluators, intended beneficiaries.
- 3) **Consumers:** Users of the results from digital inclusiveness reviews, e.g., funders, knowledge institutions, governments.

2.5. Additional Concepts

Descriptive Data: Requested data that allows for detailed contextualization and predictive analysis, encompassing system types, CGIAR action areas, operational areas, and sub-sector categorizations within aFWL systems. This facilitates AI-driven evaluations and risk forecasting to enhance digital inclusivity.

Applying these terms consistently across all levels of discourse will ensure that the initiatives and policies developed under the auspices of the MDII are rooted in a shared understanding, enabling more effective communication, policymaking, and implementation. Through this collective linguistic framework, the MDII aspires to sculpt a digital aFWL landscape that is inclusive, equitable, and sustainable.

3. Guiding Principles

The 8 Guiding Principles guide the core values and strategic intents underpinning the Index, allowing better and more effective decision-making throughout the development of the MDII. These principles are essential for ensuring that the development and application of the MDII are cohesively aligned with its overarching mission of advancing digital inclusivity in the aFWL system. They serve as a reference point for the interdisciplinary team, providing a clear and common framework that guides collaborative efforts and decision-making processes by facilitating the integration of diverse stakeholder perspectives while safeguarding the index's foundational objectives.

3.1. Equity and Accessibility

The MDII is anchored in equity, with a mandate to facilitate equal digital access. This principle underpins the Index's commitment to dismantling barriers and expanding opportunities for comprehensive digital engagement within the aFWL sector, with emphasis in Marginalized Users.

3.2. Transparency and Collaboration

The creation and refinement of the MDII is rooted in transparency, promoting openness and shared learning. By engaging a diverse array of stakeholders in a collaborative process, the Index nurtures trust and co-ownership among participants.

3.3. Rigor and Relevance

The MDII is underpinned by strong methodological standards, ensuring that the Index remains robust and meaningful. The approach is grounded in empirical validation, maintaining relevance to the evolving dynamics of digital inclusion.

3.4. Adaptable Future-Oriented Data & AI Strategy

With foresight, the MDII should incorporate a forward-looking data strategy, capturing not only current inclusivity metrics but also anticipating the needs of future mapping within IWMI and CGIAR and/or other stakeholders. This orientation should aim for the seamless integration of emergent technologies and advanced analytical methods, such as artificial intelligence, to refine the Index's predictive capabilities.

3.5. Good (intersectional) User Profiling

Understanding the user base is paramount. The MDII commits to considering a nuanced profiling of users, embracing an intersectional lens to capture the multi-dimensional

experiences of all potential beneficiaries, particularly marginalized groups. This profiling is not static; it evolves through continual feedback and re-evaluation to remain aligned with user needs.

3.6. Simplicity and Tailoring

Despite the intersectional complexity it navigates, the MDII should maintain its simplicity in design and function, ensuring accessibility and comprehensibility. Tailoring to diverse user groups is central, with a built-in flexibility that allows the Index to be customized for different evaluators, from innovators to NGOs.

3.7. Comprehensible yet flexible Framework

The MDII should be designed (and iterated) to be intuitively comprehensible, allowing stakeholders from varied backgrounds to grasp its purpose and methodology easily. At the same time, it needs to have an inherent adaptability, enabling it to flex and evolve with the needs of different user groups and accommodate future use cases. This dual focus ensures that the MDII remains relevant and user-friendly, serving as a versatile tool that can pivot as necessary to meet emerging challenges and opportunities in digital inclusion within the aFWL systems.

3.8. Clarity

To further enhance clarity and applicability, the MDII is guided by nuanced considerations that address the multifaceted nature of digital inclusivity:

- **Cultural Relevance:** Ensuring that digital solutions resonate with the cultural and social fabric of the target communities.
- **Disability Inclusion:** Implementing inclusive design principles to make digital solutions accessible to all users, including those with disabilities.
- **Gender Sensitivity:** Proactively addressing gender-based disparities and promoting empowerment through digital inclusion.
- **Intersectionality:** Acknowledging the interplay of social identities and experiences in the design and application of the MDII.
- **Regional Variability:** Adapting to the varied aFWL systems, cultural contexts, and digital infrastructures that span different regions.
- **Technological Devices and Requirements:**

Acknowledging the spectrum of technological devices and requirements necessary for effective digital engagement by addressing availability and suitability of devices that users have access to and the technical specifications that digital solutions demand.

Through the application of these principles, the MDII aspires to be a definitive resource for driving digital inclusivity within the aFWL sector, delivering a human-centered tool that is both practical and impactful in its implementation.

4. Theoretical, Conceptual and Logical Frameworks

This section aims to explore and explain the three frameworks that will allow the development of the full Index. Before presenting all frameworks, it is important to reiterate that the MDII can be deployed globally through CGIAR and its research centers, such as IWMI.

Therefore, the Index and its frameworks represent an evolution from a theoretical foundation to a practical implementation tool within the aFWL sector.

Additionally, there is also a logical framework that operationalizes these concepts, providing actionable steps and tools to effectively implement and assess digital inclusivity. This progression from theory to practice ensures that the MDII is not only academically robust but also relevant and effective in enhancing digital inclusion.

This dual-framework approach reinforces the mission of the MDII to act as a comprehensive solution for digital inclusivity within agri-food systems. Its objective is to foster inclusive innovation both in the short and long term, covering the complete spectrum from production to disposal in the domains of Land, Food, and Water.

4.1. Rationale from a Theoretical Foundation to a Conceptual Framework

Grounded in academic research, the [original theoretical](#)

[framework](#) provided five core pillars, based on an extensive literature review. These pillars were identified as 'Access', 'Benefits', 'Use', 'Consequences', and 'Participation'. By grounding the theoretical framework in solid theoretical knowledge, it ensures that the final MDII has academic rigor and relevance. The MDII's evolution was done in 3 different phases, starting with the creation of the theoretical framework, adjusting it to a conceptual approach, and then to the development of a logical framework (Figure 1).

Building on the theoretical framework pillars through practical digital inclusion expertise, the Conceptual framework encapsulates a more refined and adjusted real-world-oriented framework that defines the broad concepts and categories integral to the MDII. It lays out the dimensions of digital inclusion, illustrating how they interconnect and shape the assessment of digital innovation for inclusivity within the aFWL sector.

Building on the theoretical framework pillars through practical digital inclusion expertise, the Conceptual framework encapsulates a more refined and adjusted real-world-oriented framework that defines the broad concepts and categories integral to the MDII. It lays out the dimensions of digital inclusion, illustrating how they interconnect and shape the assessment of digital innovation for inclusivity within the aFWL sector.

Transitioning to a more practical approach, it illustrates the transformation of academic insights into applied strategies. To refine terminology and application, the initial MDII's pillars have been revised to 7 core dimensions (Table 1). These core dimensions have been refined to align with commonly used terminologies and to address specific adoption barriers, drawing the 'Adoption Facilitation' from the construct 'Facilitating Conditions' from the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2012).

Furthermore, the separation of 'Consequences' into 'Ethical & Responsible Innovation' and 'Risk & Harms' ensures a balanced assessment of digital tools, promoting positive



Figure 1. Evolution of the Digital Inclusiveness Index (MDII)



Figure 2. Conceptual Framework of the MDII

outcomes while guarding against adverse effects.

This way, the Conceptual Framework for the MDII is composed of 7 dimensions (Figure 2): Accessibility, Beneficial Impact, Usage Efficacy, Ethical & Responsible Innovation, Co-creation and Governance, Adoption Facilitation, and Risks and Harms.

4.2. Components of a Comprehensive MDII and Proposed Plan for Final Granularity

The MDII is structured hierarchically (Figure 3). To create an effective index scoring, the overarching Dimensions, which are the key areas of focus, are further refined into Sub-Dimensions, which provide more specific aspects or elements within the broader area. Within each Sub-Dimension, there are Indicators, which are measurable elements that concretely

assess performance or progress in that specific aspect. Finally, the Criteria are the detailed, specific standards or questions used to evaluate and score each Indicator, providing a granular assessment of digital inclusivity.

Currently, the Conceptual Framework is very comprehensive and detailed with the following Dimensions, Sub-dimensions, and Indicators. Following the hierarchical structure of the MDII, each of the dimensions has a corresponding sub-dimension that evaluates several indicators. This represents a multi-tiered approach to measurement.

The first dimension of Accessibility (Table 2), which are

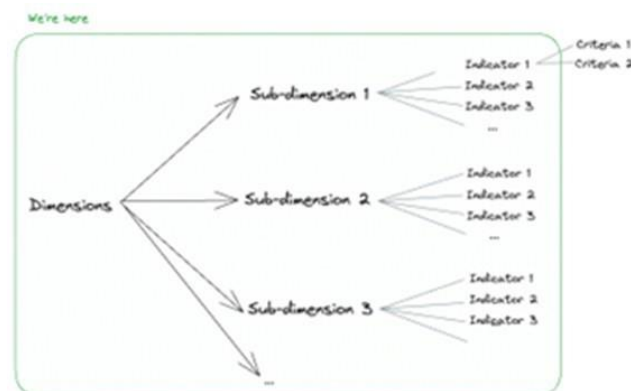


Figure 3. Index Components Structure

Table 1: Overview of name adjustments from the theoretical to the conceptual frameworks

Theoretical Name	Conceptual Name
Access	Accessibility
Benefits	Beneficial Impact
Use	Usage Efficacy
Consequences	Ethical & Responsible Innovation
Participation	Co-Creation & Governance
--	Adoption Facilitation
Consequences	Risks & Harms

further divided into sub-dimensions such as Infrastructure Accessibility, Economic Accessibility, Informational Accessibility, and Capacity Development. Each sub-dimension is composed of specific indicators like Digital Availability, Quality and Functionality, and Cost of Access, among others, to provide a comprehensive assessment framework for what accessibility is regarding digital innovation solutions.

The dimension of Beneficial Impact (Table 3) aims to evaluate the positive impacts of digital innovations on marginalized users. It becomes significant due as it measures the real-world benefits and positive impacts of digital solutions in improving the quality of life and addressing the unique challenges faced by marginalized users. This dimension is further divided into Solution Effectiveness, Problem Relevance, Digital Divide, Sustainability, and Social Value Creation. Each sub-dimension is composed of several indicators, such as Problem-Solution Fit, Relevance to Target Group, Scalability, among others.

Regarding Usage Efficacy (Table 4), this dimension aims to evaluate the ease and effectiveness of digital innovations, because it is important to evaluate how effectively digital solutions meet the unique needs and circumstances of marginalized users, promoting ease of use and beneficial outcomes, and thereby facilitating digital inclusion. It is further divided into Digital Literacy, Innovation Desirability, Usability, and Community Networks. There are different indicators for these sub-dimensions, such as Resource Sharing and Collective Problem-Solving, Performance Efficiency, User Satisfaction, Perceived Value, and Learning Support, among others.

The fourth dimension, Ethical and Responsible Innovation, aims to evaluate the ethical practices and responsible innovation in digital solutions (Table 5). Digital Innovations aren't exempt of responsibility and ethical implications. Through the assessment of Data Governance, Ethical Compliance, Epistemic Justice, and Reflexive Innovation from digital innovations, it is possible to evaluate if digital innovations are ethically sound and responsibly managed, promoting justice, fairness, and responsible innovation for marginalized users. Sub-dimensions are further divided into several indicators, such as Data Privacy, Data Accessibility, Informed Consent, Knowledge Accessibility, and Feedback Integration, among others.

To ensure that digital solutions are co-created with marginalized users, governed inclusively, and are reflective of the diverse needs of these users, the Co-Creation and

Governance dimension (Table 6) aims to capture the collaborative innovation and inclusive governance in digital innovations. This dimension is divided into Intellectual Property Assurance, Collaborative Innovation, Grassroots Innovation Inclusion, and Inclusive Governance, and includes several indicators, such as IP Protection Mechanisms, Diversity and Representation, Community-led Solutions, Inclusive Decision-making, among others.

For the Adoption Facilitation dimension (Table 7), the goal is to focus on the adoption and sustained use of digital innovation solutions. This dimension can help assess factors like behavioural intention and facilitating conditions, focused on ensuring that digital solutions are not only accessible but also adaptable and usable in a sustained manner by marginalized users, fostering a supportive ecosystem for digital engagement. It is divided into Training Accessibility, Supportive Ecosystem, Behavioural Intention, and Facilitation Conditions. For these sub-dimensions, there are several indicators, such as Documentation and Guidance, Intention to Use, Feedback Mechanisms, Training Affordability, among others.

The final dimension, Risks & Harms (Table 8), has 4 sub-dimensions: Gender-Related Risks, Job Displacement, Technological Dependency, and Technological Dependency. This dimension aims to capture the potential negative impacts that digital innovation products might have on users, especially marginalized groups within agrifood systems. The main reasoning for the inclusion of this dimensions relies on the assumption that digital solutions should not only be efficacious but also equitable and safe for diverse user groups. It emphasizes the critical need for digital innovations to be socially responsible, avoiding and addressing potential adverse effects on vulnerable populations. Like the previous dimensions, each sub-dimension is further divided into several indicators, such as Gender disparity, Gender Equality and Empowerment, Support for Traditional Practices, Dependency on Continuous Tech Support, Impact on Traditional Knowledge and Practices, Data Representation Equity, among others.

