Digitalising farm-to-table supply chains in Asia

On-demand transport services and insurtech

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Abbreviations

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
COVID-19	Coronavirus disease (SARS-CoV-2)
FSC	Farmers specialised cooperatives
GPS	Global Positioning System
IoT	Internet of things
MSMEs	Micro, small, and medium-sized enterprises
SME	Small and medium-sized enterprise
UNCTAD	United Nations Conference on Trade and Development
USD	U.S. dollar

Executive summary

What is the challenge?

By 2030, Asia will be home to almost half of the global population, with only one-fifth of the world's agricultural land; and 65% of the world's middle-class population will reside in Asia, seeking nutritious, fresh, and safe produce delivered conveniently and on demand, with minimal environmental impact (PWC, Rabobank, Tamasek, 2019). To meet this demand, Asia requires highly efficient and resilient food value chains that are both highly productive and able to get that produce into the hands of consumers efficiently. Food logistics are therefore a vital element of the food supply chain and are crucial in fulfilling consumer demands by providing the right product and quantity at low cost, with on-time delivery while limiting food waste.

However, the prevalence of smallholder farmers, fragmented supply chains, absence of scale economies, insufficient risk management tools, inefficient coordination, poor transport infrastructure, physical inaccessibility due to low-quality roads, and a lack of cooling and other facilities at the farm level are all major contributors to the poor efficiency of supply chains across much of Asia (AFCAP, 2013). The inefficiencies in the food value chain impact the amount of food that goes to waste due to spoilage. Approximately a third of fresh fruits and vegetables in the world is thrown away due to reduced quality; a high share of the losses is related to suboptimal handling throughout the supply chain (Gustavsson, Cederberg, Sonesson, Otterdijk, & Meybeck, 2011). Furthermore, it has been estimated that about 14% of global food production is lost during supply chain stages (United Nations Environment Programme, 2021).

This report explores the opportunities for, and scalability of, digital platforms within the food supply chains that can act as aggregators to the fragmented logistics sector and, in this role, enhance coordination and efficiency in the logistics across value chains. The report also addresses the prospects and business case for implementing insurtech solutions in the chain. Focusing on Cambodia, China, India, Indonesia, Laos, Mongolia, Philippines and Vietnam, this report articulates the rationale for considering digital platforms as a key potential driver of logistics sector development and considers the critical enablers for these platforms to develop and scale across developing economies.

What is the opportunity from digital platforms?

The development of digital platforms has profoundly transformed the landscape and business case of diverse industries such as hospitality (e.g. Airbnb, Booking.com), software ecosystems (e.g. Apple IOS, Tencent, Google Android), e-commerce (e.g. Alibaba, Pinduoduo, Amazon), social media and marketing (e.g. WeChat, Facebook), insurance (e.g. ZhongAn, PingAn, Pasarpolis), and transportation (e.g. Grab, Gojek, Uber). This transformation has only been possible due to the enhanced coordination, findability, and engagement between actors that the digital networks foster.

Driven by the growth in e-commerce platforms and boosted by the effects of COVID-19, last-mile logistics (i.e. delivery of goods to the end consumer) enabled through aggregating platforms has grown rapidly. However, outside of China, first-mile logistics (i.e. transportation of products from farms) in Asia have experienced far less innovation and development. But there is considerable room for growth. Digital platforms' open and participative infrastructures, simpler scaling mechanisms than traditional business models, and on-demand access features position them as potential solutions to improve logistics coordination and resilience from farms to tables. In that context, insurtech solutions have started to develop, presenting resilience solutions to the users of digital platforms.

Integrating different companies into the same platform can leverage each of the companies' logistics resources into an integrated chain. Farmers, aggregation points, warehouses, transportation companies, wholesalers, retailers, insurers and consumers can be actively interconnected. The integration of farmers to the market through low-priced, app-based logistics digital platforms could translate into the creation of more efficient aggregation points, better communication between farmers and further actors in the supply chain, as well as easier access to transport solutions. This can bring benefits such as improved access to on-demand transportation and risk management solutions; better organisation of in-farm and between-farms produce aggregation points; increased visibility from consumers that would translate in a higher demand for their products and even access to new markets they have never considered before due to lack of information or tools to reach them.

