Informal transactions are still widespread in Asia and the Pacific, however contractual agreements are on the rise for high-value agricultural commodities. Innovations in contract farming can facilitate the shift towards more structured markets, providing farmers with the opportunity to fully integrate into modern value chains. Contract farming arrangements in the region are becoming more innovative through the application of digital solutions, introduction of gender-sensitive regulations, employment of risk-reducing insurance, utilization of third-party verification systems and engagement in sustainable public-private partnerships. In particular, digitalization offers opportunities for improving the governance and efficiency of contract farming schemes. Specifically, the application of digital solutions such as blockchain technology, smart contracts and supply management platforms can increase traceability in contract farming operations, reduce transaction costs and reduce risks through price forecasting and improved screening of partners.

**WHAT IS CONTRACT FARMING**

Contract farming is a forward agreement between farmers and agribusinesses for the production and supply of agricultural commodities (FAO, 2013; FAO, 2018). Through this agreement both partners settle in advance on the terms and conditions for the production and marketing of farm products, including:

- The price to be paid to the farmer.
- The quantity and quality of the product the buyer demands.
- The date for delivery to the buyer.

The contract may also include more detailed information on how the farmer will carry out the production, or if the buyer will provide any inputs such as seeds, fertilizers and technical advice.
Spot transactions, which are transactions without contracts and formal standards, are still the norm for undifferentiated, staple crops in the region. However, contractual agreements have moved into the mainstream in high-value agrifood chains, such as poultry, pork, aquaculture rubber, oil palm, sugar, tea, specialty coffee, and high-value fruits and vegetables (Mishra et al., 2021). Businesses in these value chains produce differentiated products, competing primarily on non-cost traits such as quality. But quality products require asset-specific investments that have little utility when shifting to different products, constraining the ability of these firms to diversify their supply base vis-à-vis other firms that source bulk and undifferentiated commodities (Simmons, 2002). Consequently, these companies often decide to engage in contract farming with farmers, locking them in through incentives and co-investments to convince them to make these investments, meet private standards, obtain certification and accept monitoring.

The contracts that govern these relationships specify the timing, quantity and quality parameters of the transaction, including compliance with voluntary standards (FAO, 2020). Some countries, including China, Indonesia and Thailand, have further aided the proliferation of contract farming through government policies and regulations (FAO, 2018). On the one hand, contract farming can help smallholder farmers integrate in a more sustainable manner into modern and more complex value chains that serve remunerative markets for added value foods, for example through issuance of quality labels (FAO, 2020). These contracts are intended to coordinate the interaction between sellers and buyers of agricultural products and may include the provision of inputs, such as seeds and fertilizers, technical assistance, credit and insurance, and a guaranteed price at harvest. On the other hand, existing imbalances in market power may influence the bargaining positions of the parties involved in contracts, potentially leading to contractual arrangements that are unfair for smallholder farmers (FAO, 2013).

To prevent this from happening, government agencies may be involved in contract farming operations to ensure their inclusiveness and long-term sustainability, in various capacities. These include active facilitation roles such as coordinating farmers and matchmaking between buyers and producers when a contract farming operation is in the planning stages. They also cover financing intermediation, resolution of conflicts through alternative dispute resolution mechanisms such as arbitration and mediation, and third-party quality certification (FAO, 2013).
INNOVATIVE CONTRACT FARMING ARRANGEMENTS IN ASIA AND THE PACIFIC

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Contract farming in Asia and the Pacific is evolving through a series of incremental innovations with a focus on increasing inclusion and overcoming existing market failures (Gatzweiler and von Braun, 2016). These innovations include:

- Digitalizing contract farming schemes to reduce costs related to searching for partners, bargaining and monitoring contracts, and using blockchain for better governance and transparency.
- Adopting innovative regulations to support gender equality and women’s empowerment in contractual farming practices.
- Bundling inputs and services with insurance to minimize the production risks of contract farmers.
- Turning to a trusted third-party to bear witness during the weighing, quality inspection and sampling processes in order to ensure transparency and fairness in the delivery of the contracted products.
- Introducing contract farming in the framework of broader governance tools such as public-private partnerships (PPPs) or public-private-producer partnerships (4Ps) to ensure inclusion (IISD, 2019; FAO, 2020).

APPLICATION OF DIGITAL TECHNOLOGIES TO CONTRACT FARMING SCHEMES

Digitalization offers novel ways to reduce costs related to searching for partners, bargaining and monitoring contracts, and to increase transparency in the farmer-buyer relationship (FAO, 2020). Digital innovations can be used for:

- **Facilitating the screening of potential partners.** Digital technologies make it easier for both the buyer and the seller of agricultural products to identify potential partners and agree on a contract that closely matches their preferences and circumstances. Lower search costs can significantly improve the match between buyers and sellers, and reduce bargaining costs while potentially adding to the bargaining power of the farmer.

