



Digital needs & gaps assessment for farmer producer organizations in Maharashtra, India

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Abstract The Digital Innovation in Agriculture workshop was centred on bolstering digital capabilities within Farmer Producer Organizations (FPOs) and nurturing collaborations with Disruptive Agricultural Technology start-ups. The event, held in Pune, convened FPOs, digital innovators, and experts to explore digital needs, promote digital innovation awareness, and foster FPO-innovator partnerships. Interactive sessions emphasized the adoption of key technologies, continuous stakeholder interaction, and consortium-based approaches, aiming to demonstrate digitalization's value and transparent collaboration frameworks. The workshop also recognized the constraints in perspective coverage and discussion depth, offering a foundation for future initiatives to scale effective models and cultivate a dynamic ecosystem for collaboration in the agricultural digital landscape.

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Digital needs & gaps assessment for farmer producer organizations in Maharashtra, India

1. Executive summary

This workshop on Digital Innovation in Agriculture, organized by the CGIAR Initiative on Digital Innovation in collaboration with the Agricultural Technology Management Agency (ATMA), Government of Maharashtra, SMART Project, and the Gokhale Institute of Politics and Economics (GIPE), Pune, aimed to address the digital needs of Farmer Producer Organizations (FPOs) and promote awareness of digital innovations in agriculture. This two-day event brought together FPOs, digital innovators, and various stakeholders from Maharashtra, seeking to overcome pricing and business model challenges that hinder collaboration between FPOs and Disruptive Agricultural Technology (DATs) start-ups.

The workshop's significance lies in its socio-technical framework, recognizing the relationship between technological advancements and their social implications. Through knowledge sharing, best practices, and expert insights, the workshop aimed to pave the way for a successful partnership between Digital Innovators (DIs) and FPOs, ultimately benefiting the agricultural landscape.

Pune was chosen as the workshop location due to ongoing discussions between FPOs and Digital Innovators facilitated by the SMART Agtech Integration Facility 2022. The workshop's objectives included identifying digital needs, increasing awareness of digital innovations, and fostering collaboration between FPOs and digital innovators.

The selection process involved a diverse group of FPOs and Digital AgTech Companies (DATs) from the SMART network and beyond, ensuring a mix of established and emerging entities. External experts from SMART, the Reliance Foundation, and the M.S. Swaminathan Research Foundation (MSSRF) enriched the discussions with best practices and case studies.

The workshop's design prioritized interactivity and engagement among participants, utilizing formats such as marketplace interactions, breakout groups, and facilitated discussions. Key recommendations from the workshop included recognizing fundamental technologies, continuous interactions, consortium-based approaches, demonstrating the value of digitalization, defining key performance indicators, and establishing transparent collaboration mechanisms. Future opportunities include scaling successful models across various FPOs and regions. However, it is crucial to acknowledge that the workshop's diverse representation might only cover some perspectives, and the limited duration may have restricted the depth of discussion. By addressing the digital needs of FPOs and fostering collaboration with digital innovators, the workshop sets the stage for creating a robust ecosystem for a collaboration platform for information exchange, displaying best practices, strategic partnerships, and collaborations to amplify the positive impact of digital solutions.

2. Background

FPOs and FPCs

The emergence of Farmer Producer Organisations (FPOs) or Farmer Producer Companies (FPCs) in India can be traced back to the amendment of the Companies Act in 2002. The amendment aimed to instil fundamental business principles within farming communities, foster integration between industry and agriculture, and to boost rural development [1]. The National Bank for Agriculture and Rural Development (NABARD) defines FPO as a legal

entity formed by primary producers such as farmers, milk producers, fishermen, rural artisans, etc. FPOs may take various forms such as a trust, society, cooperative or company. The FPOs registered under the Indian Companies Act are called Farmer Producer Companies (FPCs). These entities may take various forms or other models that ensure profit and benefit sharing among their members [2]. FPCs are seen as a hybrid between cooperatives and private organisations, possessing essential features of private enterprises while fostering cooperation like cooperatives [3].

The core idea behind establishing an FPO is to address the challenges faced by individual small producers who are limited by substantial volumes for both input and output. By coming together under an FPO, small producers and farmers can achieve better income opportunities, and the aggregation of their resources ensures economies of scale by eliminating numerous intermediaries [2]. This aggregation enables them enhanced bargaining power in purchasing inputs and selling outputs, ultimately leading to higher profits than individual producers. The fundamental aim is to liberate producers from various constraints such as financial limitations, inadequate infrastructure, limited access to healthcare, transportation, educational facilities, and exploitation by mediators [4]. In essence, the establishment of FPO/FPC is driven by the vision of empowering individual farmers and small producers by pooling resources and leveraging collective strength. Through this unified approach, they can break free from the constraints that hinder their progress and pave the way towards a more prosperous and self-reliant future.

The growth of Farmer Producer Companies (FPCs) in India has witnessed a significant upswing over the recent years. Between the financial year (FY) 2002-03 to FY 2018-19, there were 7431 registered FPCs [5]. However, there has been a remarkable surge in registrations during FY 2019-20 and FY 2020-21, leading to the current count of 15948 FPCs [5]. The positive impact of the FPOs on their members is very evident and well documented. For example, a recent study has highlighted how FPO members in Guntur district, Andhra

Pradesh revealed that FPO membership significantly enhances the economic well-being of smallholder dry chili farmers by increasing prices and income, reducing poverty incidence, and improving their standard of living [6].

Among the 15,948 registered FPCs, 43.2% of these entities have a paid-up capital exceeding INR 1 Lac (~USD 1210), and 30.2% of FPCs boast a paid-up capital surpassing INR 5 Lacs (~USD 6030). However, it is noteworthy that only a mere 2.2% of FPCs have a paid-up capital of 25Lac (~USD 30,000) or more, signifying a smaller fraction of FPCs with higher financial resources [5]. Several studies indicate that the average membership size of FPCs in India hovers around 500 members [7, 8]. The following figure represents the number of producer companies registered in India over the years [5].

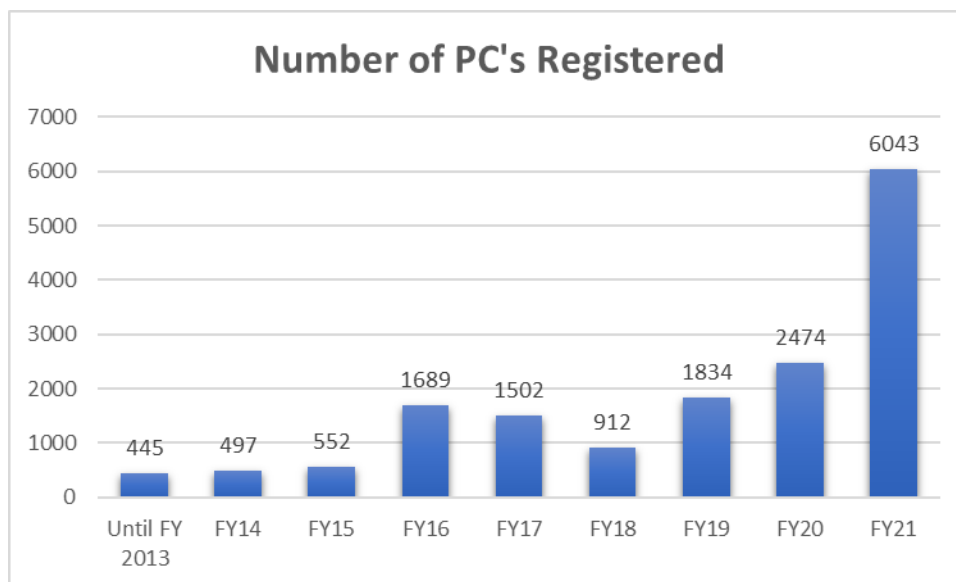


Figure 1: Number of FPOS in India

PACS: This recent rapid expansion shows the increasing interest and recognition of the potential benefits of FPCs to smallholder primary producers. The rise in their numbers reflects a growing acknowledgement of the potential of collective action in ensuring the economic well-being of farmers and fostering sustainable agricultural practices. Alongside FPCs, other forms of collectivisation are also prevalent among smallholder farmers, such as

Cooperative Societies and the Primary Agricultural Credit Society (PACS). The cooperative movement in India is notably significant, with the country housing 0.85 million (850,000) out of the global count of 3 million cooperative societies. These cooperative societies in India collectively cater to around 130 million members [9]. As of FY 2021-22, the number of functional PACS has reached 67251, further emphasising these cooperative entities' substantial role in empowering and supporting farmers [10]. These collective entities offer a platform for smallholder farmers to pool resources, share knowledge, and collectively overcome challenges.

FPCs in Maharashtra: Maharashtra is widely recognised as a trailblazer in India's smallholder aggregation movement, with 5,216 registered FPOs out of the country's total 15,948 FPCs [5]. Maharashtra is also known for hosting the first successful sugar cooperative in Asia, the Pravara Sahakari Sakhar Karkhana Ltd in the Ahmednagar district [11]. The state also houses a significant proportion of PACS and cooperative societies, accounting for 31% and 25% of those registered in India [12]. This leadership position can be attributed to favourable agricultural conditions, robust institutional support, and a history of successful farmer aggregation initiatives.

FPO promotion in Maharashtra is actively supported by state patronage and international donors, including the World Bank-backed Maharashtra Agricultural Competitiveness Project (MACP) taken up from 2010-2018. This project has trained over 406 FPOs in various areas, leading to a remarkable 45% increase in farm profits for all crops, a 7% reduction in input costs, and a 22% rise in price realisation through aggregated smallholder marketing. The state government is pivotal in promoting FPOs and operating farmers' markets. With over 31 farmers' markets already operational, the Maharashtra State Agriculture Marketing Board (MSAMB) plans to establish more than 100 such markets in the future [13].

FPO digitalization: Digitizing Farmer Producer Organizations (FPOs) in India is crucial for transforming the agricultural landscape and empowering farmers with advanced

technologies. Integrating digital solutions can revolutionize how FPOs operate, increasing efficiency and profitability. The Government of India has taken several initiatives¹ to promote digitalisation in the agricultural landscape, like India Digital Ecosystem of Agriculture (2021-2025), National e-Governance Plan in Agriculture (2010), National Agriculture Market (2016) and AGMARKNET (2000), among others [14].

