TRANSITIONING FUTURE SMALL FARMS IN INDONESIA:

10 BEST PRACTICES FOR AGRITECH STARTUPS & WIDER ECOSYSTEMS

UTS UNIVERSITY OF TECHNOLOGY SYDNEY

lestari

Australian Government

Australia-Indonesia Institute

Acknowledgments

This report is the first edition of the first publication from a study conducted by a team from the Transdisciplinary School at the University of Technology Sydney (TD School at UTS) on Indonesia's agricultural innovation ecosystem and the diffusion of innovation. February 2025.

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Website for more updates on this initiative:

https://agritech.futurelestari.com

UTS, LESTARI, AND AUSTRALIA-INDONESIA INSTITUTE

About the University of Technology Sydney & Transdisciplinary School

UTS is Australia's #1 young university and has over 44,000 students. It focuses on theory application for real world solutions, especially technology related. Our strength relies on hands-on and creative approaches in teaching, research, work placements, community and case-based projects, with strong industry connections. UTS also sits in an innovation precinct that is home to Australia's largest cluster of start-up firms that are designed to inspire and support creativity, entrepreneurship and collaboration.
The Transdisciplinary School at UTS epitomises this by bringing together academics, students and industry partners from across a radically diverse range of disciplines and sectors. Together, we use complex systems thinking, innovative and entrepreneurial methods to address complex societal challenges. More at tdi.uts.edu.au.

About Lestari & Pijar Foundation

Lestari is a sustainable innovation hub and venture builder ecosystem that focuses on building, accelerating, and investing in sustainability innovations within Indonesia and Southeast Asia. It focuses on bringing together startups and innovations that address current and future challenges. As part of Pijar Foundation, Lestari contributes to the foundation's mission of accelerating a future-fit ecosystem in Indonesia.

Pijar Foundation is a non-profit organization dedicated to guiding and assisting strategic players in embracing future trends, opportunities, and challenges. Through programs like Lestari, Pijar Foundation fosters transformation by shaping minds, markets, and policies to create a sustainable and prosperous future. More at https://futurelestari.com/.

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Australia-Indonesia Institute (AII) is established by the Australian Government - Department of Foreign Affairs and Trade (DFAT) to foster mutual understanding and engagement between Australia and Indonesia. Since its inception in 1989, AII has played a critical role in strengthening bilateral ties by supporting initiatives in education, economic and business engagement, digital innovation and technology, culture, and community development. Through grants, partnerships, and programs, AII promotes people-to-people connections, enhances cross-cultural dialogue, and addresses shared challenges, such as sustainable development. By prioritizing long-term engagement and inclusivity, AII contributes to a robust and dynamic Australia-Indonesia relationship for mutual respect and cooperation. More at https://www.dfat.gov.au/people-to-people/foundations-councils-institutes/australia-indonesia-institute.

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FOREWORD FROM THE AUTHORS

Welcome to the report on "Transitioning Future Small Farms in Indonesia: Ten Best Practices for Agritech Startups & Wider Ecosystems."

This report is a synthesis of the latest research on how innovation makes its way to market in context of rural areas and the agricultural sector. The agricultural sector is under increasing pressure to keep up with global population growth, while also not leaving farmers and smallholder behind in the increasing wealth gaps. There is enormous opportunity for sustainable, technology-enabled growth in a way that is a win-win-win for farmers, the tech sector, and public policy across Indonesia.

Agritech is a particularly challenging space because the innovators are often far removed from the implementation of their ideas, which can result in good ideas never getting adopted and not-so-good ideas being implemented poorly, both of which create wasted opportunities for innovators, farmers, intermediaries and public policy. In this report, our team looks to the latest research on rural and agricultural entrepreneurship, and on the diffusion of innovation and innovation systems, coupled with interviews with over 100 key stakeholders across the Indonesian agritech landscape to propose ten best practices.

This project and report would not have happened without the funding from the Australian-Indonesian Institute (AII), part of the Australian Department of Foreign Affairs and Trade (DFAT), and in-kind contributions from Lestari (by Pijar Foundation). Thank you! We would also like to thank our wider set of partners for this project, including Bandung Institute of Technology, eFishery, Institute for Statistics and Socio-Ecological Development, Kopernik, PRISMA, su-re.so, and Syiah Kuala University

We hope you find the best practices in this report insightful and useful and encourage you to share them with others in the agritech ecosystem.

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FOREWORD FROM LESTARI DIRECTOR

Indonesia's vast and diverse rural landscape presents immense opportunities for innovation-driven growth. However, translating groundbreaking research into scalable, real-world solutions remains a significant challenge. Rural regions, in particular, face unique barriers ranging from infrastructure limitations to market readiness gaps that hinder the widespread adoption of transformative innovations. This research on Startup Ecosystems for Scaling Innovation Adoption in Rural Indonesia explores the critical role of ecosystem enablers in bridging this gap and driving impactful change.

As a collaborator in this research, we have witnessed firsthand how the synergy between startups, companies, and local communities can accelerate meaningful, lasting progress.
This study offers essential insights into the key enablers and structural challenges shaping Indonesia's rural startup ecosystem. It also outlines strategies to strengthen the ecosystem empowering startups to drive advancements in agriculture and sustainable, sectors that are fundamental to Indonesia's sustainable future.

We hope this research serves as a catalyst for action, inspiring ecosystem stakeholders to support and scale innovations that transform rural communities. Driving innovation adoption is not just an economic necessity, it is a strategic commitment to a more inclusive, resilient, and sustainable future.

"Driving innovation adoption in rural Indonesia is not just an economic necessity, it is a strategic commitment to a more inclusive, resilient, and sustainable future"

Cynthia Krisanti
Director
Lestari

EXECUTIVE SUMMARY

This report is the first publication from a qualitative research project on agricultural entrepreneurship and innovation diffusion in Indonesia. The report summarises ten best practices that have emerged from over 100 interviews over four provinces, with a focus group workshop in each province. The project would not have been possible without the generous support from the Australian Government and our partners, especially Lestari by Pijar Foundation. Through their networks we were able to promote the project and recruit a large number of participants from a very broad range of occupations across the ecosystem, all within four months of field work. To some extent, the process of collaborating with NGOs for this research illustrates first-hand the power of cross-sector partnerships to bridge the gap between innovation providers (e.g., startups) and farmers.

The best practices described in this report have emerged via in-situ preliminary analysis of the agritech sector, with more rigorous analysis of the interviews and reports to follow. We also acknowledge that these ten best practices are not an exhaustive list, and that additional best practices may emerge with further analysis. We also note that the practices should be considered in combination with one another, and that their implementation will vary depending on the organisations involved (e.g. farmer, innovation provider or intermediary).