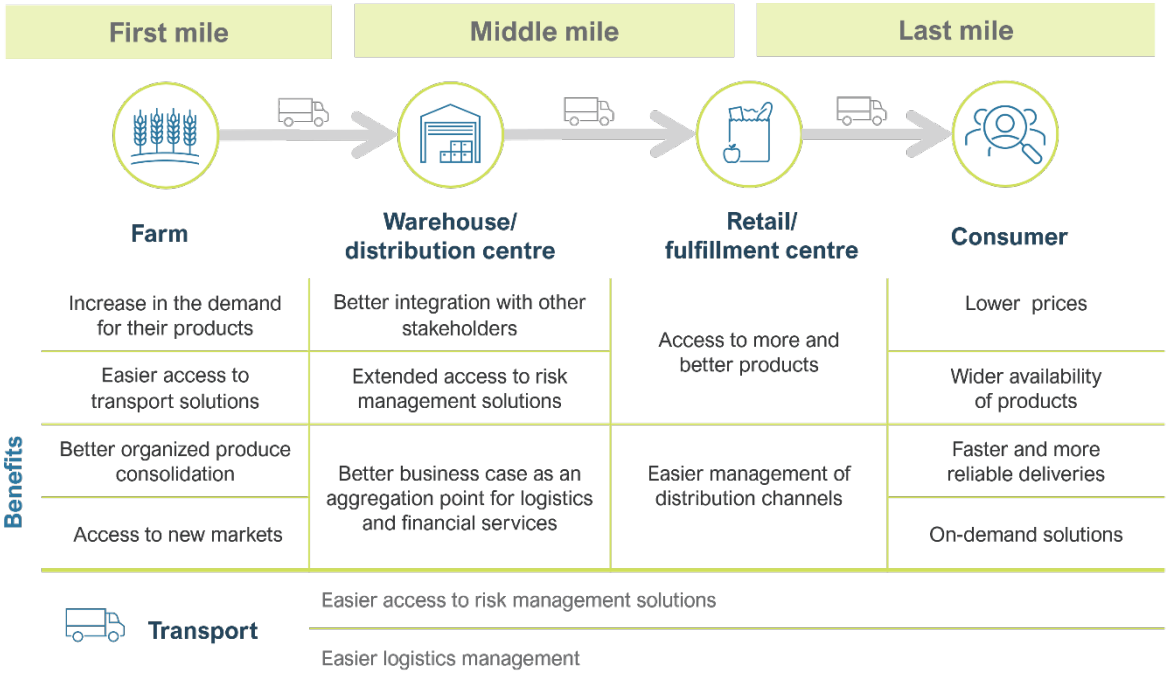

Figure 1. The potential benefits across the value chain of platform-led aggregation

Source: Authors' own

How can these solutions be developed and scaled?

Despite the strong rationale for these solutions, the lack of widespread development and success highlights the significant challenges facing the development of the sector across the region. For these solutions to be successful, logistics service providers and consumers of logistics services (i.e. the farmers) must recognise the greater value offered by these technology-enabled solutions over the traditional transport channels and modes commonly used. However, instigating this behavioural change requires a recognisable and compelling business case for providers to shift and a compelling use case for consumers. To create these incentives for different actors to use third-party logistics platforms first relies on the existence of key enablers being in place, upon which the requisite value to all users can be built. This study identifies five common enablers that either need to be already in place or for which innovative solutions need to be developed, in order for these first-mile logistics platforms to effectively scale.