Each digital innovation solution aims to provide a solution for a real-world problem, such as, for example, lack of digital tools for efficient water resources, or challenges in deploying solutions for pest control. In these cases, MDII can be transversal to different context-specific settings, which provides several practical implementations. In Table 9, there are different examples of challenges that digital innovations aim to solve. For each example, there's an example of a direct

Table 2. Dimensions, Sub-dimensions, and Indicators for Accessibility

Sub-dimension (SD)	IND ID	Indicators (IND)
Infrastructure Accessibility	D1.11	Digital Availability
	D1.12	Quality and Functionality
	D1.13	Infrastructure Readiness
	D1.14	Accessibility Features
	D1.15	Integration with Existing Systems
	D1.16	Cost of Access
	D1.17	Support and Training for Infrastructure Use
	D1.18	Resilience and Security
Economic Accessibility	D1.21	Affordability
	D1.22	Cost Transparency
	D1.23	Subsidy Availability
	D1.24	Value for Money
	D1.25	Economic Incentives
	D1.26	Cost of Transition
	D1.27	Return on Investment (ROI)
	D1.28	Cost Predictability
Informational Accessibility	D1.31	Digital Literacy
	D1.32	Innovation Desirability
	D1.33	Usability
	D1.34	Community Networks
Capacity Development	D1.41	Customized Training Programs
	D1.42	Continuous Learning Opportunities
	D1.43	Performance Monitoring and Feedback
	D1.44	Certification and Recognition

Table 3. Dimensions, Sub-dimensions, and Indicators for Beneficial Impact

Sub-dimension (SD)	IND ID	Indicators (IND)
Solution Effectiveness	D2.11	Solution Performance
	D2.12	Functionality
	D2.13	Outcome Measurement
	D2.14	Problem-Solution Fit
	D2.15	Adaptive Capability
Problem Relevance	D2.21	Problem Identification Accuracy
	D2.22	Relevance to Target Group
	D2.23	Severity Assessment
	D2.24	Engagement in Problem Definition
	D2.25	Local Contextual Understanding
Digital Divide	D2.31	Gender Gap Reduction
	D2.32	Digital Gap Reduction
Sustainability	D2.41	Long-term Viability
	D2.42	Maintainability
	D2.43	Scalability
	D2.44	Resource Efficiency
	D2.45	Economic Sustainability
Social Value Creation	D2.51	Community Impact
	D2.52	Individual Empowerment
	D2.53	Social Equity
	D2.54	Cultural Sensitivity
	D2.55	Social Capital Building

Table 4. Dimensions, Sub-dimensions, and Indicators for Usage Efficacy

Sub-dimension (SD)	IND ID	Indicators (IND)
Digital Literacy	D3.11	Skill Acquisition
	D3.12	Skill Application
	D3.13	Learning Support
	D3.14	Relevance of Skills
	D3.15	Assessment and Feedback
Innovation Desirability	D3.21	Appeal and Engagement
	D3.22	Perceived Value
	D3.23	Ease of Adoption
	D3.24	User Satisfaction
	D3.25	Innovation Relevance
Usability	D3.31	Ease of Use
	D3.32	Error Management
	D3.33	Performance Efficiency
	D3.34	Accessibility Features
Community Networks	D3.41	Network Formation
	D3.42	Network Engagement
	D3.43	Resource Sharing
	D3.44	Community Resilience
	D3.45	Community-driven Innovation

Table 5. Dimensions, Sub-dimensions, and Indicators for Ethical and Responsible Innovation.

Sub-dimension (SD)	IND ID	Indicators (IND)
Data Governance	D4.11	Data Privacy
	D4.12	Data Accessibility
	D4.13	Data Accuracy
	D4.14	Data Portability
	D4.15	Transparency of Data Practices
Ethical Compliance	D4.21	Ethical Standards Adherence
	D4.22	Ethical Oversight
	D4.23	Informed Consent
	D4.24	Impact Assessment
	D4.25	Ethical Training and Awareness
Epistemic Justice	D4.31	Knowledge Inclusion
	D4.32	Recognition Justice
	D4.33	Communicative Equality
	D4.34	Knowledge Accessibility
	D4.35	Epistemic Empowerment
Reflexive Innovation	D4.41	Continuous Reflection
	D4.42	Feedback Integration
	D4.43	Transparency and Communication

Table 6. Dimensions, Sub-dimensions, and Indicators for Co-Creation and Governance.

Sub-dimension (SD)	IND ID	Indicators (IND)
Intellectual Property Assurance	D5.11	IP Awareness
	D5.12	IP Protection Mechanisms
	D5.13	IP Inclusivity
	D5.14	IP Dispute Resolution
	D5.15	IP Education and Capacity Building
Collaborative Innovation	D5.21	Collaboration Accessibility
	D5.22	Diversity and Representation
	D5.23	Collaborative Support
	D5.24	Co-creation Opportunities
	D5.25	Outcome Sharing
Grassroots Innovation Inclusion	D5.31	Grassroots Engagement
	D5.32	Community-led Solutions
	D5.33	Local Knowledge Utilization
	D5.34	Capacity Building
	D5.35	Impact Assessment
Inclusive Governance	D5.41	Inclusive Decision-making
	D5.42	Representation
	D5.43	Transparency
	D5.44	Accountability

Table 7. Dimensions, Sub-dimensions, and Indicators for Adoption Facilitation

Sub-dimension (SD)	IND ID	Indicators (IND)
Training Accessibility	D6.11	Training Availability
	D6.12	Training Relevance
	D6.13	Training Affordability
	D6.14	Training Support
	D6.15	Training Assessment and Feedback
Supportive Ecosystem	D6.21	Community Engagement
	D6.22	Resource Availability
	D6.23	Inclusive Policies
	D6.24	Feedback Mechanisms
	D6.25	Collaboration Platforms
Behavioral Intention	D6.31	Intention to Use
	D6.32	Perceived Usefulness
	D6.33	Perceived Ease of Use
	D6.34	Attitude towards Use
	D6.35	Behavioral Control
Facilitating Conditions	D6.41	Technical Infrastructure
	D6.42	Support Availability
	D6.43	Documentation and Guidance
	D6.44	Community Support

Table 8. Dimensions, Sub-dimensions, and Indicators for Risks and Harms

Sub-dimension (SD)	IND ID	Indicators (IND)
Gender-Related Risks	D7.1.1	Gender disparity
	D7.1.2	Inclusivity in Content and Design
	D7.1.3	Gender Equality and Empowerment
Job Displacement	D7.2.1	Automation Impact on Rural Employment
	D7.2.2	Skill Adaptation for Marginalized Communities
	D7.2.3	Support for Traditional Practices
Technological Dependency	D7.3.1	Dependency on Continuous Tech Support
	D7.3.2	Adaptability to Local Technological Infrastructure
	D7.3.3	Impact on Traditional Knowledge and Practices
	D7.3.4	Risk of Obsolescence for Marginalized Users
Technological Bias	D7.4.1	Algorithmic Fairness
	D7.4.2	Cultural and Contextual Relevance
	D7.4.3	Accessibility for Diverse Abilities
	D7.4.4	Data Representation Equity
	D7.4.5	Bias Monitoring and Adaptation

relation to dimension and corresponding sub-dimensions, as well as an evaluation goal.

4.3. Specific Measurable Objectives for the MDII

By applying and scaling the MDII, we are aiming to:

- 1) **Assessment Precision:** Create an index with robust metrics that accurately gauge the extent of digital inclusivity within aFWL systems, offering a nuanced scoring system that reflects the nuances of inclusivity.
- 2) **User Engagement:** - Develop the MDII as a participatory tool that not only collects data but actively involves diverse user groups in its ongoing refinement, ensuring it remains grounded in the lived experiences of these communities.
- 3) **Policy Influence:** Utilize the insights from the MDII to guide and shape policy decisions, advocating for structural changes that enhance digital inclusivity at both local and broader governmental levels.
- 4) **Innovation Guidance:** Offer a clear set of benchmarks through the MDII that innovators can use as a guide for creating digital tools and services that cater to the inclusivity needs of the aFWL sector, with an emphasis on inclusivity for underserved populations.
- 5) **Sector Adaptability:** Ensure that the MDII remains flexible and relevant across various aFWL sectors and geographic regions, acknowledging and integrating different contextual challenges and opportunities.
- 6) **Data-Driven Interventions:** Use the MDII to pinpoint specific areas in need of improvement, thereby facilitating precise and strategic interventions aimed at closing digital

inclusion gaps.

- 7) **Continuous Improvement:** Incorporate into the MDII a mechanism for regular feedback, learning, and evolution, enabling the index to adapt proactively to technological developments and changing user requirements.

4.4. How does this look at a global CGIAR-level?

Understanding the full potential of MDII in the medium and long-term is crucial. With AI-powered technologies, it is possible to make the MDII the go-to for digital inclusiveness, especially for marginalized users.

- 1) Use the MDII to classify digital innovation products across different aFWL areas: By using a clear conditional -logic framework in the implementation of the index, it is possible to classify innovations based on their aFWL area. This way, it becomes possible to have a clear picture of all innovations developed and/or endorsed by CGIAR globally, as well as having specific databases and modules that map out innovations at a research-level center.
- 2) Use the MDII to understand which innovations are historically more inclusive or exclusive: By understanding and mapping out end-users per digital innovation products, it becomes easier to understand which are trends on digital innovation, which allows better decision-making, either in funding or policymaking.
- 3) Use the MDII for advanced analytics: By leveraging data collection in a simple, effective, and inclusive way, it is possible to provide comprehensive insights at the CGIAR level, facilitating data-driven decision-making and strategy formulation in aFWL systems.
- 4) Use the MDII as a requirement for funding proposals: The MDII can be used as a component in funding proposals, ensuring that innovators provide concrete evidence of digital inclusivity. This aligns with strategies promoting top-down inclusivity requirements, enhancing the alignment between digital innovation offerings and their adoption. This can be achieved through automatic reporting on the MDII platform and subsequent upload on the CGIAR proposal platform. This report should be manually reviewed to reduce fraud risk and reinforce the alignment with what the digital innovation product aims to solve and digital inclusion practices for marginalized users.

The objectives ensure that the MDII is not just a static

Table 9. Examples of practical implementation of the MDII in context-specific settings

Examples of Challenges that Digital Innovations aim to solve	Related Dimensions & Sub-Dimensions	Digital Innovation Example & Evaluation
1. Limited access to real-time water quality monitoring technology for small-scale farmers.	(Accessibility) Infrastructure Accessibility, Informational Accessibility	Example: Smart Water Quality Monitoring System Evaluation: Assess infrastructure accessibility to determine if small-scale farmers have the necessary connectivity to use the system, and informational accessibility to ensure clarity and availability of information on how to use the monitoring system.
2. Lack of digital tools for efficient water resource management and irrigation planning.	(Accessibility) Economic Accessibility, Capacity Development	Example: Digital Irrigation Management System Evaluation: Economic accessibility to assess affordability and financial support, and capacity development to measure opportunities for farmers to learn how to use the system.
3. Insufficient data connectivity in remote areas affecting water conservation efforts.	(Accessibility) Infrastructure Accessibility	Example: Remote Data Connectivity Solutions Evaluation: Infrastructure accessibility to evaluate the availability and readiness of connectivity solutions in remote areas.
4. Inadequate access to digital platforms for soil health assessment and land-use optimization.	(Accessibility) Economic Accessibility, Informational Accessibility	Example: Digital Soil Health Assessment Platform Evaluation: Economic accessibility to determine affordability and financial support, and informational accessibility to ensure clarity and availability of information.
5. Limited availability of affordable precision agriculture technology for smallholders.	(Accessibility) Economic Accessibility, Capacity Development	Example: Affordable Precision Agriculture Tools Evaluation: Economic accessibility to assess affordability, and capacity development to measure training opportunities for smallholders.
6. Challenges in deploying digital solutions for pest and disease control in crops.	(Beneficial Impact) Solution Effectiveness, Problem Relevance	Example: Digital Pest and Disease Identification System Evaluation: Solution effectiveness to assess the performance and relevance in identifying and controlling pests and diseases, and problem relevance to evaluate alignment with actual pest and disease challenges faced by farmers.
7. Limited access to digital supply chain management systems, impacting food distribution.	(Accessibility) Economic Accessibility, Capacity Development	Example: Digital Supply Chain Management System Evaluation: Economic accessibility to determine affordability and financial support, and capacity development to measure opportunities for users to learn how to use the system.
8. Difficulty in adopting digital solutions for food safety and traceability.	(Adoption Facilitation) Behavioral Intention, Training Accessibility	Example: Digital Food Traceability System Evaluation: Behavioral intention to evaluate the willingness and attitude of users towards using the traceability system, and training accessibility to assess the availability and relevance of training resources.
9. Insufficient access to weather forecasting and climate data for crop planning.	(Accessibility) Informational Accessibility, Economic Accessibility	Example: Digital Weather Forecasting System Evaluation: Informational accessibility to ensure clarity and availability of weather and climate data, and economic accessibility to determine affordability and financial support mechanisms.
10. Challenges in implementing digital innovations for sustainable food production and reducing waste.	(Beneficial Impact) Solution Effectiveness, Sustainability	Example: Digital Waste Management and Food Preservation System Evaluation: Solution effectiveness to assess the performance and relevance in reducing food waste and enhancing sustainability, and sustainability to measure the long-term viability and maintainability of the system.

measure, but a dynamic tool that drives change and promotes inclusivity as an ongoing process. This approach will help to ensure that digital tools and services within the aFWL sector are developed and implemented in ways that enable all individuals — regardless of their socioeconomic status, gender, age, or geographic location — to benefit from the digital revolution, while being a direct service to Sustainable Development Goals.