From our initial analysis, the ten best practices are synthesized in this report are:

1. **Arrange on-farm demonstrations**
2. **Offer insights that take the farmer's point of view**
3. **Collaborate to enable effective farm financing and advisory**
4. **Create both in-person and online interactions**
5. **Prioritise farmer ROI**
6. **Aim for sustainable and seasonal growth**
7. **Leverage blended capital**
8. **Collaborate with NGOs to advocate for policy change**
9. **Collaborate with hubs of farmers**
10. **Be authentically sustainable**

The best practices from this report benefitted from feedback on preliminary versions presented at the 2024 ISPIM Connects Conference in Osaka, Japan and the 2025 ACERE Conference in Melbourne, Australia. ISPIM is the International Society for Professional Innovation Management, formed in 1983, and is the world's oldest, largest and most active truly global innovation network. ACERE is the Australasian Consortium for Entrepreneurship Research Excellence, a newly formed society to support the ACERE conference which is now in its 21st year of operations, with a majority of international researchers. As we review the interview data with increasing rigour, we expect to publish subsequent findings via journal articles and other forms of knowledge exchange.

While this study has focussed on the Indonesian context, we believe that the findings are relevant to farmers and agritech innovators in other parts of the world. As the importance of this sector grows, we look forward to future collaborations and opportunities for Indonesia's agricultural innovation ecosystem and rural entrepreneurship to bloom and be sustained.

Section 1
Research Context

BACKGROUND

Agricultural innovation and entrepreneurship represent the intersection of primary industries upon which many economies are built, and the livelihood of many independent farmers. The introduction of new technology or new innovations in agriculture, shortened here as agritech, can contribute to the productivity and socioeconomic wellbeing of those farmers. Agritech includes agri-marketplaces, farm management software, IoT & AI based precision agriculture, farming mechanisation, digital financing, biotechnology modification, digital extension advisory, and much more, and can include innovative nature-based solutions towards sustainable regenerative agriculture. In cases where sustainable farming activities and food security are at increasing risk due to climate change, innovations are imperative (Taylor and Asnawi, 2024). Without further support, we can expect more "farm exits" and potentially more farmer suicides (Bharadwaj et al, 2023). However, there have always been gaps between those who produce an innovation and those who adopt it. These gaps can be especially challenging in the context of agricultural entrepreneurs with all the farming complexities and unattractive perceptions.

This research project aims to better understand how innovations are introduced and adopted by farmers in Indonesia, including how local knowledge by farmers can shape innovations. There are more than 500 million farmers in the world which 90% of them are smallholders (World Bank, 2016). In Indonesia, 17.2 million smallholder farmers contribute to feeding its 280 million (and growing) population (Badan Pusat Statistik, 2023). Meanwhile, according to Traxcn (2025), Indonesia boasts 247 agritech startups, consistently the largest in ASEAN countries even more than Singapore. Despite these numbers, farmers and startups struggling to find product-market fit in the agritech sector, resulting in rural areas being left behind in accessing and adopting innovations to achieve sustainable impact. This report synthesises best practices from the literature with emphasise on primary research conducted in Indonesia. The main geographical representation of this study location are the four provinces: Jakarta, West Java, Bali, and Aceh, visualised in Figure 1.

Figure 1. Workshop and research locations

METHODOLOGY

To get a current and rich understanding of how agritech innovation happens, contextualised to different regions in Indonesia, a qualitative approach was required. The primary method of data collection was via semi-structured interviews. As shown in Figure 2, we achieved a very diverse and balanced range of key stakeholders, including farmers, innovation providers, consultants, brokers, community organisations, innovation providers (incl. startups), researchers, and policy makers. These interviews were complemented by secondary resources, observations, and focus group workshops in each region. Since September 2024 – January 2025, we have completed 131 interviews from 8 group categories with 41% female participation. Each interview and workshop was audio recorded with informed consent, as per university research ethics protocol, enabling deeper analysis

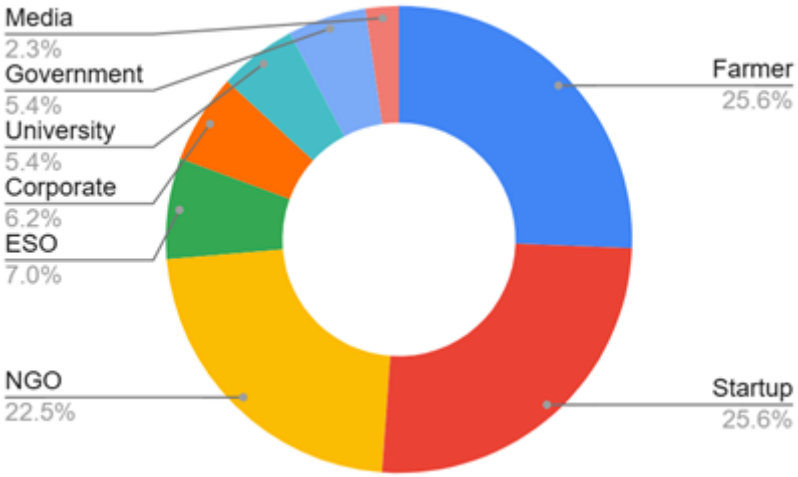


Figure 2. Research Participants

Section 2

INNOVATION THEORIES

This research builds on established theories about the Diffusion of Innovation (DoI). One of the most fundamental DoI theories is from Everett Rogers (1962). DoI is a long well-established topic in social science and innovation studies since 1940s (Rosário et al., 2022). Rogers' (1962) seminal DoI theory explains how innovation spreads with emphasis on the underlying social system. It originated as a cornerstone theory for studying the introduction of whitegoods like refrigerators and televisions, while assuming a relatively one-way flow of innovation from the innovator to the consumer.

Roger's DoI theory is focussed five key aspects of the innovation: (i) its relative advantage in comparison to the current solution, (ii) its compatibility with existing values, experiences, and needs of potential adopters, (iii) its complexity and the ability to understand what the innovation offers, (iv) its trialability and ease of testing before committing to it, and (v) its observability by those who are potentially interested in it. Most of those points are about the innovation itself, and partially about the perceptions of the potential customer.