Government of Maharashtra efforts: The Government of Maharashtra has significantly promoted agricultural digitalisation. One such initiative is the SMART Agtech Integration Facility 2022 that is funded by the Korea-World Bank partnership. The initiative aimed to transform rural Maharashtra through Disruptive Agricultural Technologies (DATs). The SMART facility encouraged the customization and adoption of appropriate solutions by facilitating interactions between technology providers and Community-Based Organizations (CBOs) [15].

SMART initiative: The initiatives undertaken by the SMART facility have undoubtedly provided a foundation for leveraging technology to benefit FPOs and farmers. However, the journey towards digital transformation is not without its hurdles. Several challenges hinder the effective implementation and adoption of digital solutions in the agricultural sector. One of the foremost challenges is limited digital literacy among farmers and FPO representatives. Many are not familiar with the intricacies of digital technologies and may find it challenging to embrace new solutions.

The implementation of digital solutions and collaboration between FPOs and Digital Innovators (DIs) faces several challenges that require thoughtful consideration and strategic planning. These challenges can hinder the effective implementation and adoption of digital solutions. Scalability is a critical factor, as the solutions implemented must be

¹ <https://pib.gov.in/PressReleaselframePage.aspx?PRID=1847506>

scalable to accommodate FPOs of varying sizes and capacities. Many FPOs and farmers lack comprehension of the potential benefits of digital technologies, while DIs might find it unfamiliar to collaborate with FPOs and navigate the agricultural landscape. Data privacy concerns are a legitimate worry for FPOs, and ensuring data security and privacy is of utmost importance to gain the trust and participation of FPOs in digital initiatives. Creating a supportive ecosystem that nurtures innovation and promotes technology adoption within the agricultural sector is another challenge that requires careful consideration.

The absence of well-defined roadmaps, frameworks, and guidance further complicates the digital integration process. There is a scarcity of successful case studies that showcase the positive impact of digital solutions in the agricultural sector. Moreover, limited financial and human resources in FPOs hinder their capacity to invest heavily in technology, making customization and localization of solutions challenging [16].

To overcome these challenges, a solution driven, context and people centric, responsible and inclusive approach to digital innovation must be adopted. Solutions need to be tailored to the unique needs of FPOs and farmers, empowering them to leverage technology effectively. Collaboration must be inclusive and foster a sense of trust and transparency between DIs and FPOs.

3. Workshop design

With the aim of identifying the digital needs of FPOs and increasing awareness about digital innovations in agriculture, the CGIAR Initiative on Digital Innovation collaborated with the Agricultural Technology Management Agency (ATMA), Government of Maharashtra and the Gokhale Institute of Politics and Economics (GIPE), Pune, to organize a two-day workshop. This collaborative event brought together FPOs, digital innovators and various stakeholders from Maharashtra.

Recognizing the challenges associated with pricing structures and business models that hinder effective collaboration, SMART aims to address these issues. By bringing together key stakeholders, this workshop sought to foster meaningful discussions, explore innovative approaches, and create an enabling environment for successful digital implementation. The workshop's significance lies in the opportunities created to overcome collaboration barriers between DIs and FPOs within a socio-technical framework which recognizes the intricate relationship between technological advancements and their social implications. This approach helps to bridge the gap between technological advancements and their impact on societies, particularly in the agricultural sector. Through knowledge sharing, best practices, and expert insights within this socio-technical framework, the workshop endeavors to pave the way for a harmonious and impactful partnership between DIs and FPOs, ultimately contributing to the advancement of India's agricultural landscape.

The origins of this workshop trace back to a previous workshop conducted by the Digital Innovation Initiative in November 2022 in Bhubaneswar, Odisha, India., themed "Digital Innovation and Transformation in Food-Water-Land Systems in India". This prior event highlighted the gaps between digital innovators and FPOs where it became evident that for the digitalization for agriculture and to achieve digitization of agriculture, FPOs are critical stakeholders, which lacked need of these digital solutions but lacked awareness and understanding.

In response to this identified gap, the current workshop was conducted, as a collaborative effort to bring together all relevant stakeholders. Pune was selected as the workshop's location due to ongoing discussions between FPOs and Digital Innovators, facilitated by the SMART Agtech Integration Facility 2022.

4. Workshop objectives

- **Identify digital needs:** Facilitate discussions and interactions between FPO representatives and digital innovators to identify the specific digital needs and challenges faced by FPOs in their operations. This will enable digital innovators to gain a deeper understanding of the requirements and develop tailored solutions to address them.
- **Increase awareness of digital innovations:** Create a platform for digital innovators to showcase their technologies, products, and services to FPOs.
- **Foster collaboration:** Encourage collaboration and partnerships between FPOs and digital innovators to facilitate the implementation of digital solutions. By fostering meaningful connections and relationships during the workshop, we envision the creation of a supportive ecosystem that nurtures innovation and promotes technology adoption within the agricultural sector.

5. Selection of the participants

To ensure a comprehensive representation of perspectives and expertise, we carefully selected Digital Agricultural Technologists (DATs) for the workshop based on the significant number of Letters of Interest and their coverage of various themes. Our selection process encompassed a diverse group Incorporating a mix of both established and emerging FPOs. This group included FPOs associated with SMART and leading FPOs from beyond the SMART network, who already possessed some experience with digitalization.

In addition to the DAT and FPOs, we recognized the importance of external perspectives and domain expertise. As a result, we invited experts from SMART, the Reliance Foundation, and the M.S. Swaminathan Research Foundation (MSSRF) to participate in the workshop.

Their insights drawn from best practices, lessons learned, and successful case studies added a crucial layer of understanding and guidance to the discussions.

There were also endeavours to include participants who had previously attended the Digital Innovation Initiative workshop in Bhubaneswar, ensuring their involvement in this workshop as well.

The complete list of participants is contained in [Annex 2](#)

6. Workshop Methodology

The design of the workshop sessions was carefully crafted to ensure interactivity, engagement, and meaningful collaboration among the participants. To achieve this, a variety of interactive formats, such as marketplace interactions, breakout groups, and facilitated discussions, were incorporated into the workshop's agenda.

On the first day of the workshop, the sessions were structured to provide FPOs and Digital Innovators with a platform to openly discuss and share their digital needs and challenges. The focus of the day was to build a collective understanding of the issues faced by FPOs and the potential areas where digitalization could have a transformative impact.

On the second day, the workshop shifted its focus towards identifying concrete solutions to address the digital needs identified on the previous day. Participants were divided into breakout groups to facilitate in-depth discussions and brainstorming. The structured approach enabled them to delve into specific themes and devise actionable strategies for successful integration and implementation of digital solutions.

To ensure continuous feedback and capture valuable insights throughout the workshop, a WhatsApp group mechanism was put in place. This allowed participants to share their reflections, queries, and suggestions after each session, ensuring that their voices were heard, and their perspectives taken into account in shaping the subsequent discussions.

Overall, the session design aimed to create an inclusive, dynamic, and participatory environment, where FPOs, Digital Innovators, and other stakeholders actively engaged in collaborative discussions and knowledge exchange.

7. Session summaries

7.1. Session 1: Inaugural session

The inaugural session commenced with a warm welcome address by Dasharath Tambhale, Director, ATMA, Government of Maharashtra who emphasised the significance of Farmer Producer Organizations (FPOs) in improving market access, reducing production costs, and achieving economies of scale. He acknowledged the existing gap between the perspectives of digital innovators and FPOs and highlighted the need to bridge this divide. Tambhale also shed light on the past initiatives of the government, notably the SMART Agtech Integration Facility 2022, which shortlisted 60 digital innovators to offer services to FPOs. However, certain challenges persist, such as determining these services' pricing and ensuring awareness and technology identification.



Image 1: Inaugural Session

Satish Nagaraji talked about the gap between digital innovators and FPOs and how the workshop aims to bring them together through discussions. Jawoo Koo and Andrea Gardeazabal shared an overview of the Digital Innovation Initiative. Hema Yadav, Director, VAMNICOM and Ajit Ranade, Vice Chancellor, Gokhale Institute of Politics and Economics (GIPE) delivered inaugural messages emphasizing the significance of digital innovation in agriculture and its potential impact on the agricultural landscape.

7.2. Session 2: Current status and needs of digitalization in FPOs

Chair: Andrea Gardeazabal, Co-lead: CGIAR Initiative on Digital Innovation

Session Objective: The primary goal of this session was to explore digitalization within FPOs and gain a comprehensive understanding of its current status. The focus was on identifying the specific requirements and advantages of adopting digital solutions across various aspects of FPO operations. Additionally, the session objective was to pinpoint the essential factors for successful digital implementation in FPOs and to learn the best practices from FPOs that have already successfully integrated digital integration.

7.2.1. Status of digitalization for FPOs in Maharashtra

Speaker: Dasharath Tambhale, Director, ATMA, Government of Maharashtra

- As an overview, the session covered SMART Project's initiatives, including Complimentary Innovation Investments and the SMART AgTech Integration Facility 2022, promoting technology-driven solutions for inclusive agricultural value chains and collaboration between CBOs and DAT enterprises. The SMART Project aims to create inclusive and competitive agricultural value chains, connecting Community-Based Organizations (CBOs) with stakeholders such as buyers, new markets, banks, and warehouses through technology-based solutions. The project will contribute 60% of the project costs as grant and 40% of the costs will be the contribution of the CBO.

- The SMART AgTech Integration Facility 2022, launched under Complimentary Innovation Investments (CII) supports CBOs in adopting innovative technology solutions through additional grants. The SMART AgTech facility facilitates collaboration between DAT solution providers and CBOs to address critical gaps in agricultural value chains.
- A study was conducted to understand the technology needs of 66 CBOs, comprising 59 FPCs and 7 PACS. The study's objectives included identifying challenges from pre/post-production and crosscutting perspectives, understanding potential technology solutions and obstacles in their adoption, assessing the landscape of AgTech firms in the state, and proposing relevant themes for evaluating DAT firms.
- Based on the assessment of documents submitted by DAT enterprises, 61 enterprises meeting the eligibility criteria moved to the Jury Evaluation round. After primary interviews by the WB-KWPF team, a final list of 61 enterprises was shortlisted. Following a boot camp with the enterprises, 130 CBOs under SMART signed 360 Letters of Intent (LOIs), showcasing their commitment to embracing digital solutions.