4.5. More than “only” an Index: Integration of Descriptive Data

As outlined before, the MDII is conceived as a multi-layered tool that combines quantitative index data with qualitative descriptive data to offer a comprehensive picture of digital inclusivity within aFWL systems.

The descriptive data component is vital for two main reasons:

- 1) **Contextualization:** It captures essential details about the nature of the innovation, demographic factors, infrastructural requirements, and operational contexts. This layer of data enriches the index by allowing for a more detailed and nuanced analysis and allows the implementation of a conditional logic in interacting with the tool, when entering information.

Depending on the target group, we can apply AI to standardize the evaluation process across various target groups, maintaining a consistent assessment of digital inclusivity while adapting to group-specific needs and perspectives. AI tools like Large Language Models (LLM), adaptive surveys, semantic analysis, and machine learning models will dynamically tailor question phrasing without altering the core criteria.

For example, a question for innovators on user comprehension can be modified for intermediaries to focus on communication strategies, ensuring clarity and relevance for each group¹⁶. This approach upholds the integrity of the evaluation while enhancing inclusivity and ensuring standardized feedback across different user profiles.

- 2) **Predictive Analysis:** By Utilizing AI, the descriptive data enables the MDII to forecast potential risks of digital exclusion and propose pre-emptive mitigation strategies. It ensures that the Index remains not only reflective but also predictive, guiding stakeholders towards more inclusive practices.

The MDII can use this descriptive data — such as user demographics, geographic locations, language

preferences, accessibility needs, and innovation types — to pre-emptively identify risks of digital exclusion. This strategy highlights areas where digital innovations might exclude specific groups or fail to meet their unique requirements.

For example, AI algorithms can analyze user feedback and usage data to uncover accessibility issues in certain regions or language barriers. They can also detect underserving of marginalized groups, like rural women or individuals with disabilities. With these insights, the MDII proposes targeted risk mitigation strategies, such as multilingual support, adaptive interfaces, or focused outreach programs, enhancing accessibility and equity.

The process (Figure 4) begins with the collection of 'Descriptive Data,' including information on agri-food systems, areas of innovation, and types of devices used, among others. Subsequently, 'Institutional Evaluators' and 'Marginalized Users Evaluators' assess the data (giving rise to the 'Index Data'). An AI-powered system processes this data, performing transformation and analysis to yield 'Platform Outputs,' which include the Digital Inclusion Index Score and insights into the risk of exclusion and mitigation strategies.

4.6. How can we weave the nuanced and diverse aFWL landscape into the MDII?

Acknowledging Challenges in Developing a Comprehensive MDII

The ambition to create a universally applicable yet sensitive Multidimensional Digital Inclusion Index for the aFWL sector is met with a complex array of challenges. Diverse target groups, the vast array of digital innovations, and the intricate web of intersectional factors that influence digital inclusivity present significant obstacles to developing an effective and robust Index.

Some nuances of the aFWL landscape include:

- 1) **Diverse Target Groups:** The MDII must cater to a range of stakeholders, from innovators to intermediaries, institutions, NGOs, and marginalized users. Each group has unique needs and perspectives that the Index must accurately capture and reflect.
- 2) **Varying Regional Contexts:** Digital aFWL innovations operate across global landscapes, each with distinct cultural, economic, and infrastructural realities. A one-size-fits-all approach is inadequate for such diversity.

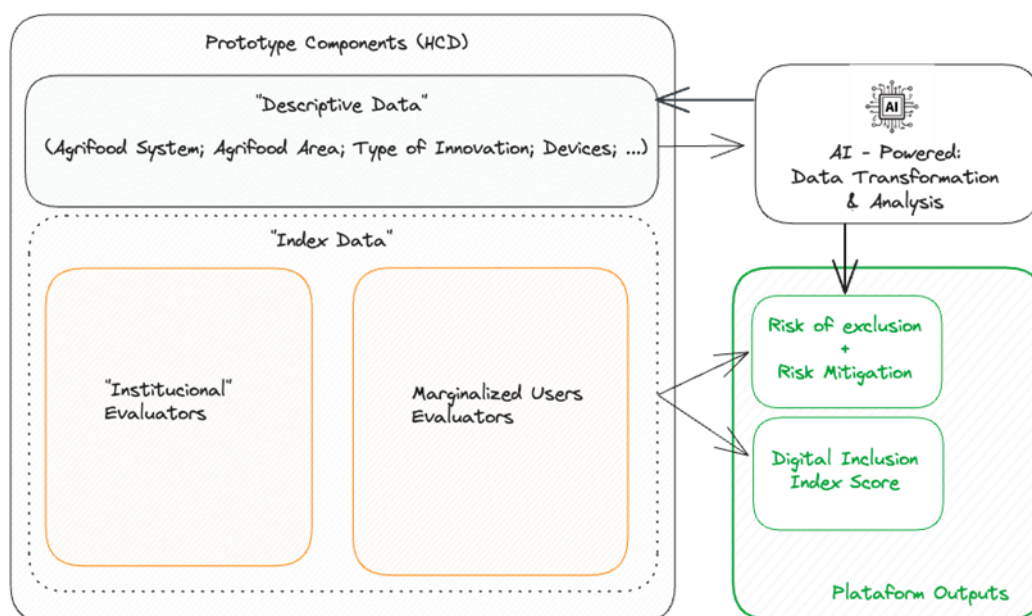


Figure 4. MDII Prototype Structure - Data processing and analysis within the MDII

- 3) **Intersectionality of Users:** The overlapping social identities of users, such as gender, age, and socioeconomic status, can create compounded experiences of digital exclusion. Addressing these layered challenges is vital for true inclusivity.

Proposed Solutions

The MDII's development strategy must be as dynamic and multifaceted as the challenges it seeks to address. Building on the guiding principles laid out earlier, the following solutions are proposed to navigate these complexities:

- 1) **Unified Indicators with Adapted Wording:** Customize the wording of the questions or evaluation criteria for each target group to make them relevant and understandable to their specific context. This allows for a standardized assessment while also acknowledging the unique position and contribution of each group.
- 2) **Tiered Questionnaires:** Possibly create tiered or branched questionnaires within the digital platform that first identify the user group and then present tailored questions based on the initial identification. This will guide users through a customized assessment journey that aligns with their role in the aFWL system.
- 3) **Intersectionality-Informed Data Collection:** Design of the data collection that includes intersectional identifiers.
- 4) **Qualitative Insights:** By creating a complementary module (more detail below) that works as an independent phone app we can employ technologies to communicate with end-users with a chatbot uses voice instructions and input (instead of text input) to gather rich, narrative data from marginalized users. The AI would analyze text and extract the defined parameters. This qualitative data would complement quantitative metrics and provide deeper insights into the lived experiences of these users, highlighting specific barriers and facilitators of digital inclusion.
- 5) **Analytical Frameworks:** Implement analytical frameworks capable of handling complex data that reflects intersectionality. These frameworks should be able to disaggregate data by multiple demographics to understand the compounding effects of various forms of exclusion.
- 6) **Localized Content and Language Translation:** By using AI, the MDII should support multiple languages and localized content to ensure relevance and ease of use for evaluators from different regions.

- 7) **Scalability and Flexibility:** Construct the MDII architecture to be scalable, so new features and iterations can be added as the need arises without overhauling the entire system.
- 8) **Indicator Alignment:** Despite customization, the MDII must ensure all evaluation frameworks align on core indicators that measure the fundamental aspects of digital inclusivity. This allows for consistent data aggregation and comparison across different user segments.
- 9) **Intersectional Data Analysis:** With the use of descriptive data, it should be possible to identify patterns of exclusion that may not be evident when considering single factors in isolation.
- 10) **Participatory Development with Stakeholder Workshops:** Workshops should be conducted with a diverse range of stakeholders to gather input on MDII design and functionality. Feedback from these workshops into the MDII development process to ensure the tool reflects the needs and experiences of all user groups.
- 11) **Dynamic Analytical Frameworks:** Through AI, such as machine learning algorithms, that can dynamically assess and predict digital inclusivity outcomes based on complex datasets.

4.7. Logical Framework

The Logical Framework outlines the operational mechanics of the MDII, detailing the processes and steps involved in its functioning.

An Overview

As a starting point, we can find an overview flow of the MDII Evaluation Flow Diagram. Figure 5 highlights the focus on the evaluation process within the context of the MDII. A core aspect is on the Evaluation Framework which should consider key use cases and be supported by foundational inputs. Depending on the level of maturity of the tool, it can either involve expert validation and marginalized users (Pre-Release) and Marginalized Users (for Post-Release innovations).

Additionally, a 'Risk Scale on Digital Exclusion' assesses the risk of digital exclusion due different factors that lead to non-adoption. The output of this process is the Index, which then loops back as feedback to allow the iteration of the Digital Innovation, as well as feedback to the 'Requesters'.

The cycle emphasizes continuous improvement, suggesting that each phase of the product cycle is currently up subject to review and refinement.

Requester Interaction

The MDII aims to provide two distinct pathways for evaluation of Digital Innovations (Figure 6). One "quick AI-powered" path in which the psychometric profiling of an AI persona is made, and which that AI-persona interacts with the digital innovation. The other path, which is optional, is a longer human-based evaluation path, allowing for a more qualitative approach, which can provide enriched insights regarding innovation.

On the other hand, Figure 7 illustrates the overview of the process flow from the initial request through data collection, evaluation, and index output, to the final consumption stage, detailing the roles of requesters, local organizations, specialists, target users, and consumers in the data provision and assessment phases.

The process begins at the "Start" node and moves to a "Request" phase, where a requester initiates the process. From the "Request," the system proceeds directly to "Data Collection," which details the type of data to be collected from the 'Requester' side, such as "Technical," "Business," or "Implementation" data.

Following data collection, the process moves to the "Evaluation" stage, where a 'request prompt' is sent to local organizations for to gather input from specialists, and target users is considered. The evaluation phase is then followed by "Index Output," which produces the results for the requester and eventually the 'Consumer'.

The process concludes at the "End" node, signifying the completion of the request cycle. Throughout the flowchart, dotted lines indicate feedback loops, suggesting that the process is iterative, and that the requester plays a central role in both initiating the process and receiving the output.

The following classifications are being considered:

- Requesters: These are innovators or entities seeking evaluation for their digital innovation products.
- Digital Innovation Product Assessment (still to be defined): Requesters input descriptive data about the Digital Innovation Product which conditions the flow of the interaction. For example, these can be:
 - a. aFWL Categorization:
 - 1) System Type: Food, Water, or Land.
 - 2) CGIAR Action Area: Systems Transformation, Resilient Agrifood Systems, Genetic Innovation
 - 3) AFWL Operational Area: Production,