Building on thos aspects, DoI identified five categories of users (also known as 'adopters') based on their willingness to try new innovations, categorised according to which sequence they adopt an innovation until the market is saturated (also visualised in Figure 3):

1. **Innovators**: Risk-takers who are the first to adopt new technologies.
2. **Early Adopters**: Opinion leaders who influence others after seeing innovator's success.
3. **Early Majority**: Pragmatic individuals who adopt innovations after seeing early adopters' success.
4. **Late Majority**: Sceptics who adopt only after the majority has already done so.
5. **Laggards**: Traditionalists who are the last to adopt, if at all.

Figure 3. Adoption of innovation over time and user segments (Source: CPI, 2019)

More recent theories recognise the flows of feedback and knowledge in the opposite direction as well as the role of intermediary organisations along the value chain as well as support organisations like incubators, accelerators, NGOs, distributors, suppliers, corporate lawyers, accountants or other professionals who help build the business that introduces the innovation. Altogether, these stakeholders form innovation ecosystems, including in the agritech sector (Barzola et al., 2020; Shrivastava & Dwivedi, 2021; Aguilar, 2021; Zanello et al., 2016). The dynamics of innovation systems reflects the non-linear rate of adoption or diffusion in Figure 3.

In agricultural innovation research, theory and practice have evolved together over multiple generations. There was initially a focus on science-led innovation, which transitioned to a focus on farm-led innovation ecosystems (as illustrated in Table 1 below, adapted from Klerkx, et al (2012). In this research project, we adopt such an ecosystems-view to simultaneously consider the micro-perspective of farmers' decisions, the perspectives of the innovation providers, and the perspectives of intermediaries in the ecosystem.

	Adoption and Diffusion	FSR (Farming System Research)	AKIS (Agriculture Knowledge & Information System)	AIS (Agricultural Innovation System)
Era	From 1960s	From 1980s	From 1990s	From 2000s
Farmer Role	Adopters to Laggards	Sources of Info	Experimenters	Partners, Innovators, Entrepreneurs
Science Tech Role	Innovators	Experts	Collaborators	Partners
Mental Model (Approach)	Supply technologies from pipeline	Learn farmers constraints through surveys	Collaborate in research and extension	Co-develop innovation in partnership
Knowledge and Discipline	Single Discipline Driven (e.g. breeding)	Multidisciplinary (agronomy and economics)	Interdisciplinary (plus sociology and farmers)	Transdisciplinary (holistic systems perspective)

Table 1 Evolution of Agricultural Innovation Approach

Section 3
Best Practices

Smallholders face unique challenges when transitioning toward sustainable and technologically advanced agriculture. This transition requires a strategic approach by multiple key stakeholders in the innovation ecosystem. This section outlines ten best practices that have emerged from our interviews in accelerating the adoption of agritech innovations, empowering smallholder farmers, and fostering sustainable agricultural growth.

BEST PRACTICE 1:

ARRANGE ON-FARM DEMONSTRATIONS

> *Not just on farming practices and how to use the new innovation, but demonstration of the increased harvest result after using that innovation can even be more significant and influential. This [demonstration] process cannot happen in a room setting but is best in a nearby field or farm" (Farmer in Aceh)*

Figure 4. An interactive demonstration on regenerative rice farming practice by Astungkara Way

One of the most convincing means for farmers to evaluate whether to implement an innovation is to see it in person, integrated into a real context. See Figure 4 for example. The majority of interviews with farmers consistently mentioned the importance of authentic demonstration as a powerful and effective way to encourage smallholder farmers to see or even experience the value of an innovation and see how its integrated within a working farm operation. In comparison, very few innovation providers were identified as doing providing on-farm demonstrations.

Implications for Practice: There are four common types of demonstration activity in agriculture: Demoplot, Farm Field Day, Field School, and Harvest Day. They often target early adopter farmers who are more open to trying new technologies and to help establish proof-of-concept. Adoption by these early thereby also provides proof-of-market for the early majority and late majority adopter types. For this majority, some of the best demonstrations also include helping farmers understand the relative advantage of the innovation in comparison to previous practices. Demonstrations can also simplify the perceived complexity of an innovation if they can demonstrate seamless integration with the existing operations, rather than requiring a reconfiguration of the farm's operations. Investing in demoplots can be done by agritech innovation providers, governments, and NGOs as a strategic way to drive innovation adoption and transform agricultural practices in rural regions.

The impact of demonstrations are further enhanced when farmers visit nearby farms (peer influence) and see the innovation in action, making the benefits more relatable and credible.
See also: FarmDemo Training Kit https://farmdemo.eu/ (funded by the European Union)

BEST PRACTICE 2:

OFFER INSIGHTS THAT TAKE THE FARMER'S POINT OF VIEW

There can be many features of an innovation and its implementation for farmers to consider. Evaluating an innovation can involve a high cognitive load and extensive evaluation criteria to compare across alternative innovations. This can overwhelm farmers who are already juggling countless tasks from preparing land, selecting and purchasing inputs, planting, managing pests, harvesting, selling, and more. Changing any part of their operations needs to be as simple as possible. This is why agritech innovations must be easy to evaluate, install, maintain and integrate into their daily lives, preferably also in a way that they can customise how the innovation fits their unique needs. From the farmer's point of view, the innovation should feel like a natural extension of what they're already doing, not a complicated add-on that requires a lengthy manual and several days of training to install, operate and maintain.

Imagine a shrimp farmer trialling a new IoT smart feeder to replace manual feeding by hand using a bucket. If it has a long setup time, requires technical knowledge to set up, adding hazardous electrical connections in wet environments, frequent troubleshooting to maintain and refill with specialised feed, they're likely to abandon it. A decision to abandon a new innovation is particularly troublesome of returning to the older method also requires a lot of effort to restart.

> *Seems like agritech startups are failing the farmers in Indonesia with their high-tech obsession. I now have more hopes on small local workshops who develop/adapt the frugal version providing customised models of equipment" (Research & Development Professional)*

Designing innovations requires genuine empathy for end users for their daily situation as well as how they experience the innovation evaluation and adoption journey on top of that daily situation. Many innovation providers have teams of product designers and product managers. But what appear obvious or simple for these product teams and their knowledge base might ended up feeling completely foreign for the farmers. Even something as simple as an app for remote or automated feeding control may easily become a burden for farmer's if the app competes for the phone's limited battery and memory, or alerts become invasive to their other uses of the phone. The above reasons are contributing to a rise in the use of non-IoT feeding equipment in shrimp sector in comparison to more technologically advanced IoT smart feeders (see Figure 5 for comparison).