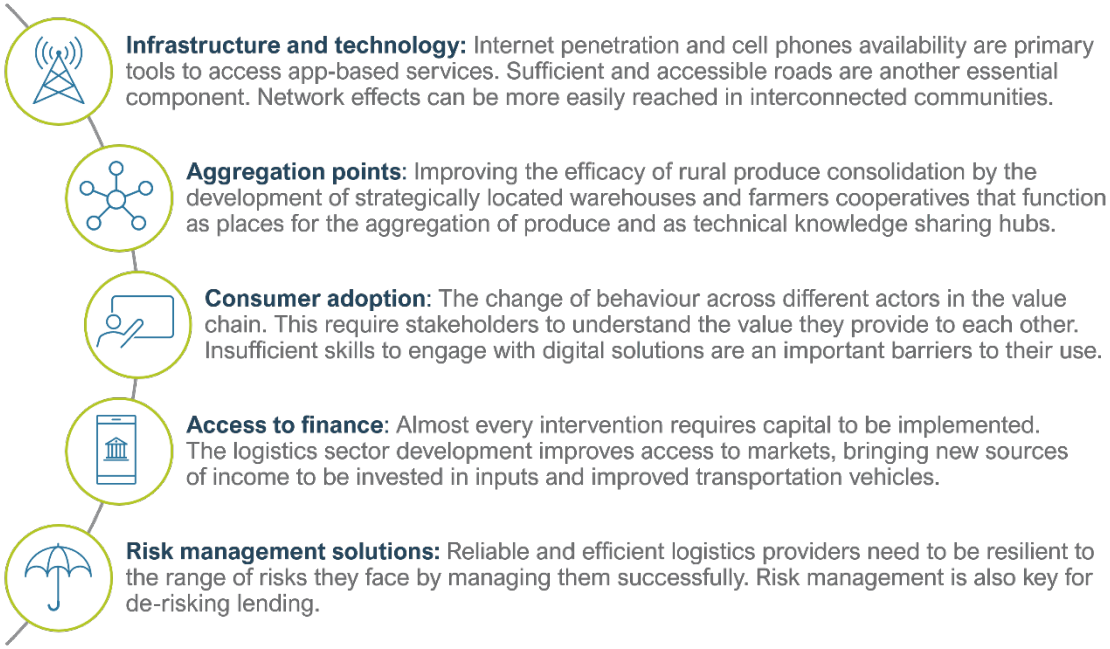

Figure 2. Enablers to unlock digital platforms' benefits in agricultural logistics

Source: Authors' own

Basic infrastructure and technology development, such as access to mobile phones and internet connectivity, is necessary to interact with digital platforms. More and better-equipped aggregation points permit cheaper, faster and more accessible interactions between the actors in the value chain. Consumer adoption of digital platforms by the value chain's stakeholders and food consumers depends on trust and visible use cases. This is a central component to increase the demand for such platforms. When designing or updating digital platforms to be used in the food value chain, it is necessary to work in conjunction with the transaction models, mechanisms, and practices with which the farmers are familiar. For the smallholder farmer, these are primary determinants to choosing a buyer. Accessing finance is critical for growth and scaling throughout the value chain. Risk management and resilience solutions reduce the impact of damage or

loss experienced by the actors in the value chain while reducing the risk of lending, allowing stakeholders to acquire better inputs and means of transport.

For most of the countries considered in this study, many of these enablers are not effectively in place. However, what is also clear is that a range of innovative models and interventions have begun to emerge that address these enablers in different ways. Pinduoduo, for example, has developed a gamified social team purchasing model. The platform offers discounts and specials that can only be unlocked if the purchaser finds at least another member from their social network who also buys the products in order to construct "temporary" aggregation points and encourage the spread of consumer adoption. Ecofrost in India offers solar-powered cold storage solutions that help to overcome infrastructural challenges; and Cainiao, Alibaba's logistics platform, has seen success with its "one young person, one computer and one internet connection per village" approach in expanding consumer adoption, as this strategy has created small hubs to provide farmers with access to the internet and allowed unskilled farmers to both observe the benefits from digital adoption and to learn digital skills from a trained person.

The financial sector also has a critical role to play in supporting the development and scaling of these first-mile logistics platform-aggregated networks. Logistics providers need lump sums of capital to afford transportation vehicles, like trucks. The greater access to larger lump sums of capital available from lenders, the larger and newer the trucks that can be purchased by logistics providers. As general maintenance costs for newer trucks are lower, this can have a long-lasting impact on the sustainability of these business-case sustainability for individual operators and hence impact the potential development of MSMEs across the transport sector, allowing the network to scale.

Insurance providers have an equally important role to play. As the means for transporting goods represent one of the most expensive assets for farmers and transporters to acquire (Sieber, 2009), having access to effective risk management solutions to reduce the impact of damage or loss of vehicles and other assets is vital to the longevity of individual MSMEs and hence the successful scaling of the logistics network. Effective resilience tools also help to de-risk lending allowing logistics MSMEs to acquire the larger lump sums of capital they require. However, what is critical for insurance providers to recognise is that logistics value chain actors require holistic resilience solutions. Traditional insurance policies may constitute a component of these solutions but are rarely able to fully address SMEs risk management and resilience needs in isolation. This study found that few insurance providers or insurtechs currently recognise the opportunities within this sector, however, technological risk management solutions, such as tracking devices and temperature monitors, present a major opportunity for industry growth. Bundling these technological solutions together with traditional insurance offers customers greater value and tangibility, while the role the technology play in managing and mitigating key risks and the data collected through these tools improves the ability of insurance providers to understand and model the risks and reduce claims likelihood, strengthening the business case. However, demonstration cases may be required to illustrate the feasibility of such holistic risk management approaches.

What is the role for policymakers and/or development partners?

The first task for policymakers and development partners to answer, when considering the key interventions required to develop first-mile logistics within a given context, is to determine the existing level of development of the logistics and transport sector. Context matters, and the level of development, and hence the most urgent interventions differ substantively across different countries and within different logistics ecosystems, even within countries. This assessment will provide an indication of which of the enablers are likely to be most critical to target initially.