Disruptive Agriculture Technology (DAT) thematic solutions

SMART
INTEGRATION FACILITY
2022



Digitization solutions for
FPCs and PACS



Precision Agriculture and
Automation services



Urban food systems and
logistics solutions



Market linkage and
traceability solutions



Value chain actor
aggregator platforms



Access to Financial
Services

Image 2: Dasharath Tambhale and a Snip from the session 'Status of digitalization for FPOs in Maharashtra

7.2.2. Good practices of digitalization

Speaker: Ashutosh Deshpande, Reliance Foundation

- The session highlighted how digital tools can play a crucial role in various stages of agriculture. For example: before sowing, digital tools can be used to purchase agricultural inputs, conduct soil testing, and prepare the land. During cultivation, the possibilities extend to using IoT devices, satellite-based crop monitoring, and machine learning for tasks like sowing, transplanting, crop nutrition, and plant protection. Post-harvest management, quality control, marketing, processing, branding, packaging, and retail can also benefit from digital solutions.
- A crucial factor in making digital innovations work effectively is tailoring them to fit the specific situation. When it comes to basic services, it's important to have the ability to trade and make transactions. For solutions that boost productivity, willingness and ability to pay is necessary, and for solutions that add value, change in farmer's behavior is essential.

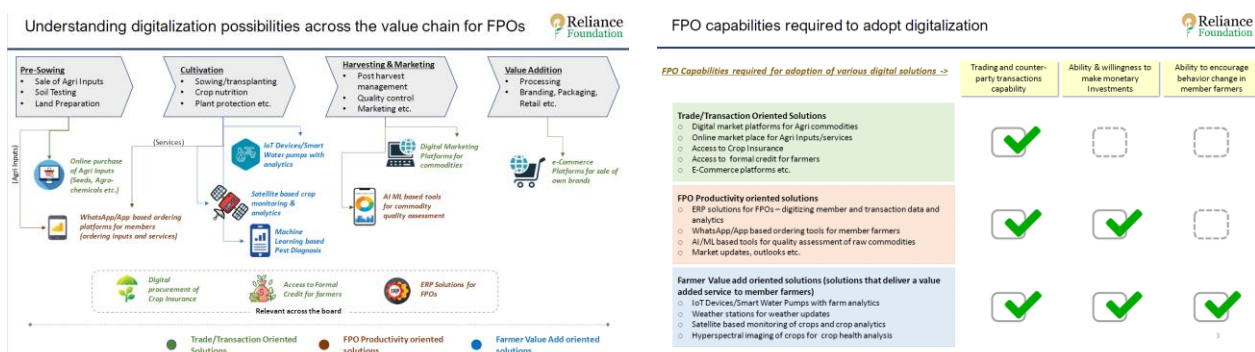


Image 3: Snips of the session on good practices of digitalization

7.2.3. Key considerations for successful digital implementation in FPOs

Speaker: K.C. Mishra, e-Kutir

The session underscored that the landscape for digitizing FPOS (Farmers Producer Organizations) is saturated, underscoring the necessity for a deliberate strategy. This might encompass communal ownership of digital agricultural infrastructure and, notably, a collaborative effort of the DI (Digital Innovation) community to effectively aid FPOs in their digital progression.

7.2.4. Chair's concluding remarks

Speaker: Andrea Gardeazabal

The challenges identified during the discussion revolved around crucial aspects such as impact, reach, trust, transparency, data ownership, data as an asset, network, and partnership. Addressing these challenges is essential to foster a robust and effective collaboration between Farmer Producer Organizations (FPOs) and Digital Innovators (DIs).

7.3. Session 3: Experience sharing: Business process of FPOs and digital experiences

Chair: Andrea Gardeazabal

Session Objective: The objective of this session was to showcase how different FPOs across the region are already equipping themselves with digital transformation and shedding light on the challenges, best practices, and progress made while implementing technology. Representatives from two FPOs were invited to share their firsthand experiences, offering insights into the obstacles faced, and the benefits obtained from their digitalization efforts.

Speaker: Karsanbhai Jadeja

- Banas Employs FPC, Gujarat digital innovation technology to monitor tractor operations and forecast weather. This holds significant importance for crops such as cumin, which are highly sensitive to weather conditions. There's a growing need to incorporate drone

technology for input spraying and quality assessment, aiming to mitigate losses caused by price fluctuations due to potential delays in quality evaluations.

Speaker: Sammati Nalage

- Each FPO faces unique local problems, and DIs must comprehend ground-level challenges. For FPOs, uniting members is crucial, while addressing fundamental issues like compliances of Registrar of Companies, administrative compliance, and building trust in technology remains essential.



Image 4: Andrea Gardeazabal and Karsanbhai Jadeja from the session 'Experience Sharing: Business process of FPOs and digital experiences'

Speaker: Rahul Godse

- Instances of how technology facilitated the monitoring of commodity theft by logistic management systems and improved the value proposition of mangoes through traceability were evident. Identifying appropriate value propositions for different technologies and skillful negotiation were imperative. Technology also optimized financial management, and the FPO is contemplating the integration of inventory tracking technology to oversee their extensive network of more than 100,000 farmers.

7.4. Session 4: Digital innovations showcase

Chair: Jawoo Koo

Session Objective: In recent years, there has been a growing interest in using digital technology to support FPOs, since digitalization has the potential to improve their efficiency, effectiveness, and resilience. The primary objective of the session was to provide a platform for Digital Innovators to showcase their digital innovations for FPOs and other stakeholders sharing knowledge and best practices about digital innovation for FPOs.

- This session covered innovations at various touch points of the agrifood value chain, including farm management Services; automation; peer to peer advisory; risk prediction; food system logistics; market linkages; schemes, insurance, data security and ownership. Among the digital innovators were Digital Agricultural Technologies (DATs) selected under the CII initiative, and other digital innovations. All the innovation showcases aligned with the SMART digitization themes.

Table 1: Thematic DI showcase

Theme	DI	Highlight of the session
Digitization of FPC	Navneet	Arya Shakti app offers one-click access to crucial storage information of commodities. The warehousing solutions include doorstep approval and sanctioning, affordable financing with competitive interest rates, automated farm plot mapping, and advanced crop health monitoring.
	Rai, Arya	
	Collateral	
	Warehouse	
Precision Ag and automation	Morup	Importance of shift from production-driven to data and demand-driven farming for FPOs was highlighted.
	Namgail,	
	IFFCO Kisan	

and farm advisory		<p>Six key digital tools were presented: Farm Traceability, Satellite Imagery Analysis, Image Recognition, Crop Simulation Models, IoT Sensors, and Automated Farm Advisory.</p> <p>Farmers' willingness to adopt new practices, training and capacity building, access to credit and adequate infrastructure, and improving post-harvesting practices know-how are some of the challenges in digitalisation.</p>
Farm management services	Amit Patil, Kheti Buddy	Kheti Buddy offers a comprehensive unified agtech platform, encompassing Farm Data Management, Crop Management, Post-harvest Management, and Business Management functionalities
Risk prediction/ Crop Advisory	Adarsh Muri, Agri Bridge	Krishivaas uses remote sensing technologies to detect crop stress (biotic and abiotic) on the farmer field and provides early advisories at sub-plot level without requiring any human intervention.
Automation and Market linkage, traceability	Dinesh Kumar Chauhan, DeHaat	DeHaat platform encompasses a wide range of services from seeds to market, providing access to agri inputs, financial services, crop advisory, and market services. The aim to offer market expansion, improved supply chain efficiency, enhanced farm engagement, and increased adoption of digital solutions for FPOs.

Value chain aggregation & food system logistics	Venu Margam, Kalgudi	Kalgudi's unified platform caters to different stakeholders, such as farmers and FPOs, offering information, knowledge, advisory services, and output and input market linkages.
Data security and ownership	Pavan Kumar BlueNumber	Farmers data, privacy and ownership is key aspect of digitalisation. BlueNumber provides farmers and FPOs with ownership and control of their data through digital self-sovereign identity (SSI). the platform enables farmers to monetise and trade the data they create, promoting digital inclusion.
Schemes and insurance	Vedant Manore, HaqDarshaq	HaqDarshap provides assisted-tech services for doorstep delivery of welfare entitlements for individuals and businesses. The Yojana Card of HaqDarshaq allows citizens to access information about their entitlements, and Yojana Sath, an AI-driven module, provides personalised welfare program information.



Image 5: Navneet Rai and Pavan Kumar from the session on 'Digital innovations showcase'

7.5. Session 5 – Resource mobilisation for FPOs

Session Objective: Recognizing that the adoption of digital technologies can be financially challenging for FPOs, this session aimed to underscore the critical role of resource mobilization in facilitating their digital transformation journey. The session sought to present and explore diverse sources of resources available to FPOs and discuss the steps that FPOs can take to mobilize resources for digital innovation.

Speaker: Deepak Sinha, Grand Thorton

- Commodity Stewardship Councils (CSCs) function as Section 8 companies, bringing together all the stakeholders within the value chain to establish a legal entity. A vital component of the SMART project, CSCs play a crucial role in creating an impact and achieving the project's objectives, which include enhancing competitiveness, developing new markets, and making an efficient agri-value chain with sustainable strategies for all stakeholders.
- The Maharashtra Agribusiness Network Project (MAGNET) supports FPOs by enhancing post-harvest marketing and value chains for select horticulture crops.

7.6. Session 6: Mini-marketplace by Digital Innovators & World café

Facilitator: Sachin Kadam, SMART Project, Government of Maharashtra

Session objective: Digital innovators are developing innovative digital solutions that can help farmers to improve their operations. These solutions can range from supply chain management platforms to weather forecasting tools. However, there may be a mismatch between the digital solutions being developed by digital innovators and the needs of FPOs. This is because innovators are often focused on developing technically innovative solutions but do not always consider the specific needs of FPOs. Thus, this session served as a platform for FPOs and technology providers to interact, exchange ideas, and explore potential collaboration opportunities.