Digital Inclusion Components & Flow

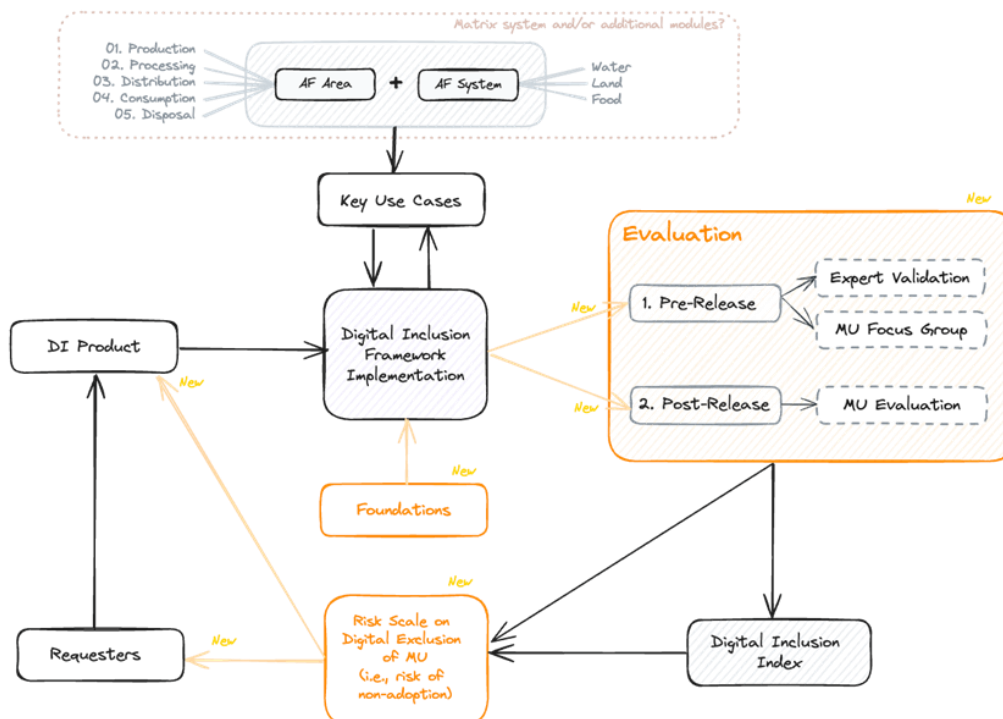


Figure 5. MDII Draft of the Evaluation Process

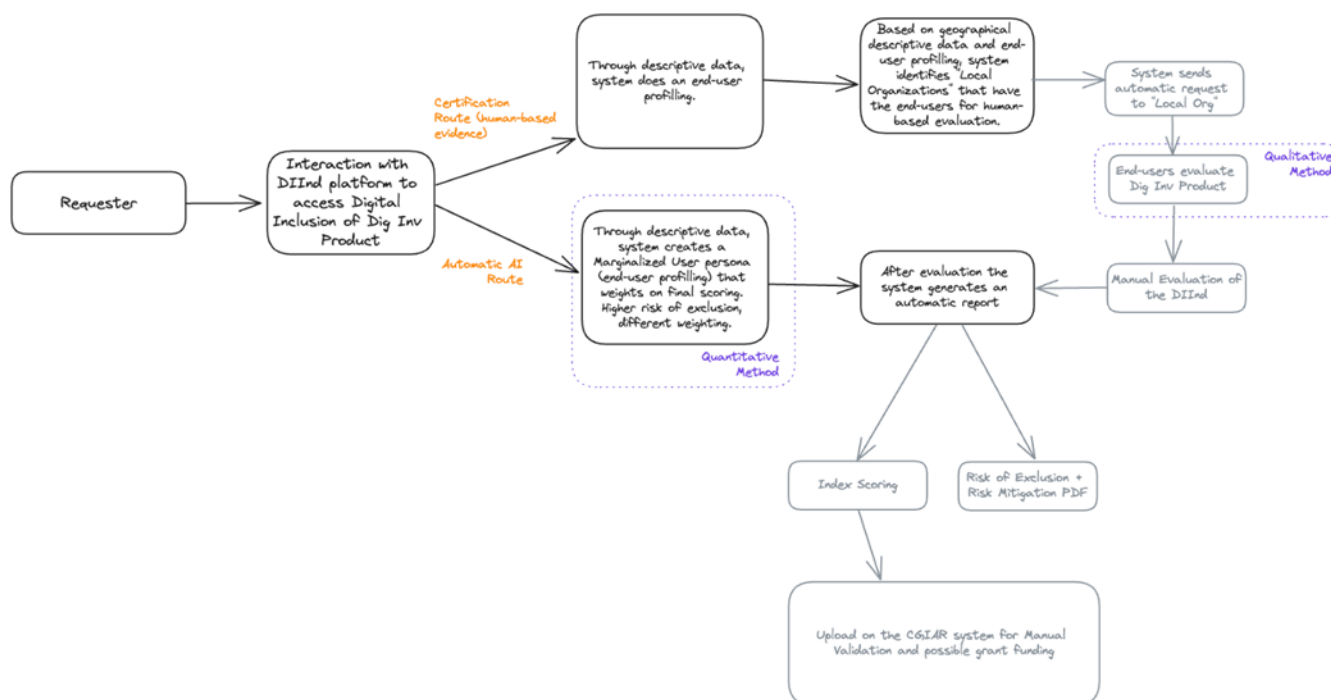


Figure 6. MDII Quantitative and Qualitative Evaluation Workflow

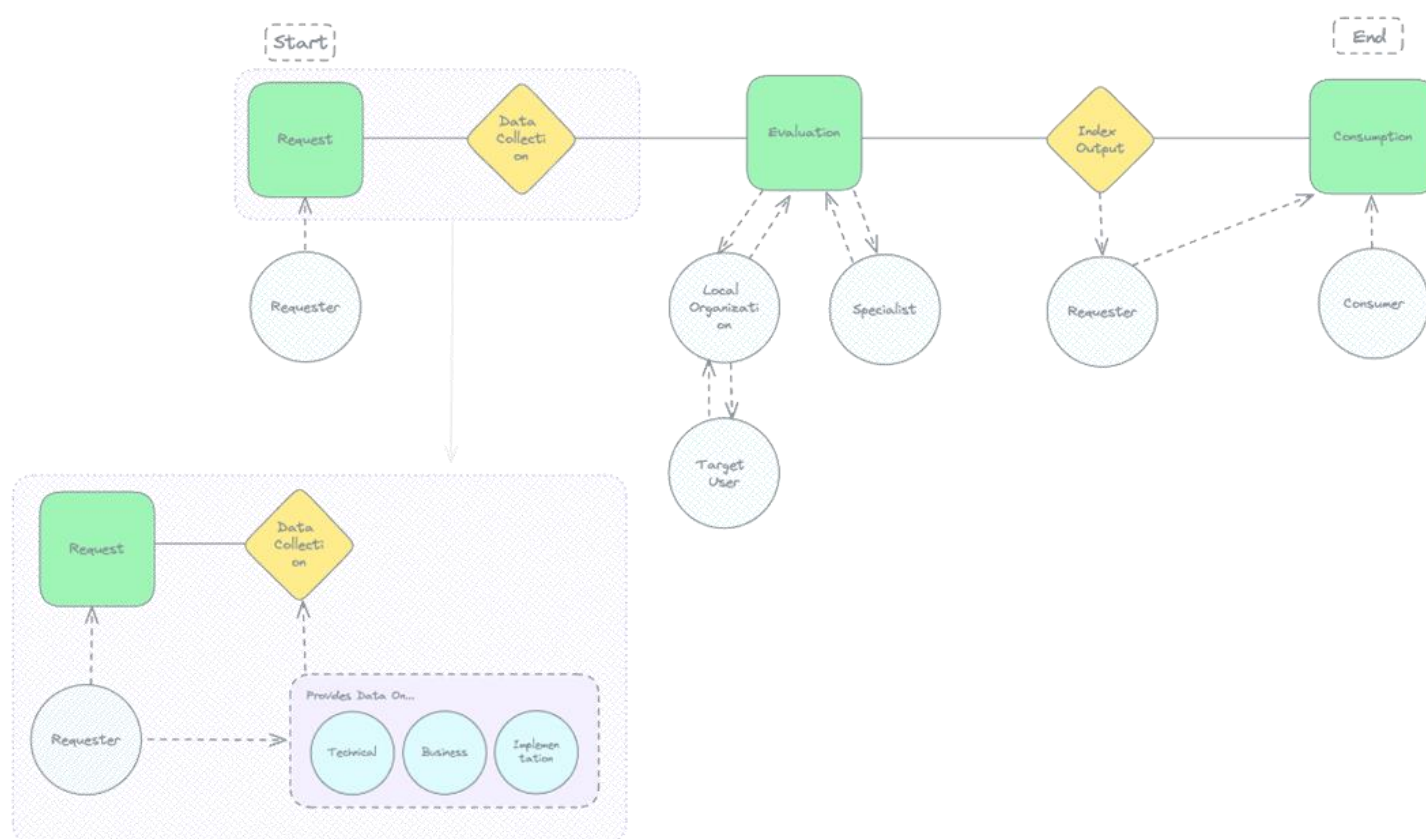


Figure 7. MDII Request Process Flowchart for Human-based Evaluation

Processing, Distribution, Consumption, or Disposal.

- 4) What is the SDG that it answers to: SDG 1 to 17.
- 5) Sub-Sector Categorization:

- Systems Transformation: Agroecology, Climate Resilience, Digital Innovation, Foresight, Fragility, Fruits and Vegetables, Gender Equality, Rethinking Food Markets, Low-Emission Food Systems, NEXUS Gains, National Policies and Strategies, Sustainable Healthy Diets
- Resilient Agrifood Systems: AgriLAC Resiliente, Aquatic Foods, Asian Mega-Deltas, Diversification in East and Southern Africa, Excellence in Agronomy, Fragility to Resilience in Central and West Asia and North Africa, Livestock and Climate, Mixed Farming Systems, Nature-Positive Solutions, One Health, Plant Health, Resilient Cities, Sustainable Animal Productivity,

Transforming Agrifood Systems in South Asia, West and Central African Food Systems Transformation

- Genetic Innovation: Accelerated Breeding, Breeding Resources, Genebanks, Genome Editing, Market Intelligence, Seed Equal
- 6) End-users Demographics: Gender, Age Group.

b. Digital Innovation Product Categorization Details:

- 1) Innovation Type: Single Innovation, Bundled Innovation, Organizational Innovation, Policy-level Innovation
- 2) Language of Innovation
- 3) Region of Implementation + Number of Regions
- 4) Connectivity Needs: Internet Use (Y/N)
- 5) Device type for Usage: smartphone, conventional phone, laptop, desktop computer.
- 6) Level of Maturity
- 7) Development Stage: Ideation, Conception, Deployed, Scaling-Up

- 8) Funding/Grants: Y/N
 - 9) Years in Market
 - 10) Scaling Readiness
- Evaluation Process: The process is twofold, with different paths for pre-release and post-release products.
 - a. Automated AI Scoring: Both pre-release and post-release products undergo an initial AI-driven scoring process.
 - b. Optional Human Interaction for Certification: If a requester opts for certification, a human-based evaluation is conducted.
 - Target Evaluation Group: For human-based evaluations, marginalized users are engaged to assess the product.
 - Outcome of Evaluation:
 - a. Multidimensional Digital Inclusiveness Index Report: A report is generated outlining the DI score.
 - b. Risk Assessment and Mitigation Document:
 - The report includes a digital exclusion risk scale.
 - Provides guidelines and strategies for risk mitigation.

The MDII evaluation can then be fed into the CGIAR system for grant funding of Digital Innovation Products (DIP).

5. Future Directions and Continuous Improvement

As we keep working on developing the MDII for the aFWL sector, it is important to recognize that this document is an evolving journey, not a destination. The landscape of digital innovation is dynamic and ever-changing, and as such, our approaches and tools must be adaptable and responsive.

Future enhancements will focus on refining our conceptual framework to better capture the nuances of digital inclusiveness, particularly for underserved communities. We will also continue to improve our tool development, integrating feedback from diverse stakeholders to ensure that our solutions are not only technologically advanced but also culturally and contextually relevant.

Emphasis will be placed on strengthening partnerships for collaborative research, enhancing data accuracy and privacy, and exploring innovative methodologies for more impactful assessments. By acknowledging the iterative nature of this

work, we remain committed to continuously advancing the MDII, ensuring it remains a robust, relevant, and reliable resource for guiding digital innovations towards a more inclusive and sustainable aFWL future.

5.1. Roadmap for 2024

Our current roadmap for 2024 (Figure 8) begins with a kick-off meeting in Q1 of 2024.

The activities for 2024 are categorized into several lanes:

- 1) Planning & Outreach: This includes effort planning, donor scouting, resource planning, and establishing partnerships for offline and online prototype development.
- 2) Prototyping: Activities such as theoretical design, index weighting, and iterations of the Digital Inclusion Index (MDII).
- 3) Testing: Includes steps like offline prototype launch, expert evaluator validation, online testing, and risk mitigation refinement.
- 4) AI-Development: This involves descriptive data analysis, development of AI-driven personas algorithms, and online weighting algorithm adjustments.
- 5) Platform Develop: Encompasses the development of the platform, including dashboard development, UX/UI design, model fine-tuning, and feedback incorporation.
- 6) Releases: This is marked by different version releases of the platform, including online releases and dashboard updates.
- 7) Closing: The final phase includes capacity building, confirming completion, and archiving documentation.