Interventions that target the five key enablers are likely to be the most impactful in contributing towards the development of the logistics ecosystem to enable the growth and scaling of first mile. Potential interventions identified in this study include:

- **Coordinating public-sector and private-sector actors**. Development partners can work together with local organisations, such as cooperatives and local governments, to help them put the enablers for digital integration of the value chain in place. This strategy may be more effective and to build trust and capacity than just direct capital investment in digital platforms.
- **Supporting the development of innovative infrastructure**. By identifying innovations globally or locally (e.g. using data powered positive deviants) that can address gaps in macro-level infrastructure, policymakers and development organisations can enable the prerequisite infrastructure with macro-level investment in national infrastructure requirements.
- **Supporting aggregation at the beginning of the value chain**. Strengthening local cooperatives and other, existing, local structures to effectively adapt to a digital ecosystem can be an impactful intervention to support aggregation with supply chains and facilitate consumer adoption.
- **Digital skills development to support consumer adoption.** Having sufficient digital skill is fundamental for consumer adoption and a central enabler to unleash the benefits of digital platforms. Development organisations and Governments need to first identify the level of existing digital skills among key target groups and then support the development of programmes and initiatives that develop and disperse these skills within these key target groups.
- **Incentivising appropriate financial services.** To incentivise financial services providers to engage with agricultural value chains, development partners, lawmakers, and policymakers to intervene by de-risking investment through consumer research, better value chain transactions understanding, or direct investment
- **Policy support and regulation.** Regulators and policymakers have a key role to play in supporting an enabling environment for innovation and the development of innovative solutions.

  Policymakers can 'set the tone' for supporting innovation through policies and stated public objectives. Furthermore, supporting the development of the other key pillars of a conducive enabling environment is a critical role for policymakers, including:
  - Investing in key national infrastructure
  - Supporting the development of required skills

- Ensuring support (both financial and non-financial) is available to early-stage innovative players and start-ups

For regulators, this means finding a balance between supporting and encouraging innovation while maintaining market stability and consumer protection objectives. This typically requires regulators to have a flexible and accommodative approach to encourage responsible innovation and to respond to innovative developments (Beyers, Gray, & Hougaard, 2018). This is particularly pertinent in the financial services sector where regulatory constraints are typically substantial for new entrants.

1. Introduction

Problem statement and objective

Supply chains the nerve system of food and agricultural systems. Food logistics are a vital element of the food supply chain and are crucial in fulfilling consumer demands by providing the right product and quantity at low cost, with on-time delivery while limiting food waste (Jagtap, Sandeep; Bader, Farah; Guillermo, Garcia-Garcia; Trollman, Hana; Fadiji, Tobi; Salonitis, Konstantinos, 2021). Moreover, smallholders linked adequately and with the respective knowledge to engage with food logistics systems can more timely and conveniently sell their produce through accessing the relevant market places and customers. Transport efficiency and proper management of downstream and upstream activities, such as aggregation, packaging and storing, are important preconditions for efficient working supply chains (AFCAP, 2013). In well integrated supply chains, activities are efficiently coordinated, value for consumers is created and there is a high profitability for every actor engaged in the supply chain (National Research Council, 2000).

Current and future challenges to agricultural supply chains in Asia. Urbanisation and growing populations in Asia have led to poor food quality and high spoilage because of stretched and broken supply chains (PWC, Rabobank, Tamasek, 2019). It is estimated that about 14% of global food production is lost during supply chain stages (United Nations Environment Programme, 2021).The prevalence of smallholder farmers, fragmented supply chains, absence of scale economies (National Institute of Agricultural Extension Management, 2013), poor transport infrastructure, physical inaccessibility due to low-quality roads, and a lack of cooling and other facilities at the farm level are among the root causes of poor efficiency of supply chains in the region (AFCAP, 2013). Other critical challenges are inadequate access to reliable information, a shortage of domestic or regional market knowledge, and coordination challenges between the stakeholders in the value chain (PWC, Rabobank, Tamasek, 2019).

Overcoming these challenges through digital solutions. In the last decade, agri-food supply chains have undergone fast technological changes in trade and consolidation of supply chains that have significantly impacted smallholder farmers *(UNCTAD, 2020)*. The adoption of technology in food logistics has presented the opportunity to transform agricultural and food systems with tools that are cheaper and quicker to implement. App-based logistics and transport systems have the potential to improve efficiency and information flows within and across supply chains. These digital platforms also serve as points of aggregation and are critical for effective, coordinated, and productive supply chains.