Session design: The session was based on the World Café and market place methods. Digital Innovators set up a MarketPlace to display posters showcasing their existing services. The World Café was a group activity method that facilitated discussions and generated ideas. The method was based on dialogue, listening, and sharing principles. The World Café session started with FPOs rotating to different market stalls to communicate their needs with Digital Innovators. While earlier sessions focused on FPOs and DIs presenting their needs and digital innovations, this session provided a valuable interaction opportunity for FPOs, DIs and other stakeholders.



Image 6: Session on 'Mini-marketplace by Digital Innovators & World café'

Session highlights

- FPOs had a chance to engage directly with digital innovators, discuss customisations, and explore partnerships that align with their needs. Following the session, the insights were shared by various stakeholders shed light on the needs of Digital Innovators and their interaction with FPOs, validating the primary objective of the workshop. The discussions addressed several challenges, notably focusing on awareness, trust-building, and the functionality of technology. Participants underscored the necessity of making technology accessible to farmers across different literacy levels and highlighted the importance of training in optimizing input utilization.
- A consensus emerged on the significance of adopting a gradual approach to digitalization, beginning with fundamental services such as the digitization of FPC processes and databases. The topic of cost structures generated substantial discussion, with participants exploring the feasibility of tailored cost options based on the intensity of operations.
- The critical role of hand-holding and support for FPOs during their digital journey was a recurring theme, as the potential benefits of digitalization could go unnoticed without

proper guidance. An alternative perspective on the 40% FPO contribution emerged, suggesting that it could encompass not only monetary resources but also time, manpower, and data sharing.

- To ensure the quality of services, the suggestion of reverse rating of Digital Innovators was put forward, allowing for the identification of those delivering valuable solutions. Additionally, the importance of year-round engagement with FPOs and the diversification of services beyond commodities were highlighted as key factors for the successful adoption of digital solutions.
- The insightful discussions held during this phase played a pivotal role in shaping the agenda and objectives of Day 2. The participants' collective insights and perspectives formed a crucial part of the actionable recommendations that were developed to guide future collaborations and digital implementations.

7.7. Session 7: Break-out activity: Comprehensive roadmap for digital transformation

Facilitators: Satish Nagaraji & Dilip Kajale

Session Objective: During the first day of the workshop we delved into the digital needs of FPOs and provided an overview of the available digital innovations landscape. On the second day our focus shifted to establishing the necessary collaboration frameworks for FPOs to effectively adopt digital innovations. The range of DI services is extensive and diverse, encompassing a multitude of services and offerings. Without a well-defined framework, the collaboration between FPOs and DIs can become unreliable, lacking transparency and accountability. The absence of a common structured approach for business models, costing structures, defined roles and responsibilities are acknowledged hurdles encountered by the SMART project.

To address this challenges, it was imperative to establish a uniform framework and operational approach that would enable DIs and FPOs to collaborate effectively with transparency, accountability and trust. The break-out sessions focused on defining and outlining the service frameworks with a particular emphasis on: (i) theme wise definition of the scope of DAT solutions (ii) standardizing the costing units for each of the service under the DAT theme (iii) defining the roles and responsibilities of the DATs, FPOs and other stakeholders (iv) defining the Key Performance Indicators (KPI) (v) eco-system level collaboration opportunities required (vi) other bottle necks and solutions.

Session Mechanics: To facilitate interactive discussions across diverse themes, participants were grouped aligning with the Disruptive Agricultural Technology (DAT) themes identified by SMART. The six themes identified by SMART project included: (i) Digitalisation of FPOS (ii) Value Chain Actor Aggregation Platforms (iii) Precision Agriculture and Automation Solutions (iv) Urban Food Systems and Logistics Solutions (v) Market Linkage and Traceability Solutions (vi) Access to Financial Services

The themes of discussion were sequentially unveiled to the groups, with facilitators introducing each theme for discussion after every round. Subsequently, the groups engaged in deliberations, presenting their solutions one by one, following a cycle that repeated for six rounds. The groups consisted of a blend of FPOs, Digital Innovators, and representatives from research organizations and SMART officials. DIs aligned with specific themes were chosen accordingly but there is a possibility of overlaps due to their diverse digital offerings across themes.



Image 7: Break-out activity: Comprehensive roadmap for digital transformation



Image 8: Break-out activity: Comprehensive roadmap for digital transformation

Each round yielded valuable recommendations, all of which are compiled in the recommendation summary.

7.7.1. Defining the service scope of DAT themes

Rationale: Among the 61 DATs categorised under the six themes of service offerings, more than 15 DATs provide services spanning three or more themes, while 44 DATs offer services that overlap across two or more themes. This complexity poses challenges for FPOs in comparing services and understanding the cost structure of the DATs. Hence there is a need

to identify fundamental services for each DAT. This emerged as a key focus during the first day of the workshop.

By adopting a bottom-to-top approach, the aim was to determine the fundamental services required within each theme, considering the range of offerings provided by Digital Innovators. This collaborative process ensures that stakeholders collectively shape the selection of essential services.

Annexure 4 outlines the breakout groups representing each DAT theme define the fundamental services for each of theme. The DATs could offer additional services, but these are the fundamental services that should be included in each category.

7.7.2. Standardized Costing Units

Rationale: The services offered by DATs within different themes are diversified and have different business models leading to variations in their costing units. This variation can create challenges for FPOs and stakeholders like SMART in comprehending the value and distinguishing between these services. Based on the fundamental services defined in the first round of the session, the groups then focused on defining a common costing framework for digital services to promote ease of implementation and procurement for FPOs. By establishing standardized costing units, FPOs would be able to compare costs across different services to make well-informed decisions when integrating digital solutions into their operations. It's worth noting that certain themes might warrant multiple costing units to cater to specific requirements.

7.7.3. Roles and Responsibilities

Rationale: Potential misunderstandings could arise between FPOs and DIs due to differing assumptions about their respective roles. Clarity in roles and responsibilities is essential for efficient resource optimization, minimizing miscommunication, and facilitating smooth

collaboration. Furthermore, recognizing theme-specific responsibilities is crucial, as different themes may entail distinct roles for both FPOs and DIs.

7.7.4. Key Performance Indicators

Rationale: The establishment of Key Performance Indicators (KPIs) plays a critical role in the effective monitoring and evaluation of digital innovations. By defining specific metrics and targets, KPIs offer a clear and objective way to track success, effectiveness, and efficiency of various digital solutions. They also function as a structured accountability framework, addressing potential challenges and grievances that may arise during collaboration between Digital Innovators (DIs) and FPOs.

7.7.5. Compliance

FPOs are required to comply with various regulatory and reporting obligations, including the disclosure of directors' interests in other entities, annual filing of non-disqualification forms, submission of annual returns, filing of financial statements, and maintaining registers of directors, director shareholdings, and members, among other requirements. Additionally, FPOs should appoint auditors and file forms if they have deposits from shareholders, demonstrating their commitment to transparency and governance [17].

7.7.6. Stakeholders and Collaboration Required

Rationale: The agri-food system landscape is complex and interconnected. The comprehensive digitization of all aspects of the value chain for FPOs is an ambitious endeavour. It's apparent that no single entity can navigate this task independently; partnerships and collaboration are imperative. Recognizing this, the necessity for collaboration and meticulous stakeholder identification within each thematic area becomes evident. Collaboration is not just a concept but a concerted effort, requiring commitment, determination, and the establishment of structured frameworks to guide the agreement stages.

By fostering collaboration among different stakeholders, including Digital Innovators (DIs), FPOs, technology providers, financial institutions, and experts, a more holistic and effective approach to digitalization can be achieved. Each thematic area requires specialized expertise and resources, which can be brought together through collaboration.

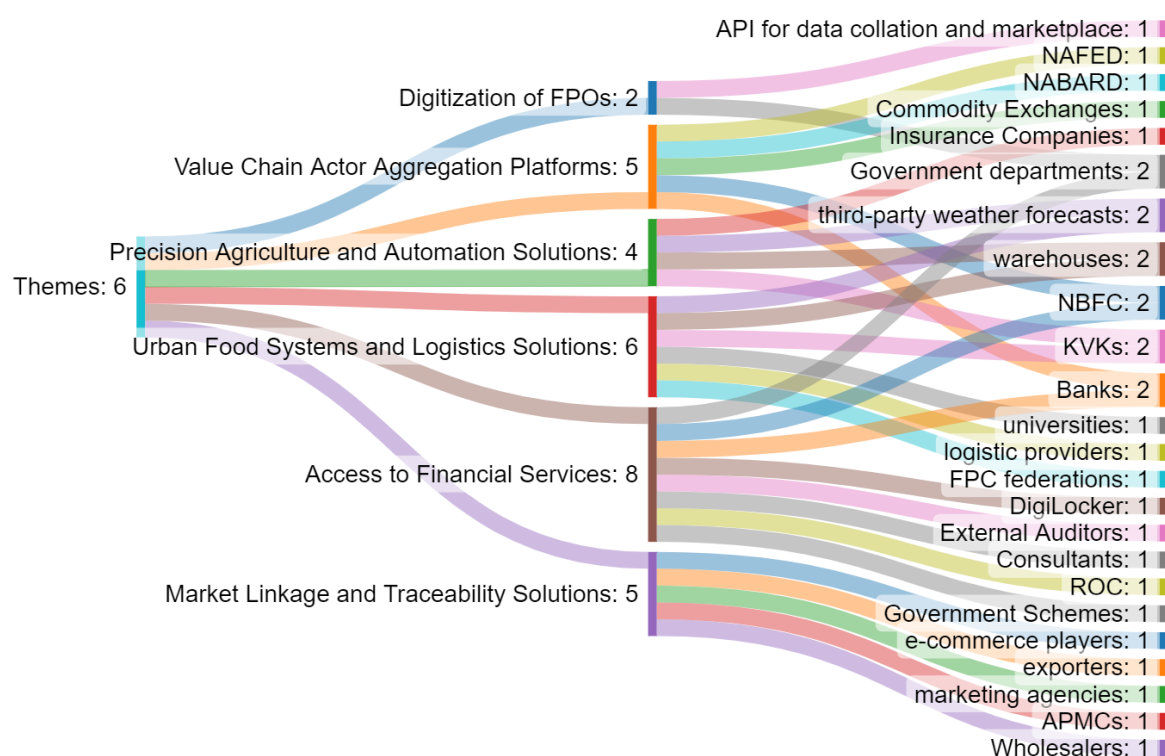


Figure 2: Mapping of themes and collaborators

Achieving the effective implementation of digitalisation for FPOs goes beyond thematic boundaries and requires a broader ecosystem approach. A well-defined framework that brings together various stakeholders is essential to harness the full potential of digital transformation. Considering this, the break-out groups identified the external actors that they require to collaborate with for successful adoption of digital innovations. The collaboration relationship is represented in the below figure 2.