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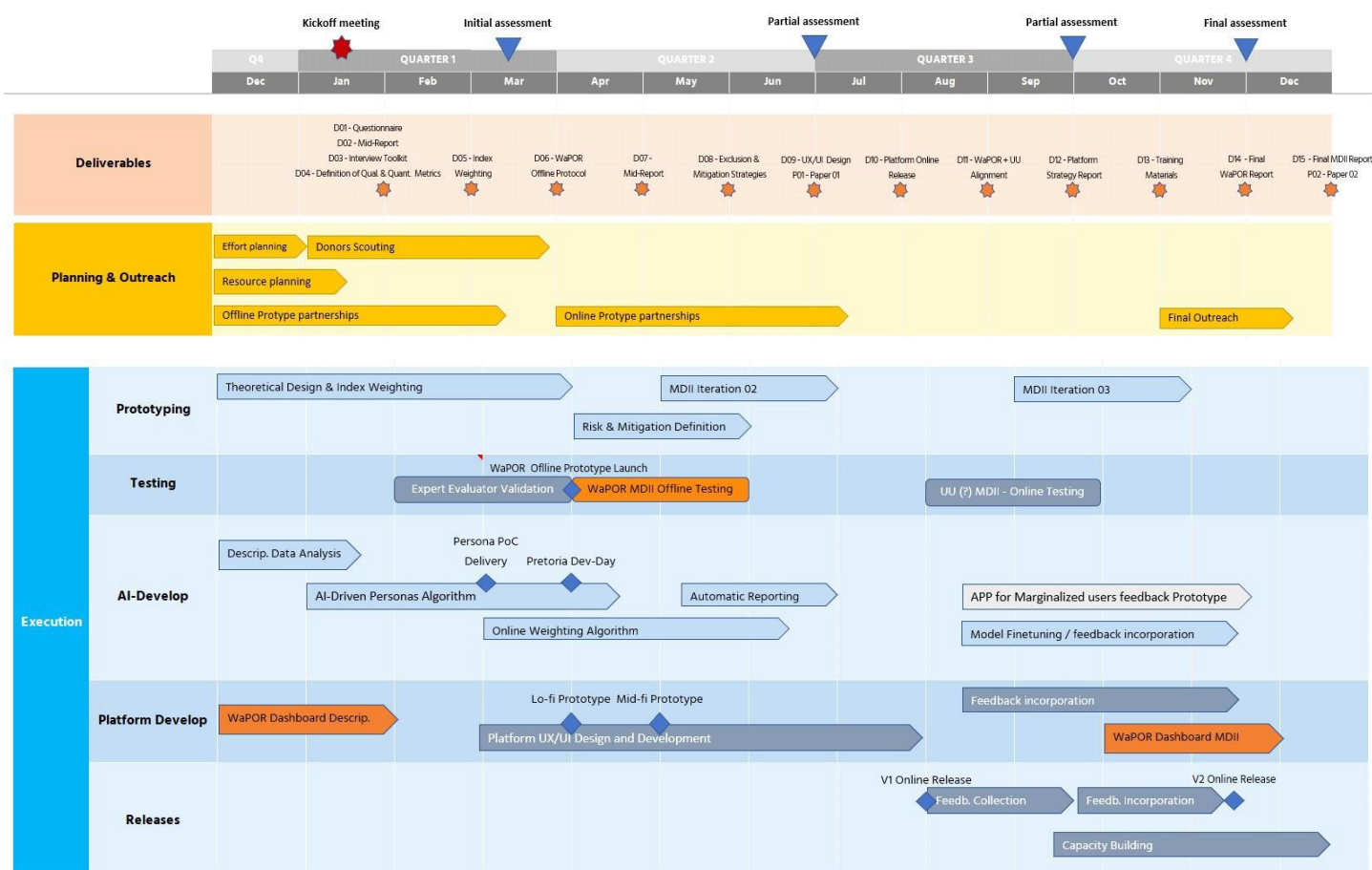


Figure 8. Aspiring roadmap for 2024

Bibliography

- Opola, F., Langan, S., Arulingam, I., Schumann, C., Singaraju, N., Joshi, D. and Ghosh, S., 2023. CAUSE: A Multidimensional Framework for a Digital Inclusivity Index For Food, Land, and Water Systems. Land, and Water Systems (November 3, 2023).
- Alkire, S., Meinzen-Dick, R., Peterman, A., Quisumbing, A., Seymour, G. and Vaz, A., 2013. The women's empowerment in agriculture index. World development, 52, pp.71-91.
- Venkatesh, V., Thong, J. Y. L., and Xu, X., 2012. Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology. MIS Quarterly, 36(1), 157-178.

Appendix A. Dimensions, Subdimensions, and Indicators

DIMENSION 1. ACCESSIBILITY

This dimension measures availability and accessibility of digital resources for marginalized groups. The accessibility dimension forms the basis of digital engagement for marginalized users, aiming to bridge the digital divide by ensuring foundational access to digital resources.

Sub-dimension 1.1. Infrastructure Accessibility

Measures the readiness and quality of digital infrastructure available to marginalized users. Infrastructure is the cornerstone of digital engagement; without reliable access, marginalized individuals remain disconnected from digital advancements, perpetuating the digital divide.

D1.1.1 Digital Availability

- Main Focus: Infrastructure Availability
- Description: This indicator evaluates the extent to which necessary digital infrastructure is available to marginalized users, ensuring that essential digital services are accessible to those who may otherwise be excluded.
- Rationale: By measuring digital availability, policymakers can identify gaps in infrastructure that hinder digital inclusion and target interventions to expand access to digital services for marginalized groups, crucial for ensuring equitable access to the benefits of digital innovation.

D1.1.2 Quality and Functionality

- Main Focus: Infrastructure Quality
- Description: Focuses on assessing the quality and functionality of digital infrastructure, which is pivotal in providing a robust user experience and promoting the widespread adoption of digital services.
- Rationale: High-quality digital infrastructure is vital for user engagement and retention, directly impacting the effectiveness of digital services in achieving inclusion and maximizing their utility for marginalized users.

D1.1.3 Infrastructure Readiness

- Main Focus: Infrastructure Readiness
- Description: Examines the preparedness of digital infrastructure for future upgrades and the availability of

maintenance support, ensuring continuous and uninterrupted digital service availability.

- Rationale: Proactive readiness planning is key to maintaining the longevity and relevance of digital services, thus supporting sustainable digital inclusion efforts and avoiding service disruptions that disproportionately affect marginalized users.

D1.1.4 Accessibility Features

- Main Focus: Accessibility for Disabled Individuals
- Description: Assesses the inclusiveness of digital infrastructure, specifically its physical and digital accessibility features for individuals with disabilities, to ensure equal access for all users.
- Rationale: Incorporating accessibility features from the outset is fundamental in building an inclusive digital ecosystem that upholds the rights and needs of individuals with disabilities, a group often overlooked in digital development.

D1.1.5 Integration with Existing Systems

- Main Focus: System Integration
- Description: Gauges the compatibility and integration potential of new digital infrastructure within existing systems to facilitate a cohesive and efficient digital environment.
- Rationale: Seamless system integration is crucial to ensure that new digital services can be adopted without disrupting current operations, thereby promoting a unified and user-friendly digital landscape for marginalized users.

D1.1.6 Cost of Access

- Main Focus: Cost Evaluation
- Description: Evaluates the financial barriers to accessing digital infrastructure, examining both the direct costs to the user and the broader economic impact on marginalized communities.
- Rationale: Affordability is a critical factor in digital inclusion; this assessment helps identify and mitigate cost-related barriers, ensuring that digital services are within reach for all segments of society.

D1.1.7 Support and Training for Infrastructure Use

- Main Focus: Support and Training Availability

- Description: Assesses the support structures and training programs available to marginalized users, aimed at facilitating the effective use of digital infrastructure.
- Rationale: Providing adequate training and support is key to empowering users with the knowledge and confidence needed to navigate digital services, thus closing the digital divide and fostering self-sufficiency.

D1.1.8 Resilience and Security

- Main Focus: Infrastructure Resilience and Security
- Description: Measures the robustness of digital infrastructure against various risks and the effectiveness of security protocols in place to protect user data and ensure service continuity.
- Rationale: Ensuring the resilience and security of digital services builds user trust and reliability, which are essential components of a sustainable digital inclusion strategy.

Sub-dimension 1.2. Economic Accessibility

Evaluates the affordability and financial support mechanisms aiding the marginalized in accessing digital resources. Economic barriers often deter marginalized individuals from accessing digital resources; addressing these barriers is vital for fostering digital engagement and inclusivity.

D1.2.1 Affordability

- Main Focus: Cost Effectiveness
- Description: This indicator scrutinizes how economically feasible it is for marginalized users to access digital innovation solutions, ensuring cost does not become a prohibitive factor in digital engagement.
- Rationale: Ensuring affordability is paramount for inclusive access to digital innovations, enabling users from all economic backgrounds to participate in the digital revolution.

D1.2.2 Cost Transparency

- Main Focus: Transparency in Costs
- Description: Evaluates the openness and clarity of cost structures related to digital innovation solutions, empowering users to make informed financial decisions.
- Rationale: Transparent cost structures prevent hidden fees and unexpected costs, fostering trust and long-term engagement with digital services among marginalized popu-

lations.

D1.2.3 Subsidy Availability

- Main Focus: Subsidy Access
- Description: Assesses the availability and accessibility of financial assistance programs that reduce the economic burden of accessing digital innovation solutions.
- Rationale: Subsidies can significantly lower the threshold for entry into the digital space for marginalized users, driving broader digital adoption and inclusion.

D1.2.4 Value for Money

- Main Focus: Value Assessment
- Description: Determines whether the benefits and services received from digital innovation solutions are commensurate with their cost, ensuring users receive fair value.
- Rationale: Demonstrating value for money encourages investment in digital services from users who might otherwise be skeptical about the utility of such innovations.

D1.2.5 Economic Incentives

- Main Focus: Economic Incentives
- Description: Explores the presence and impact of financial incentives designed to motivate the adoption and ongoing use of digital innovation solutions.
- Rationale: Economic incentives can be a powerful catalyst for digital engagement, particularly for marginalized users who may need additional motivation to invest in digital technologies.

D1.2.6 Cost of Transition

- Main Focus: Transition Cost
- Description: Examines the financial and logistical implications for users transitioning from existing systems to new digital innovation solutions.
- Rationale: Understanding and managing transition costs is vital for ensuring that the switch to new digital services does not create undue hardship or disincentivize users.

D1.2.7 Return on Investment (ROI)

- Main Focus: ROI Evaluation
- Description: Analyzes the benefits, savings, or value generation in relation to the investment made by users in dig-

ital innovation solutions.

- Rationale: Positive ROI can be a compelling argument for marginalized users to adopt digital innovations, signaling that the benefits outweigh the costs.

D1.2.8 Cost Predictability

- Main Focus: Cost Predictability
- Description: Measures the stability and predictability of costs associated with digital innovation solutions, which is critical for users' financial planning.
- Rationale: When users can anticipate and budget for costs, they are more likely to maintain and expand their engagement with digital services, contributing to sustained digital inclusion.

Sub-dimension 1.3. Informational Accessibility

Assesses the availability and clarity of digital information to marginalized users. Providing clear, accessible information is crucial for enabling informed digital engagement and empowering marginalized communities.

D1.3.1 Digital Literacy

- Main Focus: Literacy Level
- Description: This indicator assesses the degree of digital literacy that is necessary for users to effectively engage with digital innovation solutions, highlighting the need for basic digital skills and knowledge.
- Rationale: Digital literacy is the cornerstone of digital inclusion, equipping marginalized users with the skills required to navigate and benefit from digital innovations.

D1.3.2 Innovation Desirability

- Main Focus: Desirability of Innovations
- Description: Evaluates the appeal of digital innovation solutions to marginalized users, ensuring that the solutions align with their interests and needs.
- Rationale: The attractiveness of innovations is essential for their adoption; desirable solutions are more likely to be embraced and integrated into daily use by marginalized populations.

D1.3.3 Usability

- Main Focus: Ease of Use
- Description: Assesses how user-friendly and intuitive

digital innovation solutions are, ensuring they are easily navigable and accessible to users regardless of their technical proficiency.

- Rationale: Usability is a key determinant of a solution's success; user-friendly interfaces lead to higher adoption rates and a more inclusive digital ecosystem.

D1.3.4 Community Networks

- Main Focus: Community Network Access
- Description: Investigates the presence and effectiveness of community networks in promoting collaborative use and collective learning of digital innovations.
- Rationale: Community networks can significantly enhance digital inclusion by creating supportive environments for shared learning and mutual assistance in digital endeavors.

Sub-dimension 1.4 Capacity Development

Measures the opportunities for marginalized users to develop digital skills and knowledge. Capacity development is essential for equipping marginalized individuals with the skills necessary to navigate the digital realm confidently.

D1.4.1 Customized Training Programs

- Main Focus: Customized Training
- Description: Looks at the availability and effectiveness of digital training programs tailored to the specific needs of marginalized users, accommodating diverse learning styles and capabilities.
- Rationale: Customized training is essential for addressing the unique challenges faced by marginalized users, fostering a more inclusive and empowered user base.

D1.4.2 Continuous Learning Opportunities

- Main Focus: Continuous Learning
- Description: Evaluates the opportunities for ongoing education and skill development to keep pace with the rapid evolution of digital innovation solutions.
- Rationale: The digital landscape is constantly evolving; providing avenues for continuous learning is vital to ensuring that marginalized users remain competent and confident in their digital interactions.

D1.4.3 Performance Monitoring and Feedback

- Main Focus: Performance Monitoring
- Description: Assesses the mechanisms in place for monitoring the efficacy of capacity development initiatives and the utility of feedback provided in enhancing digital skills.
- Rationale: Effective performance monitoring and feedback are crucial for adapting training programs to meet the evolving needs of users, thus contributing to sustainable capacity building.

D1.4.4 Certification and Recognition

- Main Focus: Certification Availability
- Description: Evaluates the recognition and availability of certifications for digital skill development, which can bolster the digital profiles of marginalized users.
- Rationale: Recognized certifications can validate users' skills, opening up new opportunities and lending credibility to their digital competencies.

DIMENSION 2. BENEFICIAL IMPACT

This dimension evaluates the positive impacts of digital innovations on marginalized users. This dimension is significant as it measures the real-world benefits and positive impacts of digital solutions in improving the quality of life and addressing the unique challenges faced by marginalized users.

Sub-dimension 2.1. Solution Effectiveness

Assesses the performance and relevance of digital solutions in addressing the needs of marginalized users. Effective solutions are vital for realizing the potential benefits of digital engagement, enhancing the quality of life for marginalized individuals.

D2.1.1 Solution Performance

- Main Focus: Core Effectiveness of Digital Solutions
- Description: Assessing how well the digital innovation solutions perform in addressing the targeted issues or needs.
- Rationale: Effective solutions are fundamental for addressing the issues faced by marginalized users and enhancing digital inclusion.