Figure 5. Shrimp Feeder: IoT (Left) and Non-IoT (Right)
(Source: https://www.minapoli.com)

Implications for Practice: For agritech innovation providers, the message is clear: keep it simple for the farmer, even if it's complex behind the scenes. This means designing user-friendly interfaces, providing clear and intuitive instructions, and offering solutions that can be tailored to local conditions. Where these efforts still fall short, governments and NGOs can provide support by funding training programs that help farmers better understand and use the new innovations. Meanwhile, farmers should feel empowered to provide feedback to the innovation providers to improve their relevance.

We expand this recommendation to note that innovation providers would be wise to enable efficient supply chain integration. If the innovation provider cannot offer an integrated solution, then the interfaces to the innovation need to be standardised or modular enough to connect with those of other providers up- or down-stream in the supply chain, including component suppliers and offtakers. This will help farmers who favour market-led solutions over product-led innovations.

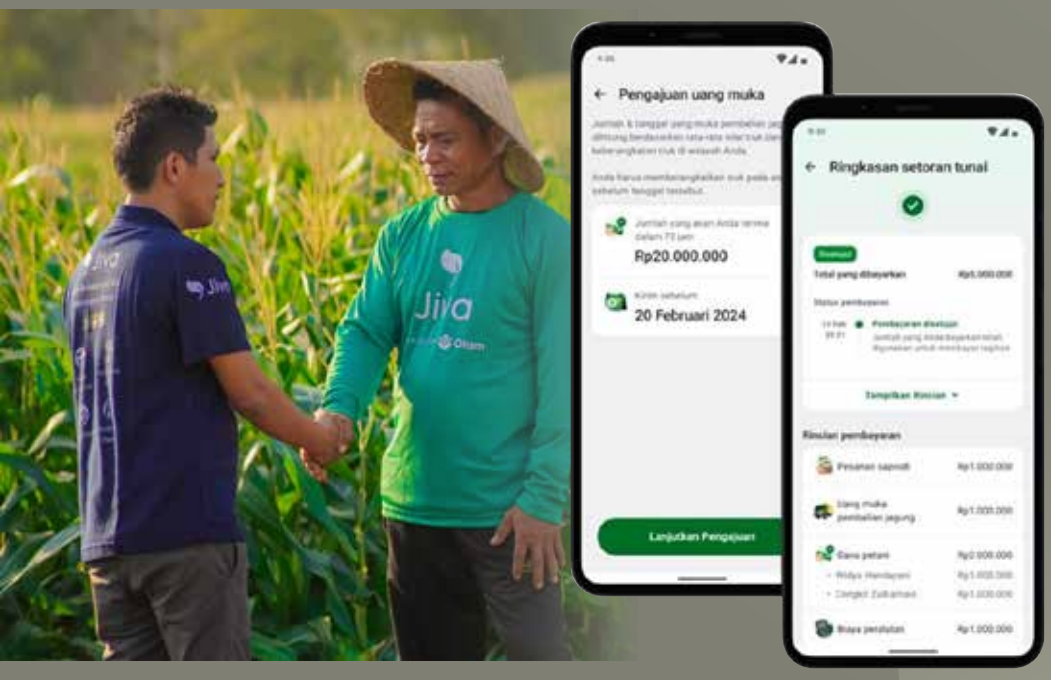
BEST PRACTICE 3:

COLLABORATE TO ENABLE EFFECTIVE FARM FINANCING AND ADVISORY

> *"The government and banks launched agricultural micro credit since more than 10 years ago, but this KUR Pertanian or KUR Budidaya on the ground most of the time cannot be accessed by us small farmers or even the cooperatives" (Head of Farmer Group)*

One of the most significant barriers to adopting innovations cited in prior research, news, and in interviews we conducted is smallholders is limited access to financing and related advice. Without the necessary capital to purchase inputs like seed, feed, equipment, critically paired with the knowledge to use them effectively, farmers are often unable to realize the full potential of their farm and innovations that require an upfront investment of time and knowledge. In the growing end-to-end agritech solutions, this embedded financing and advisory support are the phenomenon of many startups in Indonesia and other developing countries globally. While financial institutions play a crucial role in providing input financing, agritech innovation providers are uniquely positioned to deliver advisory support, ensuring the successful adoption of their innovation.

Implications for Practice: To bridge the gap between innovation providers and smallholders, collaboration is imperative, such as with other private sector organisations, multiple levels of government, financial institutions, NGOs or local farmers and entrepreneurs. Through collaboration (not purely transactions), agritech innovation providers can improve the relevance of product design and embed financing in their business model.



Changing the terms of payment can decrease economic risks to farmers. As an example, Jiva, a corn-focused startup, provides a financing scheme whereby farmers can buy inputs and defer payment until harvest (Figure 6). This kind of new business model would lead towards a healthy sustainable business ecosystem of small farms that can afford to actively adopt new innovations.

Figure 6. Financing for farmers through local collectors by Jiva (Source: https://www.jivapetani.co.id/pengumpul)

Another method of changing the terms of financing is invoice financing (also known as invoice factoring). This allows farmers to sell their harvest to a buyer along with an invoice including a delayed payment term (e.g., 30, 60, or 90 days). If the harvest buyer does not immediately pay the invoice, then the farmer can apply for invoice financing to a financial provider by submitting the unpaid invoice along with other proofs of the buyer's ability to pay. The financial provider then lends the farmer a large percentage of the invoice value upfront minus an administrative fee or interest charge. When the payment term ends, the buyer pays the full invoice amount directly to the financial provider. After deducting their fees, the financial provider then transfers the remaining balance to the farmer.

Another method of financing is for farmers to aggregate their financing needs with the aggregated application for financing being brokered and lodged to a bank by a startup. Such P2P schemes between farmers and startups can also be combined with input financing and contract farming schemes. While this is a novel form of financing, several of these startups have struggled to make this model work for themselves and discontinued offering it to farmers, such as iGrow, TaniFund, and more recently eFishery.

BEST PRACTICE 4:

CREATE BOTH IN-PERSON AND ONLINE INTERACTIONS

While digital tools have become widely used and offer incredible potential for reaching farmers, they should not be the sole focus of agritech innovation providers and stakeholders. Overemphasising digital platforms can exclude a large proportion of farmers who lack access to technology or prefer face-to-face interactions. Instead, a balanced approach that combines online engagement with in-person interactions is essential for ensuring that agritech innovations are accessible, understandable, and adopted by farmers, regardless of their location or tech-savviness. This dual strategy maximises reach while maintaining the human connection that builds trust and drives meaningful change.