Table 2 below outlines the collaborations required by each theme with other thematic providers within the SMART identified theme.

Table 2: Collaborations required with internal actors.

Themes	Collaborations Required
Digitization of FPOs	<ol style="list-style-type: none"> 1. Access to financial services 2. Market Linkage and Traceability Solutions 3. Precision Agriculture and Automation Solutions
Value Chain Actor Aggregation Platforms	<ol style="list-style-type: none"> 1. Urban Food Systems and Logistics Solutions 2. Access to Financial Services
Precision Agriculture and Automation Solutions	<ol style="list-style-type: none"> 1. Digitization of FPOs 2. Access to financial services 3. Urban Food Systems and Logistics Solutions
Urban Food Systems and Logistics Solutions	<ol style="list-style-type: none"> 1. Digitization of FPOs 2. Market Linkage and Traceability Solutions
Market Linkage and Traceability Solutions	<ol style="list-style-type: none"> 1. Digitization of FPOs 2. Access to Financial Services 3. Urban Food Systems and Logistics Solutions 4. Value Chain Actor Aggregation Platforms 5. Precision Agriculture and Automation Solutions
Access to Financial Services	<ol style="list-style-type: none"> 1. Digitization of FPOs 2. Access to Financial Services 3. Urban Food Systems and Logistics Solutions 4. Value Chain Actor Aggregation Platforms 5. Precision Agriculture and Automation Solutions

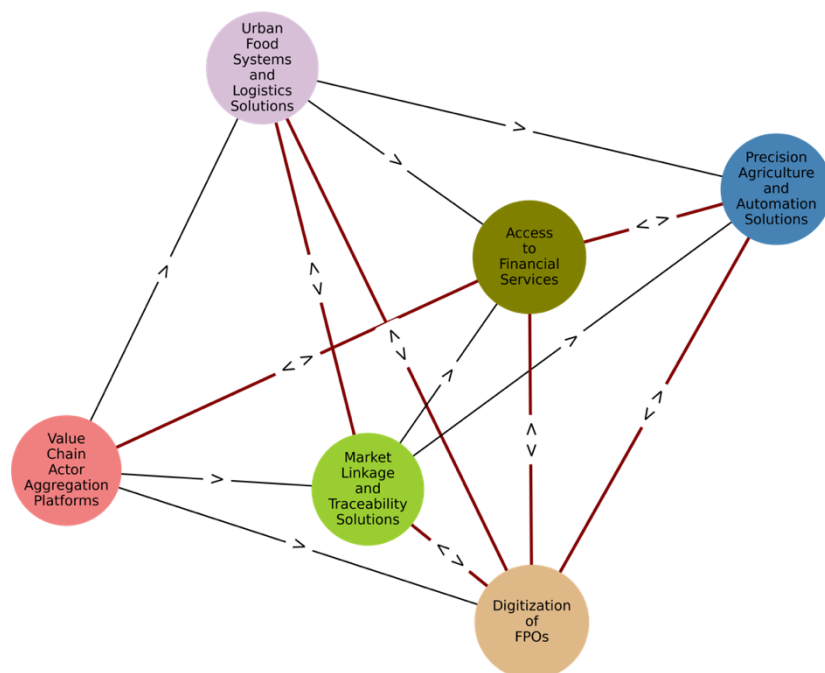


Figure 3: Network mapping of themes

Figure 3 shows the network of interconnected themes (six themes presented in different colors) and the collaboration required between these themes. The arrows represent the flow of the collaboration required between these themes. The unidirectional arrow means the collaboration requirement is from one theme to the other. The thicker bi-directional arrows represent the need for collaboration between both themes.

Table 3: Collaborations required with external actors.

Themes	External Collaborations Required
Digitization of FPOs	<ul style="list-style-type: none"> ▪ APIs for data collection and marketplace ▪ KVK, universities and agri-experts ▪ Government departments for document management
Value Chain Actor Aggregation Platforms	<ul style="list-style-type: none"> ▪ Banks and Financial institutes (incl. private, public banks, NBFC, NAFED, NABARD)

	<ul style="list-style-type: none"> ▪ Trade bodies ▪ Commodity exchanges (MCX and NCDEX)
Precision Agriculture and Automation Solutions	<ul style="list-style-type: none"> ▪ Insurance companies ▪ Premium satellite image sources, ▪ Third-party weather forecasts ▪ Cloud storage services ▪ KVK, universities and agri-experts
Urban Food Systems and Logistics Solutions	<ul style="list-style-type: none"> ▪ KVK, universities and agri-experts ▪ Warehouses ▪ Logistics providers, ▪ FPC federations ▪ Third-party weather forecasts
Market Linkage and Traceability Solutions	<ul style="list-style-type: none"> ▪ E-commerce players ▪ Commodity exporters ▪ Marketing agencies ▪ APMCs ▪ Wholesalers
Access to Financial Services.	<ul style="list-style-type: none"> ▪ Government bodies, ▪ Digital platforms like DigiLocker ▪ Banks and Financial institutes (incl. private, public banks, NBFC, NAFED, NABARD)

- Government departments
- External auditors
- Registrar of Companies

7.7.7. Bottlenecks and challenges

Rationale: Foreseeing possible challenges and bottlenecks in any new initiative and devising strategy to overcome is imperative. On the same lines, an in-depth analysis of the bottlenecks and challenges surrounding digital implementation and collaboration between Digital Innovators (DIs) and Farmer Producer Organizations (FPOs) was meticulously addressed. This exploration was conducted both thematically, delving into specific areas, and holistically, identifying challenges that cut across multiple themes.

Table 4: Bottlenecks and challenges identified.

Challenges	Possible Solutions
Flexibility in service offerings to accommodate diverse needs and preferences of different FPOs	<p>Creating a unified comprehensive ecosystem for FPOs that could plugin additionally services based on the needs of the FPOs</p> <p>Clearly defining the range of services offered by DIs will allow FPOs to easily compare services and choose according to their specific needs.</p> <p>Implementing modular solutions enabling FPOs to customize services and integrate them gradually, as required.</p>

Lack of awareness on digitalization and its uses	<p>Focused training and capacity building activities building the digital and financial literacy to FPOs and farmers</p> <p>Awareness campaigns on the use and need for digitalization</p> <p>Facilitating peer-to-peer learning networks among FPOs and farmers, where those who are proficient in digitalization share their knowledge and experiences with others.</p>
Lack of necessary basic infrastructure	<p>Government should consider schemes providing necessary basic and hardware infrastructure (computers and tablets) to enhance adoption of digitalization.</p>
Enhance adoption of digitalization	<p>Standardizing the scope of services by including basic digitalization services will help FPOs to take the first step in the journey of digitalization</p> <p>Defining budget friendly, simple and standardized cost structure of the service will be crucial</p> <p>Establishing feedback mechanisms with users and ensuring that business models provide the flexibility needed for continuous improvement and targeted service offerings</p> <p>Allocating budget for research focused on understanding usability and incentives for adoption.</p>
Overcoming potential skepticism of digitalization in terms of value	<p>Demonstrating the value of services to FPOs through standardized costing units, enabling value transfer to members through FPOs and standardizing offerings from DATs</p>

Problem of too many - diverse users' and diverse services	Flexibility in service design to suit diverse users' preferences, such as user-friendly UIs, is essential
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8. Recommendations

A list of recommendations has been compiled as a direct output of our workshop sessions and discussions. These recommendations evolved from the contributions made by the stakeholders throughout the deliberations of the workshop. They are directed towards the Digital Innovators, FPOs, SMART and other stakeholders including CGIAR and GIPE. Implementing these recommendations will demand time dedication, commitment, allocation of resources, establishment of a framework to collaborate and active participation among all stakeholders involved.

8.1. Recommendations to FPOs

- i. Digitalization is not a one-time event but rather a continuous process. Adopting all technologies at the same point of time will lead to several challenges and practical difficulties for both FPOs and the DATs. The FPOs could adopt a step-wise approach in adopting the digital technologies based on their need, maturity and familiarity. When referring to basic digitalization, it involves addressing immediate needs such as the digitalization of compliance, FPO processes, and data sharing. As the FPOs become more accustomed to digital technologies and their value becomes evident, the FPOs can explore advanced services that require behavioral change and deeper integration. Based on the ranking exercise during the break-out session, FPOs could consider the following sequence for the step-by-step approach of digitalization:
 - a. FPO digitalization, financial and compliance services

- b. Commodity aggregation platforms
 - c. Market linkage platforms
 - d. Urban food systems and logistics solutions
 - e. Precision Agriculture and automation solutions
- ii. The stakeholders including the FPOs, DI and SMART officials emphasized that FPOs are responsible for collecting data, making it a critical moment for them to gather their members' information using the standardized template. The stakeholders also recognized the need for a common comprehensive templates and tools for data collection, which they suggested could be designed with support from like the CGIAR and Gokhale Institute of Politics and Economics. By adhering to this standardized format, FPOs can ensure consistency and compatibility in their data, which will facilitate better engagement with DIs and foster more effective digital solutions for the farming community.
- iii. Furthermore, FPOs should work towards increasing their overall average membership. Scaling up membership numbers brings potential economies of scale at the FPO level and benefits both FPOs and DIs at the macro level. With a larger member base, FPOs can gain more bargaining power in the market, leading to better terms and prices for their produce. This, in turn, creates a more attractive ecosystem for Digital Innovators as the potential impact of their digital solutions increases with a larger reach. By working together to expand membership and establish basic processing units, FPOs and DIs can collaboratively build a stronger and more vibrant agricultural ecosystem.