D2.1.2 Functionality

- Main Focus: Reliability and Functional Capabilities
- Description: Evaluating the functionality of the digital innovation solutions in terms of features, capabilities, and reliability.
- Rationale: Reliable and functional solutions can significantly improve the digital experience for marginalized users.

D2.1.3 Outcome Measurement

- Main Focus: Outcome and Impact Measurement
- Description: Assessing the mechanisms in place for measuring the outcomes and impact of the digital innovation solutions.
- Rationale: Measuring outcomes is crucial for evaluating the real impact of digital solutions on marginalized users.

D2.1.4 Problem-Solution Fit

- Main Focus: Alignment between Solutions and Targeted Problems
- Description: Evaluating the alignment between the digital innovation solutions and the specific problems or needs they aim to address.
- Rationale: Ensuring a good fit between problems and solutions is vital for effective digital inclusion.

D2.1.5 Adaptive Capability

- Main Focus: Adaptability to Changing Conditions and Feedback
- Description: Assessing the ability of the digital innovation solutions to adapt to changing conditions or feedback.
- Rationale: Adaptive solutions are essential for ensuring long-term digital inclusion amidst changing conditions and user feedback.

Sub-dimension 2.2. Problem Relevance

Evaluates how well digital solutions align with the actual problems faced by marginalized users. Ensuring solutions address relevant problems is crucial for meaningful digital engagement and beneficial impact on marginalized communities.

D2.2.1 Problem Identification Accuracy

- Main Focus: Precision in Problem Identification

- Description: Assessing the precision and clarity in identifying the problems or needs that the digital innovation solutions aim to address.
- Rationale: Enhances relevance and effectiveness of digital solutions by accurately identifying problems.

D2.2.2 Relevance to Target Group

- Main Focus: Direct Relevance to marginalized users
- Description: Evaluating the direct relevance of the identified problems or needs to the targeted actors or groups.
- Rationale: Ensures that digital solutions address relevant problems, enhancing digital inclusion.

D2.2.3 Severity Assessment

- Main Focus: Assessment of Problem Severity
- Description: Assessing the severity or urgency of the identified problems or needs.
- Rationale: Aligns digital solutions with urgent needs, promoting timely digital inclusion efforts.

D2.2.4 Engagement in Problem Definition

- Main Focus: Stakeholder Engagement in Problem Definition
- Description: Evaluating the extent of stakeholder engagement specifically in defining the problems or needs.
- Rationale: Enhances digital inclusion by involving stakeholders in problem definition, ensuring relevance.

D2.2.5 Local Contextual Understanding

- Main Focus: Understanding of Local Context
- Description: Assessing the depth of understanding and consideration of local context and conditions in identifying the problems or needs.
- Rationale: Promotes digital inclusion by aligning solutions with local context and conditions.

Sub-dimension 2.3 Digital Divide

Assesses the extent to which digital technology contributes to narrowing the gender and digital gaps within society by empowering marginalized users. Addressing gender and digital gaps is crucial for fostering a more inclusive digital ecosystem. This sub-dimension enables the assessment of digital technologies in bridging these gaps and promoting equality

and inclusivity among marginalized users.

D2.3.1 Gender Gap Reduction

- Main Focus: Equitable Inclusion and Empowerment
- Description: Measures the effectiveness of digital technology in reducing gender disparities in digital access and utilization.
- Rationale: Gender gap reduction is fundamental to promoting digital inclusivity and ensuring that both male and female marginalized users have equal opportunities to benefit from digital innovations.

D2.3.2 Digital Gap Reduction

- Main Focus: Bridging Digital Divides
- Description: Evaluates the role of digital technology in narrowing the digital divide among different societal groups, especially the marginalized users.
- Rationale: Reducing the digital gap is essential for bringing marginalized users to the digital forefront, enabling them to leverage digital resources for better societal participation and economic advancement.

Sub-dimension 2.4 Sustainability

Measures the long-term viability and maintainability of digital solutions for marginalized users. Sustainable solutions ensure continuous benefits and adaptability to evolving needs, promoting lasting digital engagement.

D2.4.1 Long-term Viability

- Main Focus: Long-term Solution Viability
- Description: Assessing the potential of the digital innovation solutions to remain functional and relevant over the long term.
- Rationale: Ensures digital solutions remain relevant and functional for marginalized groups over time, supporting sustained digital inclusion.

D2.4.2 Maintainability

- Main Focus: Ease of Solution Maintenance
- Description: Evaluating the ease of maintaining and updating the digital innovation solutions to ensure ongoing effectiveness.
- Rationale: Facilitates the ongoing effectiveness and usability of digital solutions for marginalized groups, pro-

moting continuous digital inclusion.

D2.4.3 Scalability

- Main Focus: Solution Scalability
- Description: Assessing the ability of the digital innovation solutions to scale to meet increasing demand or expand to new user groups.
- Rationale: Enables digital solutions to expand and meet the growing needs of marginalized groups, enhancing the scope of digital inclusion.

D2.4.4 Resource Efficiency

- Main Focus: Efficiency in Resource Utilization
- Description: Evaluating the efficiency in resource utilization (e.g., energy, data, human resources) in delivering the digital innovation solutions.
- Rationale: Promotes efficient resource utilization which can lower costs and improve accessibility of digital solutions for marginalized groups.

D2.4.5 Economic Sustainability

- Main Focus: Economic Sustainability
- Description: Assessing the economic sustainability of the digital innovation solutions including cost-effectiveness and revenue models.
- Rationale: Plays a pivotal role in promoting digital inclusion by ensuring digital solutions are affordable, accessible, and continue to provide value to marginalized groups over the long term.

Sub-dimension 2.5 Social Value Creation

Assesses the social benefits and value generated by digital engagement for marginalized users. Creating social value is essential for fostering a more inclusive digital ecosystem and enhancing communal well-being.

D2.5.1 Community Impact

- Main Focus: Positive Community Outcomes
- Description: Evaluating the positive impact of the digital innovation solutions on the communities they target.
- Rationale: Contributes to digital inclusion by fostering positive outcomes and community development in marginalized groups.

D2.5.2 Individual Empowerment

- Main Focus: Empowerment of Individuals
- Description: Assessing how the digital innovation solutions empower individuals in the targeted groups.
- Rationale: Promotes digital inclusion by empowering individuals within marginalized groups, enabling them to actively participate in the digital space.

D2.5.3 Social Equity

- Main Focus: Reduction of Social Inequities
- Description: Evaluating the contribution of the digital innovation solutions towards reducing social inequities.
- Rationale: Enhances digital inclusion by addressing social inequities, promoting fair access to digital resources and opportunities for marginalized groups.

D2.5.4 Cultural Sensitivity

- Main Focus: Cultural Sensitivity and Inclusion
- Description: Assessing the extent to which the digital innovation solutions are culturally sensitive and inclusive.
- Rationale: Promotes digital inclusion by respecting and reflecting cultural diversity, ensuring that digital solutions are accessible and relevant to all, regardless of cultural background.

D2.5.5 Social Capital Building

- Main Focus: Building Social Capital
- Description: Evaluating the ability of the digital innovation solutions to build social capital by fostering relationships, trust, and collaboration within communities.
- Rationale: Supports digital inclusion by fostering social capital which can lead to a more cohesive and supportive environment for marginalized groups to engage with digital solutions.

DIMENSION 3. USAGE EFFICACY

This dimension assesses the ease and effectiveness of digital tool and service usage among marginalized users. The Usage Efficacy dimension is important to evaluate how effectively digital solutions meet the unique needs and circumstances of

marginalized users, promoting ease of use and beneficial outcomes, thereby facilitating digital inclusion.

Sub-dimension 3.1 Digital Literacy

Measures the extent to which marginalized users can effectively use digital tools and resources. Digital literacy is foundational for enabling marginalized individuals to engage competently and safely in the digital space.

D3.1.1 Skill Acquisition

- Main Focus: Acquisition of Digital Skills
- Description: Assessing the ability of individuals to acquire necessary digital skills through the provided solutions.
- Rationale: Fundamental to digital inclusion as it enables individuals in marginalized groups to acquire the skills necessary for digital engagement.

D3.1.2 Skill Application

- Main Focus: Application of Digital Skills
- Description: Evaluating the opportunities and ease of applying acquired digital skills in practical situations.
- Rationale: Supports digital inclusion by allowing individuals to apply acquired digital skills, enhancing their digital engagement and experience.

D3.1.3 Learning Support

- Main Focus: Support for Continuous Learning
- Description: Assessing the support available for continuous learning and skill development.
- Rationale: Promotes digital inclusion by providing support for continuous learning, helping individuals to keep up with digital advancements.

D3.1.4 Relevance of Skills

- Main Focus: Relevance of Imparted Skills
- Description: Evaluating the relevance of the digital skills being imparted in relation to the needs of the individuals and communities.
- Rationale: Enhances digital inclusion by ensuring the digital skills imparted align with the actual needs of individuals and communities.

D3.1.5 Assessment and Feedback

- Main Focus: Skill Assessment and Feedback
- Description: Assessing the mechanisms in place for evaluating skill acquisition and providing feedback for improvement.
- Rationale: Supports digital inclusion by providing individuals with feedback on their digital skill acquisition, aiding in continuous

Sub-dimension 3.2. Innovation Desirability

Evaluates the appeal and perceived value of digital innovations to marginalized users. Ensuring innovations are desirable promotes adoption and sustained engagement, thus fostering inclusivity.

D3.2.1 Appeal and Engagement

- Main Focus: User Engagement and Appeal
- Description: Assessing the appeal and the ability of the digital innovation to engage the targeted users.
- Rationale: Enhances digital inclusion by creating a positive and engaging user experience, encouraging continued use and interaction among marginalized groups.

D3.2.2 Perceived Value

- Main Focus: Perceived Value and Benefits
- Description: Evaluating the perceived value and benefits of the digital innovation solutions to the targeted users.
- Rationale: Supports digital inclusion by ensuring that digital solutions provide clear and valued benefits, motivating usage among targeted users.

D3.2.3 Ease of Adoption

- Main Focus: Ease of Adoption
- Description: Assessing the ease with which users can adopt and start using the digital innovation solutions.
- Rationale: Facilitates digital inclusion by reducing barriers to adoption, making digital solutions more accessible to individuals regardless of their digital skill levels.

D3.2.4 User Satisfaction

- Main Focus: User Satisfaction
- Description: Evaluating the level of satisfaction users have with the digital innovation solutions.

- Rationale: Promotes digital inclusion by ensuring user satisfaction, which can lead to continued use and positive word-of-mouth among marginalized groups.

D3.2.5 Innovation Relevance

- Main Focus: Relevance of Innovation
- Description: Assessing how relevant the innovation is to the users' needs and circumstances.
- Rationale: Promotes digital inclusion by ensuring that digital solutions are relevant and tailored to the needs and circumstances of marginalized groups.

Sub-dimension 3.3. Usability

Assesses the ease of use and error management of digital solutions for marginalized users. Usable solutions lower the entry barrier for digital engagement, making technology more accessible to marginalized individuals.

D3.3.1 Ease of Use

- Main Focus: User Interaction Ease
- Description: Assessing the ease with which users can interact with the digital innovation solutions.
- Rationale: Enhances digital inclusion by ensuring that digital solutions are user-friendly and easy to interact with, reducing barriers for marginalized groups.

D3.3.2 Error Management

- Main Focus: Error Recovery and Clarity
- Description: Evaluating the ease with which users can recover from errors and the clarity of error messages.
- Rationale: Supports digital inclusion by aiding users in error recovery, providing a positive user experience, especially for individuals who may be less digitally literate.

D3.3.3 Performance Efficiency

- Main Focus: Efficiency and Responsiveness
- Description: Assessing the efficiency and responsiveness of the digital innovation solutions.
- Rationale: Facilitates digital inclusion by ensuring digital solutions operate efficiently, providing a satisfactory user experience that encourages continued use.

D3.3.4 Accessibility Features

- Main Focus: Accessibility Features
- Description: Evaluating the presence and effectiveness of accessibility features for diverse user needs.
- Rationale: Promotes digital inclusion by addressing diverse accessibility needs, making digital solutions usable for individuals with varying abilities and needs.

Sub-dimension 3.4. Community Networks

Examines the formation and engagement within digital community networks among marginalized users. Community networks amplify the benefits of digital engagement by fostering social support and collaborative learning.

D3.4.1 Network Formation

- Main Focus: Community Network Formation
- Description: Assessing the extent to which digital innovation solutions facilitate the formation of community networks.
- Rationale: Supports digital inclusion by fostering community networks, enabling collective action, and promoting social capital among marginalized groups.

D3.4.2 Network Engagement

- Main Focus: Community Network Engagement
- Description: Evaluating the level of engagement within the community networks formed around digital innovation solutions.
- Rationale: Enhances digital inclusion by promoting active engagement within community networks, fostering a sense of belonging and support.

D3.4.3 Resource Sharing

- Main Focus: Resource Sharing and Collective Problem-Solving
- Description: Assessing the facilitation of resource sharing and collective problem-solving within community networks.
- Rationale: Facilitates digital inclusion by promoting resource sharing and collective problem-solving, enhancing the collective efficacy of marginalized groups.