- **Price forecasting.** Digital agriculture further supports contracting parties by increasing their ability to forecast prices, thereby minimizing their price risk (Sarkar, 2014). By facilitating farmers’ search for traders offering the highest price, this innovation can also result in decreased price dispersion across farmers and markets.

Managing the contract farming scheme. Contract farming operators are increasingly using digital supply chain management solutions to manage their relationships with smallholder farmers (CTA, 2019). These solutions are business-to-business services that include traceability solutions such as digital sustainability and organic product certification tracking; digital quality assurance solutions for farm inputs and produce; enterprise resource planning platforms for smallholder farmer cooperatives, nucleus farms, and outgrower schemes; and logistics management solutions for post-harvest cold chains, storage and transport (CTA, 2019).
These solutions can make contract farming easier and more affordable by streamlining the contracting process between farmers and buyers via the digital management of the operations (Ravis and Notkin, 2020). They seek to lower costs through greater efficiency, improve value chain quality through better traceability and accountability, and ultimately increase smallholder farmer yields and incomes by making it easier for commercial players to engage formally with large numbers of smallholder farmers. Moreover, by using these services, contract farming operators can get a deeper understanding of their target segments, allowing them to better tailor their interventions to the needs of smallholder farmers (FAO and ITU, 2018).

In Asia and the Pacific, several smallholder farmer management platforms have cropped up to essentially act as a digital coordination hub for contract farming parties. For instance, an ICT provider that currently operates in 28 countries including India, Bangladesh, Malaysia and the Philippines, has developed a digital platform that aims to improve traceability and visibility along the supply chain. In 2013, the company launched a digital agritech platform focused on agriculture and food systems. In an effort to make food systems traceable, the platform gathers farm-to-retail data on a dashboard through existing mobile and wireless data networks even in remote areas. The platform is designed for contract farming operators and other organizations working with farmers, rather than for direct use by farmers. The operator staff collects and disseminates data in the field, and conducts transactions using the mobile application. The data are aggregated in the server to assist decision-making and reporting, and feed traceability solutions for specific value chains from the farms to the market (Gálvez, 2022).

Another notable example of such a platform uses mobile technology to digitalize paper-based processes related to smallholder-farming schemes. By doing so, it enables the parties to share information and monitor contract farming operations in a transparent manner by accessing the digital platform. Equally important is that by digitalizing farm management and contractual operations, the platform provides traceability back to the farm, and facilitates e-extension and document compliance with voluntary standards, for example GlobalGAP, organic and fairtrade. The company is operating in over 25 countries including China, India, Papua New Guinea, Sri Lanka, Thailand and Viet Nam. It covers over 30 value chains, mostly cocoa but also coffee, rice, maize, spices and pulses.

In Thailand, a company offers contract farming parties a digital crop monitoring and management solution. This digital solution is currently being applied to 15 different crops including rice, corn, sugarcane, pineapple, and oil palm. The enterprise uses high-resolution satellite images, drones and on-the-ground sensors that are able to remotely detect the chlorophyll uptake in plants, and levels of nitrogen or potassium so it can recommend soil enhancement or warn about overwatering in a given sector of the farm. With the crop and weather data it gathers, the company offers advice to their subscribed farmers through smartphone or text message, while simultaneously sharing the information with buyers, who can remotely monitor the crops. Both contracting parties (small-scale producers and buyers) share the subscription cost that amounts to about USD 40 per hectare per year.

Another example comes from Viet Nam, where a public-private partnership called Sat4Rice provides large-scale satellite-based information services to farmers and buyers engaged in contract farming in the rice value chain. This multistakeholder partnership is a Vietnamese-Dutch collaboration and focuses on the Mekong Delta, the country’s rice belt. The buyer is a Vietnamese rice processor with several mills in the Mekong Delta and the country’s leading manufacturer and supplier of seeds, fertilizers and pesticides. Initially, over 50 000 smallholder farmers were reached, out of the 300 000 rice growers targeted by the Sat4Rice partnership. Other partners include the Ministry of Agriculture and Rural Development and the Department of Agriculture, and Can Tho University. The partners have developed a mobile application that uses a combination of satellite and field data on rice growth, floods, pests and diseases. Contract farmers receive real-time information and advice for free, helping them to increase both the quantity and quality of their rice. However, the buyer receives business intelligence to help optimize core business processes in both fields and rice mills, such as logistics, extension services, and marketing. The buyer is increasingly using drones in rice farming, reporting that a drone could help spray fertilizer and pesticide on 25 hectares per day, saving production costs in the range of USD 8.7 to USD 13 per hectare (Gálvez, 2022).
In 2018, Oxfam in Cambodia piloted a blockchain platform called Blocrice to manage contract farming arrangements between organic rice farmers and exporters, rice cracker makers, and other buyers. The platform uses smart contracts that predefine the primary purchase price, trade volume, quality requirements, transportation method, organic certification and other conditions.