8.2. Recommendations to DATs

- i. **Suitable technologies:** A wide array of digital tools and platforms are available across the value chain agri-food systems. The FPOs are overwhelmed with the

options. Everything seems to be necessary and critical. However, to aid quick adoption, costing and easy comparison to select the services, segmentizing DAT service is important. The services offered by DAT could be packaged in three different segments: basic, advanced and premium. The premium services could be additional services that DAT might offer outside this list. It will be imperative that this list is reviewed and updated time to time, probably every 18 months. Below is the recommendation of fundamental services that could be covered in each of theme:

Table 5: Fundamental and additional services by theme

Themes	Required services	Additional services
Digitization of FPOs	<ol style="list-style-type: none"> 1. Member registration 2. Member's farm data including their GPS coordinates Member engagement tracking 3. Member transaction records management 4. Dashboards 	<ol style="list-style-type: none"> 1. Surveys 2. FPO's farm equipment mapping 3. Compliance record keeping (Document Repository) 4. ERP System for Sales and Inventory Management 5. Resource Sharing for knowledge and training 6. Data Analytics
Access to Financial Services	<ol style="list-style-type: none"> 1. Digitalization of loan services 2. Compliance assistance and record keeping 3. Business plans of FPO 4. FPO management 	<ol style="list-style-type: none"> 1. Member registration 2. Digitalization of insurance services 3. Access to Grants and Funding 4. Financial Analytics

	5. Project monitoring, and transaction management	5. Peer-to-Peer Lending 6. Risk Advisory
Value Chain Actor Aggregation Platforms	1. Quality assaying and certification 2. Price discovery and market intelligence 3. Risk mitigation services 4. Hedging solutions	1. Post-harvest advisories 2. Market linkage 3. Market Intelligence 4. Supply Chain Transparency 5. Seasonal Planning 6. Warehouse Linkages
Precision Agriculture and Automation Solutions	*At-least one or many 1. In-situ weather forecast 2. Local/in-situ agronomic and production practices 3. In-situ soil tests and parameters 4. Drone based spraying 5. Drone or Remote sensing based (plot level) stress/yield advisories	1. Grading and waste detection using computer vision 2. Automated Harvesting 3. Automated Monitoring Systems 4. Precision Seeding and Planting 5. Automated irrigation 6. Labor Management 7. Geo fencing
Urban Food Systems and	1. Digital tools for price discovery 2. Traceability	1. Packaging services 2. Acceptable quality data to meet market standards

Logistics Solutions	3. Marketing linkages	3. Linkage to processing centers
	4. digital retail market place	4. Logistics and delivery (Last-Mile Delivery Optimization)
	5. Information on grading and sorting	5. Cold Chain Management
	6. Access to organised retail space	6. Waste Management Solutions
		7. Automated Processing
		8. Digital platform for white label products
Market Linkage and Traceability Solutions	1. User-friendly online market linkage platform	1. Product SKU generation
	2. Market and price information	2. Traceability services
	3. Market advisory	3. Demand Forecasting
	4. Payment gateway linkage	4. Feedback Mechanisms
		5. Geotagging and Certification
		6. Dynamic Pricing Algorithms
		7. Collaboration platforms

- ii. To promote digital adoption and demonstrate the value of digitalization, SMART or DIs can consider offering certain fundamental digitalization services either at no cost or with subsidized pricing to FPOs. By providing these initial services as a trial, FPOs can gain firsthand experience of the benefits of digitalization, encouraging them to explore and adopt more advanced features and functionalities. This model aims to lower the barriers to entry for FPOs, enabling them to easily access and assess the advantages of digital solutions without incurring significant upfront costs. As FPOs

begin to appreciate the positive impact of digitalization on their operations and overall efficiency, they are likely to invest further in additional services or features tailored to their specific needs.

- iii. To emphasize the value proposition of digital solutions for FPOs, DIs should provide on an commonly agreed costing framework. This will aid the SMART project and the FPOs in comprehending the value of various offerings and facilitate comparisons between different solutions. Based on the break-out exercise, below is the recommended costing unit for each of the services offered by DATs.

Table 6: Standardized costing units

Themes	Standardised Costing Units
Digitization of FPOs	FPO-wise (minimum of 250 members, and incremental for every 50 members) Number of members (per farmer)
Access to Financial Services	Compliance solutions: one-time service charge Other management related service: FPO wise (upto250 members as base, there-on incremental of 50 members)
Value Chain Actor Aggregation Platforms	Per bag or quantity-wise (% of the transaction) Risk mitigation services: crop-wise for a season Both could be a percentage-wise charges on transactions
Precision Agriculture and Automation Solutions	Advisory and alerts: Per farmer or acre-based for one season. IoT-based services and post-harvest assessments: Annual subscription for a certain number of devices

Urban Food Systems and Logistics Solutions

Market linkages: Quantity wise (% of the quantity transacted)

SKU wise for listed products

FPO wise for quality certifications

Transaction-based for platform commissions

Market Linkage and Traceability Solutions

Quantity-based commission or brokerage

- **Eliminating any ambiguity around the size of the FPOs, all the groups unanimously agreed to consider unanimous consensus to adopt a base cost of 250 members for costing calculations. For FPOs exceeding 250 members, an additional increment of 50 members can be taken into account.**
- **Additionally, there was consideration for pricing one-time effort services under all themes with an initial charge, along with an annual maintenance or supplementary fee in case of membership expansion.**

- iv. Digital Innovators must prioritize building trust with FPOs and ensuring a seamless implementation process. For this purpose, DIs should establish partnerships with local knowledge providers and collaborators familiar with the specific context and challenges of FPOs. These local partners can bridge the gap between technology solutions and actual FPO needs, ensuring relevance and effectiveness. Having local knowledge partners instills confidence in FPOs, demonstrating a commitment to understanding their unique circumstances and addressing their requirements. This aligns with the criteria under the SMART project.
- v. Digital Innovators should recognize that FPOs face resource constraints, requiring customized mainstream solutions. A governance framework, capacity building, and

sensitization approach are essential for offering reliable, practical, and affordable digital solutions exclusively designed for FPOs, ensuring clear utility.

8.3. Recommendations to SMART

- i. Having a common template for data collection, the stakeholders also acknowledged the need for a common data collection and interoperable data exchange platform for agriculture. This could be set up as a common resource by the Government of Maharashtra. This platform could bring together diverse stakeholders, including Farmer Producer Organizations (FPOs), government agencies, research institutions, digital innovators, and other relevant entities. The primary objective would be to facilitate the smooth and secure exchange of agricultural data to drive informed decision-making and enhance the overall efficiency of the agricultural ecosystem.
- ii. SMART project prescribes that the FPOs should contribute about 40% of the total budget of the digitalization. The stakeholders including FPOs and the DIs suggested that SMART should also consider the in-kind contribution made by the FPOs towards this 40% requirement. This could include their efforts, time, and human resources. FPOs possess valuable on-ground knowledge and direct access to farmers, making their active involvement in digitalization invaluable. Their role in mobilizing farmers, providing essential data, and managing day-to-day operations is invaluable. FPOs may not have the financial means to invest heavily in technology, but their willingness to actively participate in digitalization can be a significant asset.
- iii. The digitalization of the FPOs through SMART initiative requires a structured and transparent mechanism for collaboration framework and mechanism. The Peer-to-Peer Innovation Space of the CGIAR's Co-Lab platform can be adapted and used for this.

- iv. Consortium based approach: considering the continued engagement of FPOs and the DATs, it is recommended that a consortium-based approach is adopted. Collaborating together, they can map the various touchpoints along the value chain to ensure consistent member engagement throughout the crop cycle while also expanding the range of services provided by FPOs. Creating synergies and fostering partnerships through the consortium can lead to a more streamlined and integrated approach to digital solutions, benefiting both the DIs and the FPOs.
- v. Creating a framework of Key Performance Indicators (KPIs) is essential for ensuring responsible and effective digital implementation by both DIs and FPOs. KPIs serve as measurable benchmarks that gauge the progress, impact, and success of digital initiatives, allowing stakeholders to monitor their performance and make data-driven decisions. This framework of KPIs plays a crucial role in guiding the responsible design, adoption and utilization of digital solutions to maximize their benefits for FPOs and their members. Also, the establishment of guidelines, rules, and regulations for grievance redressal between FPOs and DIs is vital to ensure a smooth and transparent collaboration. The Table 7 includes the KPIs identified during the break-out session:

Table 7: KPIS for identified services

Themes	KPIs	
Digitalization of FPOs	of	<ul style="list-style-type: none"> ▪ % of members digitalized ▪ % data collection completion process ▪ Number of surveys conducted ▪ Usage of the digital system

Value Chain Actor Aggregation Platforms	<ul style="list-style-type: none"> ▪ Volume and value of commodities aggregated (perishable and non-perishable) ▪ Successful payment completion period ▪ Coverage of FPOs, frequency of payments, volume and value of aggregated commodities, coverage of villages, and farmers
Precision Agriculture and Automation Solutions	<ul style="list-style-type: none"> ▪ # of accurate and relevant advisories shared ▪ # instances where early detection has saved the crops and improved yield ▪ Timely installation and updates ▪ Turnaround time for software and hardware problem
Urban Food Systems and Logistics Solutions	<ul style="list-style-type: none"> ▪ Number of traders onboarded and matched Number of SKUs listed ▪ Price realization compared to market price ▪ Improvement in delivery time ▪ Volume and value of the commodities traded
Market Linkage and Traceability Solutions	<ul style="list-style-type: none"> ▪ Volume and value of the commodities traded ▪ Turn-around time for conflict resolutions ▪ On-time payments and for FPOs ▪ Number of farmers benefited
Access to Financial Services	<ul style="list-style-type: none"> ▪ Time-bound meeting the compliance requirements ▪ frequency of reviews

- vi. Defining clear roles and responsibilities of both FPOs and DIs is crucial for a successful and seamless digital implementation process. By establishing a well-defined framework of responsibilities, miscommunication can be minimized, and resources can be optimized efficiently.