Not enough attention being focused on the start of the value chain. A substantial part of private and public investment has been focused on developing the e-commerce sector and the last-mile deliveries in response to an increase in consumer demand. The supporting food infrastructure and first-mile logistics coordination, however, have not received the same interest (PWC, Rabobank, Tamasek, 2019). The opportunity in the development of first-mile logistics is far greater and pervasive as it focuses on the heart of established

legacy sectors and addresses traditional challenges. The disruption through technology of the traditional issues offers the opportunity for new growth.

Objective and target audience. This paper aims to articulate how app-based logistics platforms have developed and their potential link to providing risk management solutions in the Philippines, Indonesia, Vietnam, Cambodia, China, Laos, India, and Mongolia.
It explains the advantages of utilising digital platforms to scale businesses that are part of the food supply chain, particularly those in the first mile. This segment is often challenging across different contexts and relies on some key enablers to be in place to be operational. To this end, the report identifies the current state of logistics in Asia and how digital platforms are disrupting the sector. It also shows how the critical enablers identified – infrastructure and technology, aggregation points, consumer adoption, access to finance, and risk management – interact with the network effects happening within such platforms. Moreover, this report considers learnings and emerging solutions for platform developers, existing digital platforms, and insurance services providers to identify opportunities within their contexts. Finally, the report considers the potential role and business case for innovative insurers and insurtechs to support the ecosystems built around the platforms.

A diagnostic approach. A combination of desktop research and interviews with stakeholders were carried out to find current and potential solutions and suggestions for the implementation of app-based logistics solutions. The complete compendium of the interviews performed can be found in Table 3.

This report is structured as follows:

- **Section 2** describes the key conceptual frameworks applied towards understanding digital platforms and network effects and the potential benefits of these platforms to the food supply chain.
- **Section 3** explores the enablers to scale logistics and insurance digital platforms within the food supply chain and develops a stages model to facilitate the understanding of the requirements to scale. Drawing on case studies from the focus countries, measures that speak to the key enablers are discussed.
- **Section 4** describes the business case for insurers and insurtechs to provide risk management solutions throughout and around app-based logistics platforms.

2. The potential of platforms and app-based solutions

This section presents the current state of the logistics sector in Asia, as well as the main challenges it faces in the transportation of food. It then delves into the way in which digital platforms have disrupted a myriad of industries around the world and how they are starting to impact the logistics sector worldwide, and in Asia specifically. The section further addresses the specific benefits that digital platforms could bring to every member of the food supply chain by increasing coordination and efficiency between farmers, transporters, logistics services providers, wholesalers, and the rest of the chain.

2.1. The state of logistics systems in Asia

Country	World Bank's Aggregated Logistics Performance Index (1-5)[1]	UNCTAD B2C E-Commerce Index[2] (0-100)
Cambodia	2.66	31.1
China	3.60	91.8
India	3.22	57.1
Indonesia	3.08	20.1
Lao PDR	2.48	40.6
Mongolia	2.40	68.2
Philippines	2.91	44.7
Vietnam	3.16	61.6

Table 1. Logistics Performance and E-commerce Indexes

Source: (The World Bank, 2021), (UNCTAD - ICT, 2020)

1 The components analysed in the International LPI were chosen based on recent theoretical and empirical research and on the practical experience of logistics professionals involved in international freight forwarding. They are: The efficiency of customs and border management clearance. The quality of trade and transport infrastructure. The ease of arranging competitively priced shipments. The competence and quality of logistics services – trucking, forwarding, and customs brokerage. The ability to track and trace consignments. The frequency with which shipments reach consignees within scheduled or expected delivery times. The Aggregated LPI combines the four most recent LPI editions, this approach reduces random variation from one LPI survey to another and enables the comparison of 167 countries. (The World Bank, 2021)

2 The index is calculated as the average of four indicators (i.e., each indicator carries the same weight) using data for 2019 or the latest available. 1. Account ownership at a financial institution or with a mobile-money-service provider (% of population ages 15+) (Source: World Bank) 2. Individuals using the Internet (% of population) (Source: International Telecommunication Union, ITU) 3. Postal Reliability Index (Source: Universal Postal Union, UPU) and 4 Secure Internet servers (per 1 million people) (The World Bank, 2021)

Asia as a focal point for innovation in food supply chains. By 2030, Asia will be home to almost half of the global population, with only one-fifth of the world's agricultural land (PWC, Rabobank, Tamasek, 2019). Additionally, 65% of the world's middle-class population will reside in Asia, seeking nutritious, fresh, and safe produce delivered conveniently and on-demand, with minimal environmental impact (PWC, Rabobank, Tamasek, 2019). Slow port, airport, railway and road infrastructure development in countries like Cambodia, Myanmar, Vietnam, the Philippines and Indonesia, and unbalanced economic growth in the region, are challenges that the logistics sector will have to face to satisfy the customers' demand (National University of Singapore, 2011). International logistics and e-commerce development indexes, as shown in Table ***1***, provide us with a picture of the potential for the development of the logistics sector for the region. The position in the indexes vary importantly among countries in the region, with countries generally close to world average ratings (world average for the Logistics Performance Index is 2.8, and 55 for UNCTAD's e-commerce index), however, particularly when contrasting with China, it is clear that there is room for growth in the sector. These challenges are going to push governments and private investors into improving food supply chains' efficiency in implementing and developing newer technology solutions.