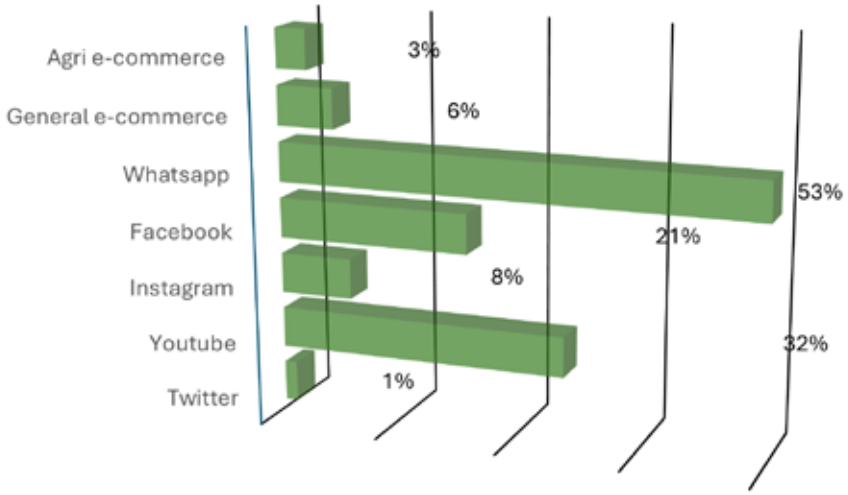


Figure 7. Apps used by farmers (Hadiarto, 2024)

Almost every interviewee said many farmers have a smartphone, but also that they mainly only used WhatsApp, YouTube, and sometimes Facebook, whether to interact socially or to learn about agritech innovations. This is aligned with a recent study that conducted a survey of ICT adoption to 375 farmers in Java (Figure 7), finding that farmers have relatively good digital literacy level at 2.44 out of 4.00 (Hadiarto, 2024), but that (i) only 3.5% were using agri e-commerce apps such as My Agri, Agromart, TaniHub, or RiTx, and (ii) only 6.4% were using more general e-commerce apps such as Shopee, Tokopedia, or Bukalapak. In contrast, farmers' usage of WhatsApp and YouTube were remarkably higher at 53% and 32%, respectively.

> ***We started the startup as an AI-powered crop doctor app, but we learned our lessons and now strongly operate in 'phygital' ecosystem – harmony of physical and digital. Our mobile app has transitioned a lot to become very simple and light that connects to WhatsApp". (Head of growth from an agritech startup)***

Implications for Practice: These distributions indicate that agritech innovation providers need to maintain a strong presence on popular platforms like WhatsApp and YouTube, through which to incrementally draw farmers towards more sophisticated apps or websites. WhatsApp can facilitate questions and answers between farmers and their shared experiences, including facilitating conversations with the innovation providers. Very recently, two AI chatbot agronomic assistants in WhatsApp have been emerged and used freely by some Indonesian farmers: Agriana AI (+6282210003885) and Pak Dayat AI by Dayatani (+6285192654199)Similarly, YouTube can demonstrate how to use an innovation, with the comments section providing an opportunity to facilitate questions and answers. YouTube channels like CapCapung and PecahTelur has become a big agriculture media with subscribers more than 1 million each.

The above statistics are encouraging, but over relying on digital platforms risks leaving behind many farmers who still lack access to smartphones or the internet, or those who simply prefer learning through direct, hands-on experiences of in-person interactions, such as field visits, demonstration plots, and training sessions. Farmer-to-farmer learning, where early adopters share their success stories, is another powerful way to inspire others and create a sense of community around new practices.

BEST PRACTICE 5:

PRIORITISE FARMER ROI

> *The single most important enabler in my opinion for modernising Indonesian farmers are the market innovations, which is when there is an offtaker prevalence" (Government Owned Professional on Agrifood)*

For small farmers, access to reliable buyers is often the missing link between increased productivity and improved livelihoods. While agritech innovations can boost yields and efficiency, their true impact is realized only when farmers can sell their produce at fair prices. Prioritising market access to farmers ensures that they not only grow more but also earn more, to make ends meet and achieve financial stability.

One of the most common ways agritech startups are supporting farmers is by acting as the offtaker or by creating business processes that connect farmers fairly to offtakers. Offtakers are buyers like supermarkets, processors, exporters, or even local businesses that purchase agricultural products in bulk. By stepping into this role or facilitating these connections, have a more reliable market for their produce, reducing the risk of unsold harvests and exploitation by middlemen. However, the key to sustainability lies in creating a balanced ecosystem where both farmers and offtakers benefit equally.

Figure 8. Daily Price Update from Startup Pempem as Sustainable Ethical Trader for Palm Oil Fresh Fruit Bunches (Source: https://welcome.pempem.io/)

Implications for Practice: A critical first step in improving market access is providing farmers with real-time transparent commodity price information. Many farmers rely on middlemen for market updates, often receiving outdated or inaccurate information that leads to poor decision-making. Startups disrupt this system by integrating price updates into their platforms. For instance, some startups in shrimp aquaculture and crop businesses have gained significant traction simply by offering real-time price data, empowering farmers to negotiate better deals and plan their production based on market trends all while regularly checking the startup's platform. An example from Pempem providing daily price update of Palm Fresh Fruit Bunch in Figure 8 above.

Beyond current price information, innovation providers can invite farmers to align their production with market demand within a business process that works for both sides. Too often, farmers grow the same crops year after year, regardless of whether there is a market for them. By using data analytics and forecasting market demand, innovation providers can guide farmers to diversify or change crops to match what buyers want, reducing the risk of unprofitable or unsold produce. This shift not only increases farmers' incomes but also makes their operations more resilient to market fluctuations.

At the heart of this practice is the need to prioritise farmer's ROI (Return on Investment). Agritech innovation providers must measure their success not just by their own profitability but by the financial gains they deliver to farmers. When farmers see that using a innovation provider's product or service leads to higher incomes, they are more likely to adopt and sustain its use. This creates a positive feedback loop, where increased farmer ROI drives further adoption and innovation.

Startups like Pempem and Astungkara Way demonstrate the power of connecting farmers to offtakers. By aggregating farmers who practice regenerative agriculture and linking them with buyers willing to pay a premium for sustainable products, Pempem ensures higher incomes for farmers and themselves while promoting eco-friendly practices.

BEST PRACTICE 6:

AIM FOR SUSTAINABLE AND SEASONAL GROWTH

> *Startup model where founders are often coming from MBA of top universities or entrepreneurship incubation program might never really understand the art of agriculture pace" (Founder of social enterprise)*

Unlike software startups that can scale rapidly with minimal infrastructure supports, agritech solutions operate within complex biological, social, and economic ecosystems. Incremental innovation where gradual improvements rather than disruptive overhauls would lead to more sustainable adoption among farmers. While scaling and growth are often the ultimate goal for startups and ecosystem players, but in agriculture it must be approached with care and mindfulness.