D3.4.4 Community Resilience

- Main Focus: Community Resilience

- Description: Evaluating how community networks contribute to resilience in facing challenges and leveraging digital innovation solutions.
- Rationale: Promotes digital inclusion by enhancing community resilience, enabling marginalized groups to better leverage digital solutions in facing challenges.

D3.4.5 Community-driven Innovation

- Main Focus: Community-driven Innovation and Learning
- Description: Assessing the extent to which community networks foster community-driven innovation and learning.
- Rationale: Supports digital inclusion by fostering community-driven innovation and learning, promoting a culture of continuous improvement and adaptation.

DIMENSION 4. ETHICAL AND RESPONSIBLE INNOVATION

This dimension ensures ethical practices and responsible innovation in digital initiatives. The ethical and responsible innovation enables greater reassurance that digital innovations are ethically sound and responsibly managed, promoting justice, fairness and responsible innovation for marginalized users.

Sub-dimension 4.1. Data Governance

Measures the privacy, accessibility, and accuracy of data practices concerning marginalized users. Ethical data governance is crucial for building trust and ensuring the respectful treatment of marginalized individuals' data.

D4.1.1 Data Privacy

- Main Focus: Data Protection
- Description: Assessing the protection of user data and privacy by the digital innovation solutions.
- Rationale: Enhances digital inclusion by establishing trust through the protection of user data and privacy, crucial for marginalized groups who may be vulnerable.

D4.1.2 Data Accessibility

- Main Focus: Data Access and Control
- Description: Evaluating the ease with which users can access, manage, and control their data within the digital

innovation solutions.

- Rationale: Supports digital inclusion by empowering users through access and control over their data, fostering a sense of ownership and trust.

D4.1.3 Data Accuracy

- Main Focus: Data Accuracy and Quality
- Description: Assessing the accuracy and quality of data managed by the digital innovation solutions.
- Rationale: Facilitates digital inclusion by ensuring accurate and quality data, which is fundamental for effective decision-making and problem-solving.

D4.1.4 Data Portability

- Main Focus: Data Portability
- Description: Evaluating the ease with which data can be transferred between different systems or platforms.
- Rationale: Promotes digital inclusion by ensuring data portability, allowing users to leverage digital innovation solutions across different contexts and platforms.

D4.1.5 Transparency of Data Practices

- Main Focus: Transparency in Data Practices
- Description: Assessing the transparency in data handling, processing, and sharing practices.
- Rationale: Supports digital inclusion by fostering transparency in data practices, enhancing trust and informed participation among marginalized groups.

Sub-dimension 4.2. Ethical Compliance

Assesses adherence to ethical standards and oversight in digital innovations targeting marginalized users. Upholding ethical standards ensures responsible innovation that prioritizes the well-being and rights of marginalized individuals.

D4.2.1 Ethical Standards Adherence

- Main Focus: Ethical Standards
- Description: Assessing the adherence to recognized ethical standards by the digital innovation solutions.
- Rationale: Supports digital inclusion by adhering to ethical standards, ensuring fair and respectful treatment of all users, especially marginalized groups.

D4.2.2 Ethical Oversight

- Main Focus: Ethical Oversight
- Description: Evaluating the existence and effectiveness of ethical oversight mechanisms within the digital innovation solutions.
- Rationale: Enhances digital inclusion by providing ethical oversight, promoting accountability and trustworthiness in digital innovation solutions.

D4.2.3 Informed Consent

- Main Focus: Informed Consent
- Description: Assessing the processes for obtaining informed consent from users, ensuring they are aware of and agree to how their data will be used.
- Rationale: Facilitates digital inclusion by ensuring users are well-informed and agree to the terms of data usage, promoting transparency and trust.

D4.2.4 Impact Assessment

- Main Focus: Ethical Impact Assessment
- Description: Evaluating the assessment of potential ethical impacts and risks associated with the digital innovation solutions.
- Rationale: Promotes digital inclusion by assessing and mitigating ethical risks, ensuring the responsible development and deployment of digital innovation solutions.

D4.2.5 Ethical Training and Awareness

- Main Focus: Ethical Awareness
- Description: Assessing the training and awareness initiatives to ensure stakeholders are informed about ethical considerations.
- Rationale: Supports digital inclusion by fostering ethical awareness among stakeholders, promoting a culture of ethical compliance in digital innovation.

Sub-dimension 4.3. Epistemic Justice

Evaluates the inclusion and accessibility of knowledge in digital platforms for marginalized users. Epistemic justice counters knowledge marginalization, promoting a more inclusive and equitable digital discourse.

D4.3.1 Knowledge Inclusion

- Main Focus: Inclusion of Diverse Knowledge

- Description: Assessing the inclusion of diverse knowledge, perspectives, and experiences in the development and deployment of digital innovation solutions.
- Rationale: Supports digital inclusion by valuing and incorporating diverse knowledge, fostering a more comprehensive and inclusive understanding.

D4.3.2 Recognition Justice

- Main Focus: Recognition of Marginalized Knowledge
- Description: Evaluating the recognition and validation of the knowledge and contributions of marginalized groups.
- Rationale: Enhances digital inclusion by acknowledging and valuing the contributions of marginalized groups, promoting a sense of dignity and respect.

D4.3.3 Communicative Equality

- Main Focus: Equal Communication Opportunities
- Description: Assessing the opportunities for marginalized groups to communicate and share their knowledge and experiences.
- Rationale: Facilitates digital inclusion by promoting communicative equality, ensuring marginalized groups have a voice in digital spaces.

D4.3.4 Knowledge Accessibility

- Main Focus: Accessibility of Knowledge Resources
- Description: Evaluating the accessibility of knowledge resources and information necessary for effective use of digital innovation solutions.
- Rationale: Promotes digital inclusion by ensuring accessible knowledge resources, enabling effective use and engagement with digital innovation solutions.

D4.3.5 Epistemic Empowerment

- Main Focus: Epistemic Empowerment
- Description: Assessing the empowerment of marginalized groups to generate, share, and apply knowledge.
- Rationale: Supports digital inclusion by empowering marginalized groups epistemically, fostering self-efficacy and community-driven innovation.

Sub-dimension 4.4. Reflexive Innovation

Assesses the extent to which digital innovations engage in

continuous reflection and feedback integration from marginalized users. Reflexive innovation fosters a culture of continuous improvement, ensuring digital solutions evolve to meet the needs of marginalized communities.

D4.4.1 Continuous Reflection

- Main Focus: Ongoing Reflection
- Description: Assessing the ongoing reflection and assessment of the digital innovation solutions' impact, practices, and processes.
- Rationale: Supports digital inclusion by promoting ongoing reflection on the impact and practices, fostering adaptability and responsiveness to the needs of marginalized groups.

D4.4.2 Feedback Integration

- Main Focus: Feedback Integration
- Description: Assessing the mechanisms for collecting, analyzing, and integrating feedback from all stakeholders, especially marginalized groups.
- Rationale: Facilitates digital inclusion by valuing and integrating feedback, ensuring that the voices and experiences of marginalized groups are considered in innovation processes.

D4.4.3 Transparency and Communication

- Main Focus: Transparency and Communication
- Description: Assessing the transparency in reflection processes and the communication of findings and adaptations to stakeholders.
- Rationale: Supports digital inclusion by promoting transparency and communication, building trust and understanding among all stakeholders, especially marginalized groups.

DIMENSION 5. CO-CREATION AND GOVERNANCE

This dimension encourages collaborative innovation and inclusive governance in digital initiatives. Co-creation and governance are important as high-level assessment for inclusive and collaborative design, ensuring that digital solutions are co-created with marginalized users, governed inclusively, and are

reflective of the diverse needs of these users.

Sub-dimension 5.1. Intellectual Property Assurance

Evaluates the awareness and protection mechanisms of intellectual property in digital innovations for marginalized users. Assuring intellectual property rights encourages innovation and protects the interests of marginalized creators.

D5.1.1 IP Awareness

- Main Focus: Awareness and Understanding
- Description: Assessing the level of awareness and understanding regarding intellectual property rights among the stakeholders, especially marginalized users.
- Rationale: Promotes digital inclusion by ensuring that marginalized users are aware of and understand their intellectual property rights, fostering a sense of ownership and protection.

D5.1.2 IP Protection Mechanisms

- Main Focus: Protection and Accessibility
- Description: Evaluating the effectiveness and accessibility of mechanisms in place to protect the intellectual property rights of marginalized users.
- Rationale: Supports digital inclusion by providing robust and accessible mechanisms to protect the intellectual property rights of marginalized users, fostering trust and engagement.

D5.1.3 IP Inclusivity

- Main Focus: Inclusivity
- Description: Assessing the inclusivity of intellectual property policies and practices in recognizing and protecting the rights of marginalized users.
- Rationale: Enhances digital inclusion by promoting inclusive intellectual property policies and practices that recognize and protect the rights and contributions of marginalized users.

D5.1.4 IP Dispute Resolution

- Main Focus: Fairness and Accessibility
- Description: Evaluating the fairness, accessibility, and effectiveness of dispute resolution processes concerning intellectual property issues for marginalized users.
- Rationale: Facilitates digital inclusion by ensuring fair,

accessible, and effective dispute resolution processes for marginalized users, promoting justice and resolution.

D5.1.5 IP Education and Capacity Building

- Main Focus: Education and Capacity Building
- Description: Assessing the availability and effectiveness of educational resources and capacity building initiatives regarding intellectual property for marginalized users.
- Rationale: Promotes digital inclusion by educating and building the capacity of marginalized users regarding intellectual property, empowering them to protect and leverage their intellectual contributions.

Sub-dimension 5.2. Collaborative Innovation

Measures the accessibility and diversity in collaborative innovation initiatives involving marginalized users. Collaborative innovation fosters a culture of inclusivity, drawing on a wider range of perspectives to create more equitable digital solutions.

D5.2.1 Collaboration Accessibility

- Main Focus: Accessibility to Collaboration
- Description: Examining the extent to which platforms and mechanisms for collaborative innovation are accessible to marginalized users.
- Rationale: Enhancing digital inclusion by facilitating marginalized users' access to collaborative innovation platforms, allowing them to contribute and benefit from collective efforts.

D5.2.2 Diversity and Representation

- Main Focus: Diversity and Representation
- Description: Evaluating the level of diversity and inclusivity in collaborative innovation initiatives, ensuring marginalized users are well-represented.
- Rationale: Promotes digital inclusion by ensuring a diverse and inclusive environment in collaborative innovation initiatives, enabling marginalized users to have a voice and contribute effectively.

D5.2.3 Collaborative Support

- Main Focus: Support for Collaboration
- Description: Assessing the support structures available to marginalized users to engage in collaborative innovation

effectively.

- Rationale: Fosters digital inclusion by providing necessary support to marginalized users, enabling them to engage in collaborative innovation effectively and confidently.

D5.2.4 Co-creation Opportunities

- Main Focus: Co-creation and Decision-making
- Description: Evaluating the opportunities provided to marginalized users to co-create solutions and contribute to decision-making processes.
- Rationale: Enhances digital inclusion by providing co-creation opportunities and involving marginalized users in decision-making processes, empowering them to contribute meaningfully.

D5.2.5 Outcome Sharing

- Main Focus: Fairness in Outcome Sharing
- Description: Assessing the fairness and transparency in the sharing of outcomes, benefits, and recognition from collaborative innovation.
- Rationale: Supports digital inclusion by ensuring fair and transparent sharing of outcomes, benefits, and recognition, valuing the contributions of marginalized users in collaborative innovation.

Sub-dimension 5.3. Grassroots Innovation Inclusion

Assesses the engagement and utilization of grassroots innovation in digital platforms for marginalized users. Including grassroots innovations ensures that digital platforms are relevant and beneficial to marginalized communities.

D5.3.1 Grassroots Engagement

- Main Focus: Engagement in Innovation
- Description: Assessing the engagement and active involvement of marginalized users in grassroots innovation initiatives.
- Rationale: Enhancing digital inclusion by promoting active engagement and participation of marginalized users in grassroots innovation initiatives.

D5.3.2 Community-led Solutions

- Main Focus: Community-driven Solutions
- Description: Evaluating the extent to which solutions are

driven by the needs and inputs of the marginalized users and local communities.

- Rationale: Promotes digital inclusion by ensuring that solutions are rooted in the needs and inputs of marginalized users, reflecting local knowledge and experiences.

D5.3.3 Local Knowledge Utilization

- Main Focus: Utilization of Local Knowledge
- Description: Assessing the utilization and integration of local knowledge and expertise in innovation processes.
- Rationale: Supports digital inclusion by valuing and integrating the local knowledge and expertise of marginalized users in innovation processes.

D5.3.4 Capacity Building

- Main Focus: Capacity Building for Innovation
- Description: Evaluating the efforts towards building the capacities of marginalized users to engage in and contribute to grassroots innovation initiatives.
- Rationale: Fosters digital inclusion by building the capacities of marginalized users, enabling them to actively participate in and contribute to grassroots innovation initiatives.

D5.3.5 Impact Assessment

- Main Focus: Assessment of Innovation Impact
- Description: Assessing the impact and benefits of grassroots innovation initiatives on marginalized users and local communities.
- Rationale: Enhances digital inclusion by evaluating and ensuring that grassroots innovation initiatives deliver tangible benefits to marginalized users and local communities.