Challenges to logistics businesses in Asia. The breadth of the logistics sector has made it difficult to demarcate the challenges it specifically faces as they depend on several factors such as the size of the companies, region of influence and transportation means (Shepherd & Hamanaka, 2015). However, researchers and stakeholders have reported general challenges to the business such as aggressive competition (National University of Singapore, 2011), poor domestic logistics capacity, persistent policy barriers (Shepherd & Hamanaka, 2015), data management and governance (The Economist Intelligence Unit, 2019), and the growth projections of the continent – Asia will contribute to approximately half of the world trade growth by 2030 (Chu, Fox; Li, Yuanpeng; Mohr, Detlev; Murakami, Yuta; Sun, Cuiwei; Yadav, Hanish, 2021). Some of these issues, particularly those related to the supply of food and produce to cities, could be addressed through strengthening the link between farms and urban spaces by using app-based logistics platforms.

Challenges specific to agricultural logistics. From a supply side perspective, Asian farms are typically much smaller than their American or European counterparts, with low technology investment, and innovations from other markets are less relevant (PWC, Rabobank, Tamasek, 2019). Additionally, the deployment of cold chain management technology has not been balanced. Bigger companies are expanding sophisticated cold chain storage, but smallholder farmers are lacking simpler cold chains storage solutions that will help them to reduce vegetable wastage (PWC, Rabobank, Tamasek, 2019). Digital app-based logistics solutions can help to overcome some of these challenges by increasing the ability of smallholder farmers to coordinate with both formal and informal logistics providers and urban aggregators to access their resources and technology. These will be increasingly relevant as the Asian population's demand for food reaches a new high in the next decade.

2.2. App-based platforms are disrupting the logistics landscape

App-based platforms changing the nature of markets across sectors.
The development of digital platforms has profoundly transformed the landscape and business case of diverse industries such as hospitality (e.g. Airbnb, Booking.com), software ecosystems (e.g. Apple IOS, Tencent, Google Android), e-commerce (e.g. Alibaba, Pinduoduo, Amazon), social media, and marketing (e.g. WeChat, Facebook), and transportation (e.g. Grab, Gojek, Uber). This transformation has only been possible due to the enhanced coordination, findability, and engagement between actors that the digital networks foster.

The power of platforms and app-based solutions. A platform is a business based on permitting interactions that generate value between producers and consumers (Parker, Van Alstyne, & Choudaray, 2016) and can positively affect consumers' welfare (Cohen, Hahn, Hall, Levitt, & Metcalfe, 2016). It also "provides an open, participative infrastructure for these interactions and sets governance conditions for them" (Parker, Van Alstyne, & Choudaray, 2016, p. 177). Platforms allow for connections between distinct but interdependent users (Asadullah, Fail, & Kankanhalli, 2018) to the "exchange of goods, services, or social currency, thereby enabling value creation for all participants" (Parker, Van Alstyne, & Choudaray, 2016, p. 177). Digital platforms are now faster and have no location constraints; the connections are more precise and straightforward and run on mobile apps that can go into anyone's pocket.

Platforms and app-based solutions in Asia. Two-thirds of the Asia-Pacific population own a mobile phone, and 48% use mobile internet (GSMA, 2020). The overall mobile penetration for South Asia[3] is 33% (Elliott, 2020). In Southeast Asia, smartphone connections are calculated to be 73% for Indonesia and 64% for the Philippines (Elliott, 2020). The relatively high mobile and internet penetration, among other factors, enabled app-based on-demand transportation systems to grow, especially during COVID-19.
A survey carried out in 2016 identified 62 major platform companies operating in Asia with a collective value of 1.1 trillion USD. A majority of them (81%) are multi-platform offering various services (e.g. Tencent, Alibaba, Softbank), the rest are mainly focused on e commerce (14%), fintech, social media gaming, transportation, and travel (Evans, 2016).