Table 8: Roles and responsibilities

Themes	Roles of DIs	Roles of FPOs
Digitalization of FPOs	Provide solution and platforms to collect data Collect, curate and clean data securely Ensure awareness about the solution Provide continued support until FPOs are comfortable with the technology.	Provide basic computers, office space Support with required human resources Organise trainings Take care of the technology assets
Value Chain Actor Aggregation Platforms	Responsibility mainly commences from the point where the commodity reaches the warehouse Support data-driven risk mitigation and plans	Time-to-time provide required inputs on the yield and crop variety for risk mitigation Quality management of the commodity until it reaches the warehouse

	Systematically collect the information required for risk management	
Precision Agriculture and Automation Solutions	<p>Technology customization</p> <p>Technology deployment, installation maintenance</p> <p>Training</p> <p>Collaboration with external data providers</p> <p>Provide timely advisory and alerts</p>	<p>Farmer mobilization</p> <p>Access to infrastructure</p> <p>Basic upkeep and care</p> <p>Minimal digital literacy</p>
Urban Food Systems and Logistics Solutions	<p>Update FPOs about market requirements</p> <p>Product listing</p> <p>Connect with logistics players</p> <p>Provide analytics and insights</p> <p>Negotiate for better price realization</p>	<p>Provide production statistics</p> <p>Adhere to trade quality and price terms</p>
Market Linkage and Traceability Solutions	<p>Real-time data availability</p> <p>Data security</p> <p>Financial integration</p> <p>Grievance redressal</p>	<p>Quality production and packaging</p> <p>On-time delivery</p> <p>Production forecasts</p>

	Branding support	
	Provide buyer feedback	
Access to Financial Services.	Compliance reminders	Data collection
	Project monitoring tools	Compliance submission
	Loan and grant eligibility alerts	Monitoring projects
	Training	

vii. Upon comprehending the digital solutions presented by DATs, the FPOs were also inquired about their readiness to invest in these offerings. The FPOs indicated a willingness to allocate an annual budget ranging from INR 15K to 40K for fundamental digital services such as record digitalization, digital compliance, and ERP systems. It is anticipated that this willingness to invest will likely increase as FPOs gain a deeper understanding of the potential advantages that these digital tools can bring. Notably, some FPOs with substantial turnovers (INR 10-15 CR) are already dedicating INR 20-30L towards essential digital services, showcasing the tangible value they attribute to these offerings.

viii. Expanding on the previous observation, these FPOs demonstrated a readiness to invest between INR 500 and INR 2000 per farmer for satellite-based crop advisories and a higher range of INR 3-4L at the FPO level for precision technologies. Additionally, they indicated a willingness to commit 0.3-0.8% commission for the aggregation of produce through online platforms. It's noteworthy that their contribution extends beyond the financial involvement of their share of 40% contribution, encompassing actions like gathering ground-level farmer data, sharing

FPO-level data, extending local stance for maintenance, and offering the FPO's infrastructure for the digital implementation by DATs.

8.4. Recommendations to Research Institutes

- i. SMART could explore a controlled research approach wherein FPOs take ownership of digital infrastructure, data, and security. DIs can offer plug-and-play solutions, fostering transparency, trust, and collaboration. Additionally, establishing a collectively owned Agricultural Information Exchange may enhance information sharing and boost the effectiveness of digital initiatives in agriculture.
- ii. Innovation showcase and evidence: To increase adoption of digitalization in FPOs, the FPOS need to understand the available technology and the impact of the digitalization use case. This requires an easy to access catalogue of technologies available that could be classified/searched based on the needs (eg: crops, agroecology, needs, usage). In addition to this catalogue, it is important to have unbiased evidence on how digitalization helps the FPOs along with their experiences and learnings. This could be in an online platform that could be accessed by FPOS, SMART and other stakeholders. The soon to be launched Co-Lab of the CGIAR Digital Innovation initiative could be used for this with specific tags and section for Maharashtra state.
- iii. Ensuring continued quality of service of the digital innovation is an integral factor in determining the success of adoption of digital innovation by the farmers, To ensure quality of services a transparent reverse rating mechanism is recommended to the DATs that are part of SMART. The concept of reverse rating suggests that businesses assess the performance of Digital Innovators in contributing to the enhancement of their services. This could be carried out with the guidance of a general framework for

rating parameters for DATs in Maharashtra. Organizations like Reliance Foundation, CGIAR and GIPE could develop these frameworks.

9. Limitations, future needs and opportunities

- The workshop included a diverse group of participants, but it's important to acknowledge that the representation might not have covered all possible perspectives. The views shared may not fully capture the complexities and challenges faced by every type of stakeholder.
- Also, the workshop spanned a specific duration, which might have limited the depth of discussion and exploration of certain themes and solutions. To truly understand the effects of digital innovations, comprehensive impact assessments are required. This would involve measuring the actual benefits and outcomes achieved by FPOs after implementing digital solutions, providing valuable insights for future initiatives.
- The workshop's success highlights the need for sustained collaboration through workshops between DIs, FPOs, and other stakeholders. Regular interactions and engagements can lead to the development of long-term strategies and solutions that evolve with the changing needs of the sector. Also, future initiatives should focus on continuous research and development of digital tools specifically tailored to the needs of FPOs. This could involve designing innovative solutions that address key challenges and enhance the efficiency of agricultural operations.
- The workshop emphasized the significance of knowledge sharing between DIs, FPOs, and other stakeholders. By leveraging digital platforms and networks, there is a significant opportunity to create a robust ecosystem for information exchange and best practice dissemination.
- As successful case studies and best practices emerge, there is an opportunity to scale these models across a broader range of FPOs and regions. This can be achieved

through strategic partnerships and collaborations to amplify the positive impact of digital solutions.

10. Partners

The workshop was organized in collaborative partnership that bring excellent knowledge and have prior involvement with the digital innovation and agriculture collectives, making them significant contributors to the workshop's success. Their combined experience greatly enhances the workshop's content and delivery.

Dept of Agriculture – ATMA (Government of Maharashtra)

<https://krishi.maharashtra.gov.in>

The Agricultural Technology Management Agency (ATMA) Scheme was launched during 2005-06. ATMA initiative aims to orchestrate a novel extension delivery system that characterizes decentralization, demand responsiveness, farmer accountability, site-specificity, systematic integration, and active participation. The initiative aims to form a research-farmer-market linkage, technically and financially sustainable in its orientation. ATMA's strategic framework underscored a comprehensive and proactive approach, leveraging the collective strengths of stakeholders to pave the way for resilient, location-tailored, and value-driven agricultural development. It aims to make the extension system farmer-driven and farmer accountable through new institutional arrangements for technology dissemination in the form of an ATMA at the district level to operationalize the extension reforms.

SMART Project

<https://www.smart-mh.org>

Maharashtra Village Social Transformation Foundation (MVSTF), Maharashtra State Rural Livelihoods Mission (MSRLM), and Maharashtra Agricultural Competitiveness Project

(MACP) intend to collaboratively formulate and implement a state of Maharashtra Agribusiness and Rural Transformation -“SMART” Livelihood Project for Rural Maharashtra. The project aims to transform Rural Maharashtra through “SMART” interventions in Agriculture and Livelihood sectors, assisted by World Bank. Over the years, Government of Maharashtra has been consistently putting efforts and resources through various central and state government schemes, programs and projects for development and transformation of agriculture and rural sectors and actively seeking private sector participation in these initiatives.

CGIAR Digital Innovation

<https://www.cgiar.org/initiative/digital-innovation>

CGIAR is also at the forefront of driving the transition towards sustainable and inclusive agrifood systems. The Digital Innovation initiative is integral to CGIAR's comprehensive approach to building resilient and equitable food systems that can effectively tackle the complexities of climate change, resource limitations, and global food security challenges. Through the CGIAR Digital Innovation Initiative, cutting-edge digital technologies and research-based insights are leveraged to empower farmers and stakeholders across the agrifood value chain. By harnessing the potential of digital solutions, the initiative aims to enhance agricultural productivity, minimise environmental impacts, and foster social inclusivity.

CIMMYT

<https://www.cimmyt.org>

CIMMYT is recognized as a dynamic and forward-looking international institution, demonstrating an unwavering dedication to confronting the challenges of tomorrow in the present. The organization's mission revolves around leveraging its expertise to foster enduring improvements in the well-being and adaptability of smallholder farmers across

the Global South. This commitment extends to shaping more robust, equitable, and ecologically conscious agrifood systems. Aligned with the fundamental principles of the CGIAR 2030 Research and Innovation Strategy, CIMMYT's 2030 strategy takes a decisive stance by elevating the climate crisis to the forefront of global food security research. This strategy focuses on fostering increased collaboration, bolstering data science capabilities, and surmounting operational hurdles, thereby augmenting CIMMYT's effectiveness and cultivating a culture of collective action.

GIPE

<https://gipe.ac.in>

The Gokhale Institute of Politics and Economics, Pune, was established in 1930 by the Servants of India Society. It is the oldest research and training institute in Economics in the country. It is dedicated to research into the socio-economic dimensions of Indian society and carries forward the legacy of Gopal Krishna Gokhale. In recognition of its contribution to higher learning and research in Economics, the Institute was awarded the status of institution Deemed to be a University, in 1993. The Gokhale Institute of Politics and Economics is renowned for its initiatives in qualitative research in diverse areas of economic theory and practice. Surveys, research, informed debates, analysis and critique generated at the Institute have shaped the public discourse on major development initiatives.

VAMNICOM

<https://vamnicom.gov.in>

In 1964, the Indian Government, led by Prof. D.R. Gadgil, initiated a panel to assess cooperative sector training needs. This led to the recommendation for a National Institute catering to senior personnel training, research, consultancy, business management courses, and comprehensive youth training. The merging of CIMCOB and NCCRI birthed VAMNICOM in April 1967. VAMNICOM serves as a hub for cooperative intellect. It offers

management development, PGDCBM for in-service officers, PGDM – Agri-Business Management (ABM), and a Diploma in Management of Computer Operations. Known for its modern infrastructure, experienced faculty, and nurturing environment, VAMNICOM excels in Management Education, Cooperative Research, and Training.