Supply chain management platforms for monitoring contract farming operations can use two key technologies: **blockchain** and **smart contracts**. These platforms can rely on blockchain for recording contractual transactions between farmers and buyers (as well as the provision of bundled goods and services) with mechanisms for processing, validating and authorizing on an immutable ledger (FAO, 2020; Ravis and Notkin, 2020). Although the incorporation of blockchain technologies can ensure transparency, trust and integration among partners in contract farming transactions, it can also pose a series of challenges. These can be governance challenges related to the interaction design or operational in nature, such as the scalability of backend data management mechanisms. While some of these digital farmer management platforms have emerged to better inform farmers of market prices, buyers remain better positioned, with greater computational and analytical capital, to forecast global production and demand, allowing them to set prices more in their interest (Ravis and Notkin, 2020). Perhaps their biggest downside lies in farmers relinquishing their data ownership and privacy, oftentimes without an understanding of this fact and its implications. In this regard, GrowAsia et al., (2020) note that farmers and other users must be cognizant of the challenges associated with sharing data, such as privacy issues and errors in data, particularly self-reported data.

Farmer management platforms can use smart contracts, which are self-executing when the terms of the recorded agreement are met. A smart contract is simply an electronic version of a document that is composed of a set of codes that distill the terms of an agreement and are stored on the blockchain (UNDP, 2020). The resulting smart contracts represent a virtual protocol intended to digitally facilitate, verify, or enforce the negotiation or performance of an agricultural contract. Such contracts enable trade, reduce paperwork, facilitate payments and mitigate the risk of fraud.

When contract farming schemes use smart contracts, the clauses that rule the exchange of crops or livestock products or services are embedded in coding, and actions are triggered automatically once conditions are met. This would result in ledger feedback such as transferring money and receiving the product or service. This way, the payment to the farmer can be automatically executed once the buyer acknowledges the satisfactory delivery of products, or the price of the inputs received by the farmer can be automatically deducted from his or her account. Smart contracts not only define the rules and penalties around an agreement in the same way that a traditional contract does, such as what to do in case of non-compliance, but also automatically enforce those obligations. They can also include excuses, defining an acceptable justification for failing to comply with the contract, such as because of force majeure, meaning weather disasters, pests, disease, plagues and epidemics, changes in government policy such as export bans, and strikes, armed conflicts and other social events (FAO, 2013).
Improvements in legal and contractual governance to support women’s participation in contract farming include options for building protections into contracts to safeguard women farmers’ interests, while also ensuring that women have a greater opportunity to act in their own interests when these contracts are being negotiated (IISD, 2019). While women do the bulk of the work on farms, and tend to produce subsistence crops for feeding the household – which are often displaced by contracted crops – their contribution to contract farming schemes tends to be ignored (IISD, 2019). Indeed, in most cases, contracts do not protect the interests of female farmers nor ensure that their voices are heard.

Purchasing companies often prefer to sign contracts with a woman’s husband rather than with the woman directly, even if she is performing the majority of the work under the contract. This is in part because women are assumed not to own the land and therefore not to own the product contracted, but also because of the cultural barriers and biases women often face in negotiating directly with men. Women may be excluded from negotiations and leadership roles or may be unable to attend meetings due to household obligations. Furthermore, higher rates of illiteracy among women put them at greater risk of exploitation in the contracting process (USAID & EAT, 2015).

Ways to address these issues include innovative legislative and contractual solutions such as: i) obtaining a woman’s consent to a contract farming arrangement that affects her, such as when she contributes with labour; ii) creating strong incentives for a female farmer to be included as a party to the contract; iii) ensuring a woman’s standing to enforce and benefit from a contract farming arrangement; and iv) ensuring that female farmers, and all farmers, who sign contracts have a clear understanding of the contract’s key terms, their rights and obligations, and the risks involved. For these protections to be applied consistently and uniformly to contract farming relationships, the best option is to implement them through legislation or by using model contracts (IISD, 2019).

Some companies engaged in contract farming in Asia and the Pacific are finding innovative ways of bundling inputs and services with insurance to address the production risks of farmers. This is especially important in view of the increasing frequency of natural disasters and extreme weather events that may cause the farmer to exit the scheme or may even endanger the viability of the contract farming scheme altogether.