The impact of digital platforms on the logistics sector. Another sector that has started to feel the benefits of digital platforms is the logistics industry. The digital transformation in the logistics sector started with multicarrier shipping software and an attempt for packages label standardisation (The Economist Intelligence Unit, 2019). Cloud computing and data management software have also been shown to address some of the challenges identified in the sector. This can be seen in efficiency improvements arising from pooling resources from different industries and allowing for easier and faster coordination among actors in diverse and extraordinarily complex supply chains. However, fragmentation, lack of accountability, and consistency make collaboration between actors in the logistics industry harder (Tipping & Kauschke, 2016). In this context, the rise of app-based logistics and transport systems can further improve efficiency and information flows within and across supply chains. These

3 A subregion of Asia including Bangladesh, Bhutan, India, Pakistan, Nepal and Sri Lanka.

platforms serve as aggregation points and hence are critical for effective, coordinated, and productive supply chains. This coordination within the logistics sector has potential cross-cutting effects among the supporting agricultural sectors by indirectly coordinating them. For ease of reference, Table 2 below shows a list of case studies of different digital platforms in the logistics sector. The table includes platforms operating in both the first-mile and last-mile logistics as indicated in the respective descriptions. While this study did not aim to conduct a comprehensive mapping of all logistics platforms across the focus countries, it is clear that there are only a small number of platforms currently operating in the first-mile logistics space, with only the Chinese market having well developed platforms fulfilling this niche.

Case	Description	Effectiveness
Pinduoduo (*Box 2*)	**Bulk purchasing e-commerce platform**: Uses a group purchasing model for organising people living within proximate locations to collectively bargain on groceries sourced from farmers and other items through bulk purchases.	Successfully implemented in China. Relied heavily in a developed logistics infrastructure.
Shopping- D (*Box 5*)	**Last-mile e-commerce and fulfilment centre**: Aggregate and deliver produce and other items through fulfilment centres with inventories available online and cold management solutions offered in the centres.	Successfully implemented in Lao PDR. Lack of logistics services has limited its reach
Cainiao (*Box 6*) (*Box 7*) (*Box 8*)	**Cloud-based logistics platform**: Connects independent logistics firms to operate within a system, sharing everything from labelling standards to customs information. They also Include farmers in delivery systems that enable them to have quicker access to technology and inputs. Likewise, they seek to Attract young talent to farms can reduce the digital divide and improve consumer adoption of digital tools in rural areas	Successfully implemented in China. Requires quite advanced technology and development
Grab	**On-demand, e-hailing, last-mile delivery and financial services app:** Offers rides, food deliveries and financial services (loans, insurance, payments, and investment) through a single app	Successfully implemented in Southeast Asia. Potential issues may arise from its relationship with financial regulators.
Gojek	**On-demand last-mile delivery, e-commerce, e-hailing and financial services app:** Offers rides, food deliveries, a marketplace, and financial services (insurance, investments and payments) through a single app.	Successfully implemented in Indonesia, Philippines, Singapore, Thailand, and Vietnam

Table 2. Case studies on digital platforms

2.3. The potential of digital platforms securing and advancing food supply chains

Leveraging platforms for farm to table connection. Supply chain integration and management can be achieved through internet-run applications that are permanently updated and accessible from anywhere. "Platforms can aggregate real-time market information on the movement of physical goods and carriers can orchestrate an ecosystem of third-party delivery agents to manage an efficient logistics and delivery system while requiring minimal capital investment" (Parker, Van Alstyne, & Choudaray, 2016, p. 167). Integrating different companies into the same platform can leverage each of the companies' logistics resources into an integrated chain. Farmers, aggregation points, warehouses, transportation companies, wholesalers, retailers, and consumers can be actively interconnected. A full integration of all these different actors within the food logistics supply chains through a platform would enable wholesalers and retailers in urban areas, and potentially end consumers as well, to source their produce more easily and directly from farmers – making logistics platforms essentially a business-to-business marketplace through which the demand from urban aggregators is matched with the supply provided by producers and transported on-demand by matching producers with logistics service providers. The implication is that these would then be three sided platforms and marketplaces that match both the demand and supply of produce as well as the demand and supply of transport services. This report focuses primarily on the development of the latter, however, the integration of these two markets would lead to further efficiencies through greater integration and would constitute a stronger business model for emerging platforms.

Digital platforms able to unlock benefits for every member of the agriculture value chain. The objective of coordinating different actors across the agricultural supply chain is to integrate an interoperable network where every member of the chain may benefit. On the one hand, these benefits would increase as more actors are integrated into the agricultural supply chain through a digital platform; on the other, as the network is formed, benefits and growth on one side of it will reflect across it (e.g. the impact of the increase in demand by consumers for specific farm products in the whole value chain). From farms, all the way to customer tables, the value chain can benefit from a stronger network and financially healthier participants.