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Annexes

Annex 1: Workshop Agenda

Day 1: Tuesday, 25 July 2023	
Time	Topic
10:00	- Registration
10:45	
Session 1	Welcome and Introduction
10:45	- Welcome: <i>Dasharath Tambhale, Director, ATMA, Maharashtra</i>
12:00	<ul style="list-style-type: none"> Objectives/Setting the context: <i>Satish Nagaraji, CIMMYT</i> Inaugural Message: <i>Ajit Ranade, Vice Chancellor, GIPE</i> Inaugural Message: <i>Hema Yadav, Director, VAMNICOM</i> Inaugural Message: <i>Jawoo Koo & Andrea Gardeazabal</i> Introduction of participants
12:00	- Group Photo and Break
12:20	
Session 2	Current status and needs of digitalisation in FPOs
12:20	- Chair: <i>Andrea Gardeazabal</i>
13:00	<ul style="list-style-type: none"> Status of digitalisation of FPOs in Maharashtra: <i>Dasharath Tambhale, Director, ATMA, Maharashtra</i> Good practices of digitalisation: <i>Ashutosh Deshpande, Reliance Foundation</i>

	<ul style="list-style-type: none"> ▪ Key considerations for FPOs for successful digitalisation of FPOs: <i>K.C. Mishra, e-Kutir</i>
Session 2 B	<ul style="list-style-type: none"> ▪ Experience sharing: Business process of FPOs and digital experiences
13:00	–
13:30	<ul style="list-style-type: none"> ○ <i>Sammati Nalage, Chandaneshwar Agro Producer Company Ltd.</i> ○ <i>Karsanbhai Jadeja, Banas FPC</i>
	<ul style="list-style-type: none"> ▪ Summary and highlights <i>Rahul Godse, Maha FPC</i>
13:30	– <i>Lunch</i>
14:30	
Session 3	Plenary: Digital innovations showcase (8 minutes each)
14:30	– <i>Chair: Jawoo Koo (5 minutes)</i>
16:00	<ol style="list-style-type: none"> 1. Digitisation of FPC - Arya Collateral Warehouse 2. Precision Ag and automation and farm advisory – IFFCO Kisan 3. Farm management services: Kheti Buddy 4. Risk prediction/ Crop Advisory – Agri Bridge 5. Automation and Market linkage, traceability – DeHaat 6. Value chain aggregation & food system logistics – Kalgudi 7. Data security and ownership – Blue Number 8. Schemes and insurance – HaqDarshaq <p>Q&A – 6 minutes</p>
Session 4	Resource mobilisation for FPOs

16:00 – *Deepak Sinha, Grand Thornton*

16:15

16:15 – *Break*

16:30

Session 5 Mini-marketplace by Digital Innovators & World café

16:30 – *Facilitator: Sachin Kadam*

18:30 Digital Innovators exhibit posters of their innovation and matching digital solutions to FPO Needs

Summary: *Dasharath Tambhale*

Day 2: Wednesday, 26 July 2023

10:00 – **Recap of Day 1**

10:30 *Sushant Malik & Sherin Maria*

Session 6 Break-out activity

10:30 – *Facilitator: Dilip Kajale & Satish Nagaraji*

13:30

- FPO representatives and digital innovators to be divided into six themes to define the minimum services needed in each theme, define costing unit and roles and responsibilities

- Themes:

1. Digitisation of FPOs
2. Value Chain Actor Aggregation Platforms
3. Precision Agriculture and Automation Solutions
4. Urban Food Systems and Logistics Solutions

5. Market Linkage and Traceability Solutions

6. Access to Financial Services

- Groups report back from the activity discussions

13:30 - Lunch

14:15

Session 6 B Break-out activity

14:15 - *Facilitator: Dilip Kajale & Satish Nagaraji*

- 15:30**
- FPO representatives and digital innovators to define the key performance indicators, identify the collaboration opportunities with FPOs and other stakeholders in each theme (Activity to be done in groups formed during Session 6).
 - Groups report back from the activity discussions

Session 7 Valedictory and way-forward

15:30 - ▪ Observations from start-ups

16:30 ▪ Observations from FPOs

- Observations from other stakeholders

- Observations: *Jawoo Koo & Andrea Gardeazabal*

- Summary: *Satish Nagaraji & Dilip Kajale*

- Valedictory remarks: *Dasharath Tambhale, Director, ATMA, Maharashtra*

Annex 2: List of Participants

NAME	AFFILIATION
1. Adarsh Muri	Agri Bridge
2. Ajith Kanitkar	Researcher
3. Amit Patil	Kheti Buddy
4. Anagha Kestur Sathyanarayan	Akashic Bytes
5. Ananya Khurane	GIPE/ CIMMYT
6. Andrea Gardeazabal	CIMMYT/ DI
7. Anil Lade	Market Yard
8. Annvar Shikh	Bhose Agro Producer Company Ltd
9. Arun Kamble	SMART
10. Aruna Sachin Pavashe	Pragati Losanchalit Sadhan Kendra
11. Arvind Rithe	SMART
12. Asha Barjo	Akashic Bytes
13. Ashok Bankhele	SMART
14. Ashok Bhor	Bhimashankar Agro Producer Company Ltd
15. Ashutosh Deshpande	Reliance Foundation
16. Atanu Garai	Social Well
17. Ayub Shaikh	Chouranginath Agro Farmers Producer Company Ltd

18.Balasaheb Solankure	Bhudargad Natural Farmers Producer Company Ltd
19.Dasharath Tambhale	ATMA
20.Dattarya Chougule	SMART
21.Deepak Jayram Waghmode	SMART
22.Deepak Patil	Resilent Lab
23.Deepak Rengade	SMART
24.Deepak Sinha	Grant Thornton
25.Dhyaneshwar Dokle	Farmer
26.Dinesh Kumar Chauhan	De-Haat
27.Dilip Kajale	GIPE
28.Hanmant J. Shinde	ATMA
29.Hrishikesh Shinde	Kheti Buddy
30.Jawoo Koo	IFPRI/DI
31.Karsanbhai Jadeja	Banas Farmers Producer Co
32.Krishna Mishra	E-Kutir
33.Manik Tiyaambake	SMART
34.Medha Adhikari	MahaFPC
35.Morup Namgail	IFFCO Kisan Sanchar Ltd.
36.Navneet Rai	Arya Collateral Warehousing Service Private Limited

37.Pavan Kumar K	Blue Number
38.Rahul Godse	MahaFPC
39.Ramdas Buchude	Government of Maharashtra
40.Ravinderjit Singh	Reliance Foundation
41.Rengalakshmi Raj	M.S. Swaminathan Research Foundation
42.Reshma Sayyed	ATMA
43.Sachin Kadam	SMART/ATMA
44.Sachin Shinde	SMART
45.Sachin Thite	Bhuseva Shetkari Farmers Producer Company Ltd
46.Sachin Thube	Greenup Farmers Producer Company Ltd
47.Sanmati Nalage	Chandan Ishwar Farmer Producer Company
48.Satish Nagaraji	CIMMYT/ DI
49.Shailesh Kumdale	Atola Farmers Producer Company Ltd
50.Sherin Maria	CIMMYT
51.Shreyas Bhartiya	World Bank
52.Sushant Malik	GIPE/ CIMMYT
53.Unmesh Suryawanshi	Scion Agricos Pvt Ltd
54.Vaibhav G Tambe	SMART
55.Vedant Manore	HaqDarshak
56.Venu Margam	Kalgudi Digital Pvt Ltd

57.Vikas Khade	SMART
58.Vikramsinh Nimbalkar	SMART
59.Vivek Swami	Kheti Buddy

Annex 3: Groups for Mini-marketplace and World café

Digital Innovators in the MarketPlace	FPOs in the MarketPlace
1. Akashic Bytes	1. Bhose Agro Producer Company Ltd
2. Market Yard	2. Pragati Losanchalit Sadhan Kendra
3. Social Well	3. Bhimashankar Agro Producer Company Ltd
4. Resilent Lab	4. Chouranginath Agro Farmers Producer Company Ltd
5. E-Kutir	5. Bhudargad Natural Farmers Producer Company Ltd
6. Agri Bridge	6. Kisan field Fresh FPC
7. De-Haat	7. Banas Farmers Producer Co
8. Kheti Buddy	8. Bhuseva Shetkari Farmers Producer Company Ltd
9. IFFCO Kisan Sanchar Ltd.	9. Greenup Farmers Producer Company Ltd
10. Blue Number	10. Chandaneshwar Agro Producer Company
11. Arya Collateral Warehousing Service Private Limited	11. Atola Farmers Producer Company Ltd
12. Kalgudi Digital Pvt Ltd	
13. HaqDarshak	

Annex 4: Breakout groups: Comprehensive roadmap for digital transformation

Group 1 (Digitization of FPOs)	Group 2 (Value Chain Actor Aggregation Platforms)
<ol style="list-style-type: none"> Kheti Buddy Blue Number Chandaneshwar Agro Producer Company <p>Facilitator: Sushant Malik</p>	<ol style="list-style-type: none"> E-Kutir De-Haat Bhose Agro Producer Company Ltd <p>Facilitator: Dilip Kajale</p>
Group 3 (Precision Agriculture and Automation Solutions)	Group 4 (Urban Food Systems and Logistics Solutions)
<ol style="list-style-type: none"> Resilent Lab IFFCO Kisan Sanchar Ltd. Agri Bridge Pragati Losanchalit Sadhan Kendra <p>Facilitator: Jawoo Koo</p>	<ol style="list-style-type: none"> Arya Collateral Warehousing Service Private Limited (ARYA) Kalgudi Digital Pvt Ltd Greenup Farmers Producer Company Ltd Bhimashankar Agro Producer Company Ltd Chouranginath Agro Farmers Producer Company Ltd <p>Facilitator: Andrea Gardeazabal & Ananya Khurana</p>

Group 5 (Market Linkage and Traceability Solutions)	Group 6 (Access to Financial Services)
<ol style="list-style-type: none"> 1. Akashic Bytes 2. Market Yard 3. Kisan field Fresh FPC 4. Bhuseva Shetkari Farmers Producer Company Ltd <p>Facilitator: Sachin Kadam</p>	<ol style="list-style-type: none"> 1. HaqDarshak 2. Social Well 3. Bhudargad Natural Farmers Producer Company Ltd 4. Atola Farmers Producer Company Ltd 5. Banas Farmers Producer Co <p>Facilitator: Satish Nagaraji</p>