Rapid unchecked scaling, often referred to as "blitz scaling", can lead to systemic instability, mismatched solutions, and unintended consequences, not only for the farmers but also for the startups and wider ecosystem stakeholders. Instead, scaling should be incremental, context-aware, and sustainable, ensuring that innovations are adapted to local conditions and genuinely meet farmers' needs. This practice emphasises the importance of respect for seasonality and temporality in agriculture, rather than prioritising speed at the expense of long-term impact.

Mindful scaling would appreciate incremental innovation. Meaning not every solution especially in agriculture needs to be groundbreaking or revolutionary. Many times, the most effective innovations are small practical improvements that build on existing practices. A good example of iterative practical improvements comes from Lokatani, an agritech startup that started with introducing Google Sheets for their new farmer partners to record monitoring notes online, which then provides incremental data for IoT smart farming adoption 2-5 years later. These incremental changes are easier for farmers to integrate into their routines, reducing resistance and increasing the likelihood of success.

A critical consideration is the seasonality and temporality of agriculture. Farming is inherently tied to natural cycles and seasons, and innovations must align with these rhythms to be effective. For example, immediate results may not always be visible within a single growing season. In addition, a solution that works perfectly during the rainy season may fail during the dry season if not adapted accordingly. Unfortunately, many interviews and articles mentioned that agritech startups have business models that were too complex or did not align with the realities of farming in Indonesia. Meanwhile, many agritech startups have struggled to grow their operations at the pace expected of mainstream startups, resulting in pivoting to a non-agriculture sector or becoming inactive, such as those featured in Figure 9. These startup dynamics can make farmers more sceptical about adopting their innovations.

Figure 9. Prominent Indonesian Agritech Startups that have Struggled with Rapid Scaling

Implications for Practice: Mindful scaling also requires good governance and system stability. While the temptation to grow quickly can be strong, prioritising speed over stability often leads to breakdowns in service delivery, farmer dissatisfaction, and even reputational damage. For example, a startup that rapidly expands its digital platform without ensuring reliable internet access in rural areas may leave farmers frustrated and disengaged. Instead, startups should focus on building robust systems that can handle growth sustainably, ensuring that every farmer, whether among the first or the thousandth to adopt, receives consistent support and value.

Engaging with Governments and NGOs can support this effort by co-developing policy, program, funding and infrastructure that enable sustainable scaling. Farmers, in turn, should be actively involved in the scaling process, providing feedback and insights to ensure that innovations remain relevant and effective. Mindful scaling is not about how fast an innovation can spread but about how well it can integrate into the lives of farmers.

BEST PRACTICE 7:

LEVERAGE BLENDED CAPITAL

> *We believed more in bootstrapping from the very beginning. It's not just about financial independence, but also about staying true to our vision without the pressure or influence of external investors. We want to grow slowly, make decisions that align with our values, and prove that we can build something meaningful without relying on VC funding." (Founder of an agritech startup*

In the world of agritech innovation providers, the pressure to deliver quick returns can often lead to a vicious cycle of failure. Traditional venture capital (VC) investors typically expect rapid growth and exits, such as IPOs or acquisitions, within a relatively short timeframe. However, agriculture is inherently a long-term game with lower returns and arguably more risky than in other sectors (Marston, 2024). This mismatch between investor expectations and agricultural realities can force startups to prioritize short-term gains over sustainable growth, leading to a change in sector or closure. To avoid this, agritech innovation providers should leverage blended capital, a mix of development grants, impact investments, and traditional funding that aligns with the longer horizons and unique challenges of agriculture. Venture capital may still be part of the mix, but requires patient VCs.

Figure 10. Climate and Sustainability Fund Investment Partnership between Australia and Indonesia (Source: Instagram @ACventures)

Blended capital allows innovation providers to balance the need for financial sustainability with the patience required to build impactful long-term solutions. For example, development grants and impact funds often come with a focus on social and environmental outcomes, rather than just financial returns. These sources of funding can provide the breathing room innovation providers need to experiment, iterate, and scale more organically, without the constant pressure to deliver ambitious revenue growth. In comparison, once a innovation providers starts issuing equity to VCs as a startup, they are trapped in a dangerous accelerating valuation game where these VCs and every subsequent investor is aiming for their investment to grow by 10x, with exit options being IPO on a public stock exchange, an acquisition (ideally at a major profit) or closing the business down. Additionally, by sharing capital risk among multiple stakeholders, such as governments, NGOs, and patient investors, startups can access the resources they need while maintaining their focus on creating value for farmers

A recent example of such blended capital in action is the Australia Development Investment (ADI), which announced on 10 February 2025 that it is providing USD 8 million to an Indonesian impact investment fund managed by AC Ventures (Figure 10). This funding will focus on sectors like climate-smart agriculture and other sustainable innovations with the goal of reducing 10 megatons of CO2 emissions (Australian Embassy Indonesia, 2025). By blending development funding with private investment, this initiative demonstrates how blended capital can drive both financial and environmental impact..

Implications for Practice: Diversifying funding sources and aligning them with the realities of agriculture is key. This means seeking out development grants, impact funds, and patient capital from investors who understand the longer return horizons of the sector. Governments and NGOs can support this effort by creating funding programs that prioritize social and environmental outcomes, while private investors can play a role by adopting more flexible, long-term investment strategies. Farmers, in turn, benefit from innovation providers that are financially stable and focused on delivering sustainable solutions.

BEST PRACTICE 8:

COLLABORATE WITH NGOS TO ADVOCATE FOR POLICY CHANGE

> "Our startup now has a dedicated government relation team that focuses to get more partnerships with government from different levels and departments, project deals, and maybe help shape better policy too." (Field Staff of an agritech startup)

In the complex landscape of agriculture, public policy plays a critical role in shaping the environment in which farmers, innovation providers, and other stakeholders operate. Every single interviewee mentioned their high expectations of government to improve the agriculture sector. Policies often lag behind the needs of farmers and innovators, and poorly designed or implemented policies can worsen gaps that hinder progress. A classic example was a policy that encouraged the use of tractors (government subsidy) which were unsuitable to many terraced rice paddies and not affordable to many farmers. This is where policy advocacy becomes essential for innovation providers as well as farmers. By working closely with NGOs, corporates, and government agencies, agritech innovators can influence policies that support sustainable agricultural development, improve market systems, and empower smallholder farmers. Successful policy advocacy may not addresses immediate challenges but creates an enabling environment for long-term growth and innovation.