One case that illustrates this point is that of a Thai company that has launched a disaster risk insurance scheme that covers the costs incurred by thousands of contract Thai chicken and swine producers should an extreme weather event or a natural disaster destroy their livestock facilities and equipment. The company shoulders the insurance costs on behalf of their small-scale farmers as a means to ensure the stability of its own supply, whereas large-scale farmers are expected to cover their own insurance costs.
Nevertheless, aside from private efforts, public engagement is needed to increase the likelihood that insurance information is presented in a balanced and fair way for the rural population. While private insurers will invest in marketing their products, they are unlikely to invest at socially optimum levels in educating farmers more generally about the appropriate role of insurance (GIZ, 2016). In this regard, the Government of Lao PDR has prepared, with support from FAO, a national roadmap for inclusive contract farming development that includes this type of provision. The Lao contract farming roadmap places smallholder farmers front and centre, emphasizing legal provisions and support schemes, such as insurance provisions, that seek to redress the power imbalances that prevail in many cross-border and domestic contract farming arrangements.

Instating an independent third-party agency to verify the quantity and quality of the products delivered under the contractual scheme is a powerful way to combat abuse of power. FAO (2020) adds that this is most relevant when quality attributes are not observable and individual testing is costly, such as in milk. This may lead to information asymmetries that can lead to buyers under-reporting quality levels to farmers to pay less.

This type of innovation was introduced in the milk value chain in Viet Nam analyzed by Saenger et al., (2014) whereby an independent agency was brought in to verify product quantity and quality, for example quantity of milk fat and total solids. This had a positive impact on quality levels and income generated by contract producers.
Another innovative solution is inserting contract farming schemes in the framework of pro-inclusion governance systems such as PPPs or 4Ps (Rankin et al., 2017). Contract farming seldom stands in isolation. Governments and the civil society are supporting contract farming more through PPPs or 4Ps to make it more sustainable and reach larger numbers of smallholder producers. This support generally translates into the provision of extension services and capacity building to prepare farmers to negotiate contract farming arrangements on an equal footing, as well as in the transmission of technologies and tools (FAO, 2013).

In turn, contract farming has shifted from being a purely buyer-driven governance system, to become the generator of value chain innovations that involve other businesses such as providers of inputs and agricultural equipment, banks, digital technology and mobile telephone companies, and so on.

CONCLUSIONS

Although informal transactions are still the norm in Asia and the Pacific, contractual agreements are on the rise, especially for high-value agricultural commodities. As contract farming arrangements grow in number and become more sophisticated, a series of innovations are emerging to enhance their inclusion and efficiency. The nature of these innovations can range widely – from the adoption of digital technologies, to new governance mechanisms and novel regulations.

Governments in the region face the challenge to further mainstream contract farming while ensuring inclusiveness and fairness. Traditionally, their support to contract farming ranged from facilitation, provision of a legal framework, financing, intermediation and resolution of conflicts (FAO, 2013). As innovations reshape contract farming in Asia and the Pacific, a second generation of contract farming policies is emerging to target the existing mainstreaming deficiencies and to address governance and inclusion challenges (Gatzweiler and von Braun, 2016).

Consequently, recent government interventions are targeting areas such as introducing gender sensitive regulations leading to the increased participation of women in economic transactions, facilitating insurance to reduce contract farming risks related to weather-based agriculture or natural disasters, utilizing third-party verification systems to combat power abuse, and promoting sustainable public-private partnerships that enhance inclusion and equity.

The discussed policy measures can contribute to facilitating the shift towards more structured market channels that provide farmers the opportunity to integrate into modern and more complex agrifood value chains that serve remunerative markets. Nonetheless, governments should ensure that those interventions are able to create a suitable enabling environment to potentially lead to contractual arrangements that are fair to all value chain actors, including smallholder farmers.
Price dispersion refers to the variation in prices across sellers of the same agricultural product.  

The Sat4Rice partnership is supported by the Geodata for Agriculture and Water (G4AW) programme of the Netherland's Ministry of Foreign Affair.  

Information on crop conditions is timely recorded and uploaded to the Sat4Rice mobile application by LTG’s extension workers. The field data thus gathered are subsequently combined with satellite information and analyzed to come up with actionable advice.  

For example, the contract farming agreement may require for a wife to give her active consent because her rights and interests will be affected in some way, e.g. as the primary worker, another user of the land, or as the person who will bear additional duties as a result of the overall greater household workload (IISD, 2019).

Note from personal experience, as the author of this publication contributed to the development of Lao's Contract Farming Roadmap.