Sub-dimension 5.4. Inclusive Governance

Examines the representation, transparency, and accountability in digital governance involving marginalized users. Inclusive governance ensures that the needs and rights of marginalized individuals are considered and protected in digital decision-making processes.

D5.4.1 Inclusive Decision-making

- Main Focus: Decision-making Inclusion
- Description: Evaluating the involvement of marginalized

users in decision-making processes.

- Rationale: Enhancing digital inclusion by promoting the active involvement of marginalized users in decision-making processes.

D5.4.2 Representation

- Main Focus: Representation in Governance
- Description: Assessing the representation of marginalized users in governance structures.
- Rationale: Promotes digital inclusion by ensuring representation of marginalized users in governance structures.

D5.4.3 Transparency

- Main Focus: Governance Transparency
- Description: Evaluating the transparency of governance processes and decision-making.
- Rationale: Supports digital inclusion by promoting transparency and accessibility of governance processes to marginalized users.

D5.4.4 Accountability

- Main Focus: Governance Accountability
- Description: Assessing the accountability mechanisms in place to ensure the rights and interests of marginalized users are protected.
- Rationale: Enhances digital inclusion by establishing accountability mechanisms to protect the rights and interests of marginalized users.

DIMENSION 6. ADOPTION FACILITATION

This dimension supports the seamless adoption and sustained use of digital solutions. The adoption facilitation function explores subjective dimensions of use adoption. This dimension can help assess factors like behavioral intention and facilitating conditions, focused on ensuring that digital solutions are not only accessible but also adoptable and usable in a sustained manner by marginalized users, fostering a supportive ecosystem for digital engagement.

Sub-dimension 6.1 Training Accessibility

Measures the availability and relevance of training resources for marginalized users. Accessible training is key for equip-

ping marginalized individuals with the necessary skills to adopt and use digital solutions effectively.

D6.1.1 Training Availability

- Main Focus: Availability of Training
- Description: Assessing the availability of training resources for marginalized users to learn and adapt to the digital innovation.
- Rationale: Promotes digital inclusion by ensuring that marginalized users have access to necessary training resources.

D6.1.2 Training Relevance

- Main Focus: Relevance of Training
- Description: Evaluating the relevance and appropriateness of training materials for the needs and context of marginalized users.
- Rationale: Enhances digital inclusion by ensuring that training is relevant and appropriate for marginalized users.

D6.1.3 Training Affordability

- Main Focus: Affordability of Training
- Description: Assessing the affordability of training programs and resources for marginalized users.
- Rationale: Supports digital inclusion by making training affordable and accessible for marginalized users.

D6.1.4 Training Support

- Main Focus: Support during Training
- Description: Evaluating the level of support provided to marginalized users during the training process.
- Rationale: Fosters digital inclusion by providing necessary support to marginalized users during training.

D6.1.5 Training Assessment and Feedback

- Main Focus: Training Assessment and Feedback
- Description: Assessing the mechanisms for evaluating training effectiveness and collecting feedback from marginalized users for continuous improvement.
- Rationale: Encourages digital inclusion by evaluating training effectiveness and incorporating feedback from

marginalized users for improvement.

Sub-dimension 6.2. Supportive Ecosystem

Assesses the community engagement and resource availability supporting marginalized users in digital engagement. A supportive ecosystem fosters an enabling environment for marginalized individuals to engage with digital solutions confidently.

D6.2.1 Community Engagement

- Main Focus: Engagement with Marginalized Users
- Description: Evaluating the extent to which the ecosystem engages with and supports marginalized users.
- Rationale: Enhances digital inclusion by fostering engagement and support within the community.

D6.2.2 Resource Availability

- Main Focus: Availability of Resources
- Description: Assessing the availability of necessary resources and support services for marginalized users.
- Rationale: Promotes digital inclusion by ensuring necessary resources are available in the ecosystem.

D6.2.3 Inclusive Policies

- Main Focus: Inclusivity of Policies
- Description: Evaluating the inclusivity of policies within the ecosystem towards marginalized users.
- Rationale: Supports digital inclusion by promoting inclusivity through ecosystem policies.

D6.2.4 Feedback Mechanisms

- Main Focus: Feedback from Marginalized Users
- Description: Assessing the mechanisms for collecting and addressing feedback from marginalized users.
- Rationale: Fosters digital inclusion by valuing and acting upon feedback from marginalized users.

D6.2.5 Collaboration Platforms

- Main Focus: Collaboration Platforms
- Description: Evaluating the presence and effectiveness of platforms for collaboration among marginalized users and other stakeholders.

- Rationale: Encourages digital inclusion by facilitating collaborative interactions within the ecosystem.

Sub-dimension 6.3. Behavioral Intention

Evaluates the willingness and attitude of marginalized users towards using digital solutions. Understanding and fostering positive behavioral intention is crucial for promoting digital engagement among marginalized individuals.

D6.3.1 Intention to Use

- Main Focus: User Willingness
- Description: Evaluating the level of interest and willingness of marginalized users to use the digital innovation.
- Rationale: Understanding and enhancing the behavioral intention can significantly contribute to digital inclusion.

D6.3.2 Perceived Usefulness

- Main Focus: User Perceived Benefits
- Description: Assessing the extent to which marginalized users believe that using the digital innovation will be beneficial.
- Rationale: Digital inclusion is fostered when users perceive the innovation as beneficial.

D6.3.3 Perceived Ease of Use

- Main Focus: User Perceived Ease of Use
- Description: Evaluating how easy marginalized users perceive the digital innovation is to use.
- Rationale: Enhances digital inclusion by ensuring the digital innovation is perceived as easy to use.

D6.3.4 Attitude towards Use

- Main Focus: User Attitude
- Description: Assessing the attitude of marginalized users towards using the digital innovation.
- Rationale: Positive attitudes towards use can significantly contribute to digital inclusion.

D6.3.5 Behavioral Control

- Main Focus: User Control
- Description: Evaluating the extent to which marginalized users feel in control while using the digital innovation.

- Rationale: Enhancing the sense of control can foster digital inclusion by making users feel empowered.

Sub-dimension 6.4. Facilitating Conditions

Evaluates the adequacy of support structures enabling marginalized users to use digital innovations effectively. Adequate facilitating conditions are crucial for ensuring marginalized individuals can effectively utilize and benefit from digital solutions.

D6.4.1 Technical Infrastructure

- Main Focus: Infrastructure Adequacy
- Description: Evaluating the availability and adequacy of technical infrastructure that enables the use of the digital innovation by marginalized users.
- Rationale: Adequate technical infrastructure is crucial for digital inclusion as it facilitates the use of digital innovation.

D6.4.2 Support Availability

- Main Focus: Support Services
- Description: Assessing the availability of support services that assist marginalized users in utilizing the digital innovation.
- Rationale: Availability of support services can significantly improve digital inclusion by assisting marginalized users in using the digital innovation.

D6.4.3 Documentation and Guidance

- Main Focus: Documentation Clarity
- Description: Evaluating the availability and clarity of documentation and guidance materials that help marginalized users in understanding and using the digital innovation.
- Rationale: Clear documentation and guidance materials facilitate digital inclusion by empowering marginalized users to utilize the digital innovation effectively.

D6.4.4 Community Support

- Main Focus: Community Assistance
- Description: Assessing the presence of a supportive community that assists marginalized users in overcoming challenges faced while using the digital innovation.
- Rationale: A supportive community can foster digital

inclusion by providing a network of assistance and support for marginalized users.

DIMENSION 7. RISKS AND HARMS

Evaluation of the potential negative impacts that digital innovation products might have on users, especially marginalized groups within agrifood systems. This dimension is pivotal to fostering a holistic understanding of digital innovation within agri-food systems. This dimension ensures that digital solutions are not only efficacious but also equitable and safe for diverse user groups. It emphasizes the critical need for digital innovations to be socially responsible, avoiding and addressing potential adverse effects on vulnerable populations.

Sub-dimension 7.1. Gender-Related Risks

Evaluates the potential negative impacts of digital innovations on gender equality within agrifood systems. Addressing gender-related risks is vital to ensure that digital innovations do not exacerbate existing gender disparities but rather contribute to gender equality, which is essential for a fair and inclusive agrifood ecosystem.

D7.1.1 Gender disparity

- Main Focus: Access & Usage Patterns
- Description: Assess differences in access and usage of the digital product between genders, including usage rates and ease of access.
- Rationale: To identify and address any gender-based disparities in accessing and using the digital product.

D7.1.2 Inclusivity in Content and Design

- Main Focus: Content & Design Inclusivity
- Description: Evaluate how the product represents and caters to diverse genders in its content, language, imagery, and user interface.
- Rationale: Ensures that the product does not perpetuate gender stereotypes and is welcoming to all genders.

D7.1.3 Gender Equality and Empowerment

- Main Focus: Gender Equality Impact
- Description: Measure the product's impact on gender equality and empowerment, checking for reinforcement of stereotypes or empowerment features.

- Rationale: To promote gender equality and assess if the product contributes positively or negatively to this goal.

Sub-dimension 7.2. Job Displacement

Assesses the risk of job losses or shifts in job roles within agrifood systems due to the implementation of digital technologies. Understanding job displacement risks helps in identifying the trade-offs between technological advancements and employment opportunities, which is crucial for developing strategies to mitigate adverse effects on livelihoods within the agrifood sector.

D7.2.1 Automation Impact on Rural Employment

- Main Focus: Rural Employment
- Description: Assess the impact of the digital product on job roles in rural areas, focusing on potential job reductions due to automation.
- Rationale: To identify if the product significantly displaces jobs in rural communities, especially those vulnerable to automation.

D7.2.2 Skill Adaptation for Marginalized Communities

- Main Focus: Skill Requirements
- Description: Evaluate if the product creates a skill gap for marginalized communities, requiring new training or skills.
- Rationale: Ensures the product's implementation is inclusive and doesn't create barriers for marginalized communities due to skill requirements.

D7.2.3 Support for Traditional Practices

- Main Focus: Preservation of Traditions
- Description: Review if the product supports or disrupts traditional agricultural practices, focusing on job relevance.
- Rationale: To ensure that the product aligns with and supports existing traditional practices rather than displacing them.

Sub-dimension 7.3. Technological Dependency

Examines the extent of dependency on digital technologies and the vulnerabilities it introduces within agrifood systems. Addressing technological dependency is crucial to ensure the resilience and sustainability of agrifood systems, especially in scenarios where digital solutions may fail or become unavailable.

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D7.3.1 Dependency on Continuous Tech Support

- Main Focus: Support Necessity
- Description: Evaluate the extent to which the digital product requires ongoing technical support, which may not be readily available in marginalized communities.
- Rationale: To ensure the product can be sustained in environments with limited technical support.

D7.3.2 Adaptability to Local Technological Infrastructure

- Main Focus: Infrastructure Compatibility
- Description: Assess how well the digital product adapts to the existing technological infrastructure in marginalized areas.
- Rationale: Ensures the product is suitable for the technological environment of marginalized communities.

D7.3.3 Impact on Traditional Knowledge and Practices

- Main Focus: Preservation of Knowledge
- Description: Review the extent to which the product influences or replaces traditional knowledge and practices with technology.
- Rationale: To evaluate if the product respects and integrates traditional knowledge instead of causing over-reliance on new technology.

D7.3.4 Risk of Obsolescence for Marginalized Users

- Main Focus: Obsolescence
- Description: Assess the risk of the product becoming quickly outdated in marginalized areas, considering their slower technology update cycles.
- Rationale: To ensure the product remains relevant and useful for a longer period in environments with slower technology turnover.

Sub-dimension 7.4. Technological Bias

Evaluates the presence and impact of biases in digital technologies, including AI algorithms, that may affect decision-making and practices within agrifood systems. Identifying and mitigating technological biases is essential to ensure fair and ethical use of digital technologies, promoting inclusivity and justice in agrifood systems.

D7.4.1 Algorithmic Fairness

- Main Focus: Fair Decision-Making
- Description: Evaluate if the algorithms used in the product are unbiased and make fair decisions across diverse user groups.
- Rationale: To prevent discrimination and ensure equitable outcomes for all users.

D7.4.2 Cultural and Contextual Relevance

- Main Focus: Cultural Appropriateness
- Description: Assess how well the product respects and aligns with the cultural and contextual realities of marginalized users.
- Rationale: To ensure the product does not impose or reinforce cultural biases.

D7.4.3 Accessibility for Diverse Abilities

- Main Focus: Inclusivity in Design
- Description: Check if the product is designed to be accessible to users with a range of abilities, including disabilities.
- Rationale: Ensures that the product is usable by people with diverse physical and cognitive abilities.

D7.4.4 Data Representation Equity

- Main Focus: Equitable Data Usage
- Description: Review how well the product's data representation includes and fairly represents marginalized groups.
- Rationale: To prevent bias in data that could lead to exclusion or misrepresentation.

D7.4.5 Bias Monitoring and Adaptation

- Main Focus: Continuous Improvement
- Description: Assess the product's ability to monitor and adapt to potential biases that may arise over time.
- Rationale: To ensure ongoing vigilance against biases as the product evolves and user demographics change.