A standout example of successful policy advocacy is the cattle feed standard change in 2024, led by PRISMA, an NGO-like Australia-Indonesia partnership program focused on agricultural market system development and co-led with PISAgro, an NGO-like association of public-private partnerships on Indonesia's sustainable agriculture and part of international NGO Grow Asia. For years, smallholder cattle farmers in Indonesia relied on affordable locally produced feed that did not meet the Indonesian National Standard (SNI). This high standard was unsuitable for the diverse needs of farmers, forcing many to use unregulated feed or pay premium prices for compliant products. PRISMA and PISAgro, in collaboration with private sectors and universities, advocated for a revised feed standard that introduced multiple quality gradings (see Figure 11). This change allowed affordable locally produced feed to be legally recognized and regulated within safe quality range, benefiting both farmers, feed companies, and the whole beef sector. The new policy not only improved access to quality feed but also boosted beef productivity and market efficiency across Indonesia. This example demonstrates how policy advocacy can address systemic issues and create a win-win situation for all stakeholders.

No	Jenis pakan konsentrat	Persyaratan									
		Kadar air (maks, %)	Kadar abu (maks ,%)	Protein kasar (min, %)	Lemak Kasar (maks, %)	Kalsium (Ca,%)	Fosfor (P,%)	aNDF (maks ,%)	UDP (min, %)	Total aflatoksin (maks,µg/kg)	TDN (min ,%)
1	Sapi potong penggemukan	14,00	12,00	13,00	7,00	0,60-1,20	0,40-0,80	35,00	4,80	200	68
2	Sapi potong Induk	14,00	12,00	12,00	6,00	0,80-1,20	0,60-0,80	35,00	4,80	200	65
3	Sapi potong pejantan	14,00	12,00	12,00	6,00	0,60-0,80	0,30-0,60	35,00	4,80	200	65

No	Jenis pakan konsentrat	Kadar air (maks)	Kadar abu (maks)	Kadar protein kasar (min)	Kadar lemak kasar (maks)	Kadar se-rat kasar (maks)	Kadar kalsium (Ca)	Kadar fosfor (P)	Kadar aflatoksin total (maks)	TDN[a)] (min)	Kadar urea (maks)
		%	%	%	%	%	%	%	µg/kg	%	%
1	**Sapi pedaging penggemukan**										
	Mutu 1	14,00	13,50	14,00	7,00	18,00	0,60 - 1,30	0,40 - 0,80	100	68	2,00
	Mutu 2	14,00	14,50	12,00	7,00	20,00	0,60 - 1,30	0,40 - 0,80	150	62	2,00
	Mutu 3	14,00	15,50	10,00	7,00	22,00	0,60 - 1,30	0,40 - 0,80	200	56	2,00
2	**Sapi pedaging induk**										
	Mutu 1	14,00	13,50	12,00	7,00	20,00	0,80 - 1,20	0,35 - 0,80	75	65	2,00
	Mutu 2	14,00	14,50	11,00	7,00	24,00	0,80 - 1,20	0,35 - 0,80	100	60	2,00
	Mutu 3	14,00	15,50	10,00	7,00	28,00	0,80 - 1,20	0,35 - 0,80	125	56	2,00
3	**Sapi pedaging pejantan**	14,00	12,00	12,00	7,00	22,00	0,60 - 1,00	0,30 - 0,60	100	65	2,00

[a)] TDN: *Total Digestible Nutrient*

Figure 11. Beef Cattle Feed Quality SNI Change: Before PRISMA 2017 (Up) and After PRISMA 2024 (Below)
Source: BSN (2017) and BSN (2024)

Another inspiring example of a recent policy advocacy is the work of Koalisi Ekonomi Membumi in collaboration with Bappenas (Indonesia's National Development Planning Agency) and their member companies and NGOs to shape the country's bioeconomy policy as a coalition. Bioeconomy is the new concept beyond agriculture that was first introduced by OECD in 2006 for improved sustainability transitioning from extractive economy. By focusing on the bioeconomy, a model that integrates biological resources into economic systems, the coalition aims to drive innovation in sectors like agriculture, forestry, and fisheries while promoting environmental sustainability. Their efforts have helped position Indonesia as a leader in bioeconomy development, demonstrating how collaborative policy advocacy can align national development goals with the needs of farmers, businesses, and the environment.

Again, for agritech innovation providers, engaging in such policy advocacy is not just about addressing immediate challenges. It's about creating an innovation ecosystem that supports long-term success. Innovation providers can collaborate with NGOs to identify policy gaps, provide data, market-driven recommendations, and advocate for changes that benefit farmers and the broader agricultural sector. Governments can do better by having platforms for innovation dialogue and collaboration, ensuring that policies are informed by ground-level insights and aligned with the needs of farmers.

Implications for Practice: One of the most effective ways to drive policy change is by leveraging the closeness of NGOs to farmers. NGOs often have deep insights into the challenges faced by smallholder farmers and can provide valuable feedback on how policies can be improved. Innovators and policymakers should actively seek out NGOs to understand ground-level realities and co-create solutions and policies that are practical and impactful. NGOs are arguably in better position between the market and policy makers to identify regulatory barriers, such as outdated standards or restrictive laws, that prevent farmers from accessing affordable inputs or adopting new technologies.

BEST PRACTICE 9:

COLLABORATE WITH HUBS OF FARMERS

> *"It should be highly encouraged to do live-in ethnography in designing a product for farmers with this level of different realities than ours in the urban setting. Currently product managers maybe just do a field visit 2-5 days but they have most says on the product and service" (Design Researcher of an agritech startup).*

Many agritech innovation providers aim to eliminate middlemen, believing that direct connections between farmers and markets will increase efficiency and profits. However, these local middlemen who operate at the first layer of interaction with farmers are actually important local champions. Some interviews showed the dual contradictive argument on eliminating or embracing middlemen. Agritech innovation providers and wider ecosystems could develop business model innovations that can leverage the right middlemen to be local champions and become hubs for farmers.

Local champions are influential figures within their farming communities who have existing strong networks in the area. Andari et al (2024) define local champions as people who can influence policies, opinions, or actions in a community having three primary characteristics: mediators, mobilizers, and facilitators. These are local farmers who take a lead role within their community. So, they have a dual role of being a middleman or gatekeeper to the other farmers while also having their own lived experience as a farmer. This means that they have a more authentic view of what is best for the farmers, and can advocate for suitable ideas, while filtering out ones that don't fit their collective situation.

This is echoed by a study from Rivera et al (2019) that conducted 369 interviews in seven countries and concluded that networks play a very important role in agricultural and rural development from the four elements: (1) trust and quality of relationship, (2) common interests and cooperation, (3) sense of community, and (4) culture and tradition. Agritech innovation providers should focus on the first two and it include avoid eliminating existing middlemen, instead building a better system formalising the business model with them. Only by collaborating with these champions, can innovation providers foster relevant innovation co-creation, customization, and local adaptation, ensuring that agritech solutions are effective for smallholder farmers.

When reviewing at the many agritech innovation providers in Indonesia, it is uncommon to see ones that are successful in engaging with existing local champions. Only some of them hire a lot of field staffs with main KPI of sales target. One example, not from an agritech startup but a rural fintech, is Amartha, that recruits local business partners as their main front face to assist a hub of 15-20 ultra micro women entrepreneurs (including farmers) that they call "majelis", as shown in Figure 12. For Amartha, these business partners are importantly young local champions from the area having good digital skill and able to represent Amartha in 35,000 villages providing community-based working capital loans, financial literacy education, and entrepreneurship training.

Figure 12. Amartha's Local Business Partner and 'Majelis' Model (Source: https://amartha.com/)

Implications for Practice: Analogous to the previous best practice of working with NGOs, innovation providers, governments and NGOs would be wise to identify farmers who are local champions within their community and to work with them to get a better understanding of their needs and priorities. These local champions can be a local farmer and/or a local entrepreneurs or founders who is building their business too. We also identified several instances where a local hub was institutionalised in the form of social enterprise, cooperative, BUMDes, or MSME. Thus, the implication for farmers or other local champions is to consider formalising their local network into such an organisation which will give them more visibility and status when innovation providers and policy makers are aiming to contextualise their offerings to the area.

BEST PRACTICE 10:

BE AUTHENTICALLY SUSTAINABLE

Sustainability is more than a marketing and branding exercise. In includes environmental, social and economic sustainability. Especially for farmers with limited resources, they do not want to be sold a new product, service or program if there are too many hidden costs involved or if it does not deliver the benefits it promised.

Tech-based and nature-based solutions need to go hand-in-hand and this environmental sustainability is not yet common among the ecosystem actors despite the agritech sector's dependence on the environment. Innovation providers mainly focus on the tech innovations, meanwhile social enterprises and NGOs championing on nature-based solutions.

> *"The way most people treat productivity goal is currently not sustainable, very short term as if only thinking the next one or two harvest cycle. We are seeing a shift from productivity goal to more sustainability goal." (NGO Practitioner)*

A good example from a Balinese founder who started a grounded organic farming cooperative for local youth called Petani Muda Keren (PMK). Now it has grown to utilise digital tech innovations including an active agri-marketplace branded as Bali Organik Subak (https://bosbox.id/) as well as IoT smart farming provider (https://mikikotechnology.com/). This is while also prioritising minimum to zero chemicals and ensuring social cultural practices which are deeply embedded in Bali's culture.

Figure 13. IoT Smart Farming Innovation in an Intercropping Natural Farm by Petani Muda Keren (Source: Mongabay Indonesia)

Implications for Practice: There is a need to not overlook traditional farming practices that have been sustainable for generations, such as intercropping, crop rotation, natural/organic fertilisers, biopesticides, agroforestry, and permaculture. These can now be enhanced with mobile apps, AI, and IoT sensors. See Figure 13 Agritech innovation providers should respect and build upon local knowledge, cultural values and practices rather than assuming entirely new solutions will be rapidly adopted. Mindful scaling in agritech requires balancing technological ambition with practical execution that is farmer-centric, and increases local social and environmental sustainability.

Section 4

Trends and Concluding Insights

The agricultural sector in Indonesia has been growing rapidly in Indonesia from ~$20B USD (equivalent) in 1990 to over $170B USD by 2023, compared to Australia's much more incremental growth from $13B USD to $45B USD over the same time frame (World Bank, 2024). With the growth of the agricultural sector, and historic factors like the distribution of farmlands, their ownership and practices, there come challenges.

This report identified several challenges to increasing the productivity of the Indonesian agricultural sector, enabled by Indonesian agritech innovation providers, in an ecosystem that involved many intermediaries and support organisations, governments, regional differences as well as of course the farmers and smallholders. The findings are presented here as best practices that are opportunities for people in the Indonesian agritech sector to learn from 'positive deviants' in the sector. Positive deviants are those who have discovered ways to make advances with disproportionately successful outcomes, ideally win-win situations for the farmers, innovation providers, the ecosystem that connects them, through to the consumers and the environment, i.e. the land and water that sustains our life.

While smart farms and tech-savviness are still a myth for many Indonesian farmers, there are isolated examples where tech meets tradition for mutual gain, with opportunities for growth. While tech like AI, IoT, and precision farming contributed to an increase in crop yields (World Bank, 2021), there is simultaneously a push towards more sustainable farming practices (Swastika, et al., 2024), many of which are linked to traditional methods like intercropping, crop rotation, and natural/organic fertilizers. This tech versus tradition paradox is also reflected in the World Economic Forum's latest Future of Jobs report (2025), that forecasts that by far the number one largest growth of jobs is in farm workers, while the rise in digital access and 'green transition' (i.e., efforts and investments to reduce carbon emissions) are two of the top three macro trends that will transform future businesses.

A pessimistic view is that these trends will result in increasing income disparities and that traditional farmers will exit the sector, new wealth will take over and modernise their farms and hire them back as farm workers. A more optimistic view is that the farmers will maintain ownership of their land as they modernise their farms and that there will be an increase in wealth equality.

Each of the ten best practices in this report are based on interviews, reports and observation across four regions of Indonesia. Farmers, innovation providers and other stakeholders may adopt any one of them or their combination. Not one of them alone is a silver bullet, and each of them takes time, effort and often resources to implement. Most of them require a systemic and holistic view to the sector, involving intermediaries like local NGOs and rural entrepreneurs through whom trust and information is brokered. These trends are collectively reflected in the emergence of agribusiness convergences and the bioeconomy (BRIN, 2024; Bugge, Hansen & Klitkou, 2019).

It's clear that, from production to distribution and then consumption, change will come from innovation and collaboration throughout the food and bioeconomy ecosystem. An effective strategy to increase productivity and reduce waste must consider demand, supply, operations and point of sale - and it hinges on building a supply chain that is sustainable not by default, but by design.

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