Understanding the structure and components of the food supply chain. To understand the benefits for the different stakeholders involved in the agricultural supply chain we need to know the structure and components of the chain (see Figure 3). The first mile is the primary transport segment between farms and initial consolidation points, such as market hubs or collection points. The second segment in the agricultural supply chain is the distance traders or logistics companies travel to aggregate loads through a series of collection points and then to a secondary market or storage point. A third section, operated after complete consolidation of the produce, involves the transport to national markets, e-commerce distribution warehouses, supermarkets, or airport terminals (AFCAP, 2013).

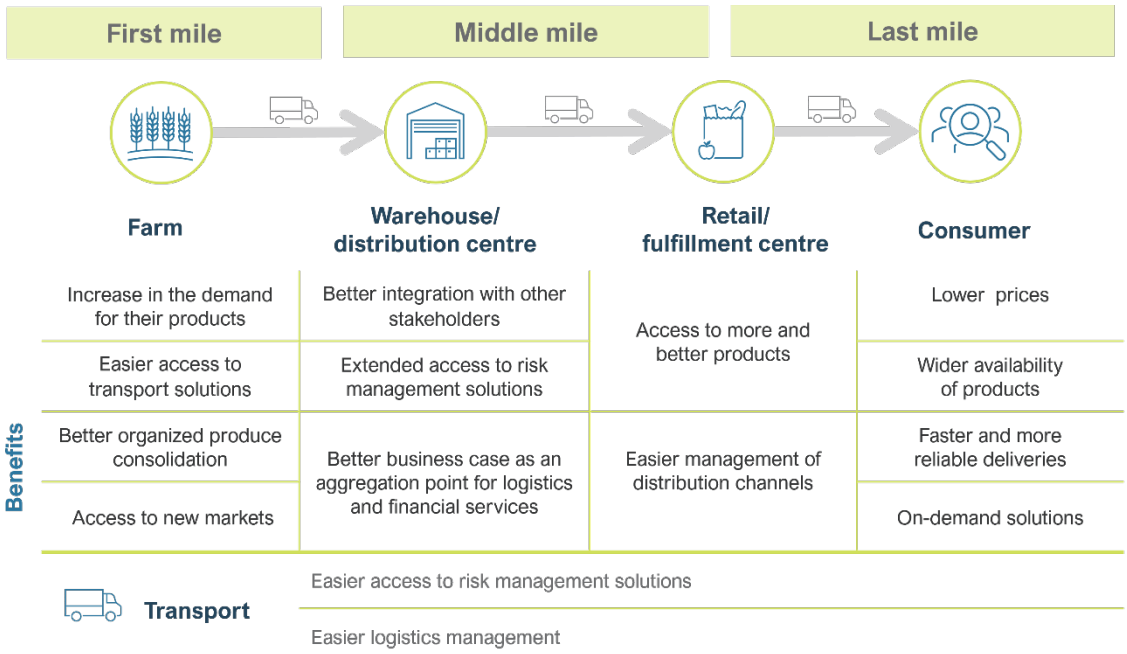

Figure 3. The potential benefits across the value chain of platform-led aggregation

Source: Authors' own

The first mile as a significant segment to emphasise innovation. The first mile provides the biggest transport constraints to developing vibrant smallholder agriculture (Njenga, 2015). It is the most inaccessible segment of the smallholder food supply chain in low-income and lower-middle-income countries due to poor infrastructure and transport service provision (Bradbury, 2018). It is also the most expensive in terms of tonne/km and has the largest constraints in terms of post-harvest losses and agricultural marketing[4] (Njenga, 2015). The first mile will usually take place on local paths and may involve carrying or using animals, bicycles or motorbikes to transport goods to higher-capacity vehicles.

Impact of digital platforms in the first mile. As mentioned, the first mile is one of the segments of the agricultural supply chain that has received the least attention from technology developers. Most innovations have focused on in-farm improvement tools using weather, markets and soil data, but not logistics developments. The integration of farmers to the market through cheap app-based logistics digital platforms could translate into the creation of more efficient aggregation points, better communication between farmers and the rest of the actors in the supply chain, and easier access to transport solutions. This can bring benefits such as improved access to on-demand transportation solutions; better organisation of in-farm and between-farms produce aggregation points; increased visibility from consumers that would translate in a higher demand for their products and even access to new markets they have never considered before due to lack of information or tools to reach them.

4 In one study (Njenga, 2015), the price of tomato transport in Tanzania was analysed throughout different aggregation points and markets. The results demonstrated that the prices at the major markets can be 250% higher than the farm gate price.

Benefits of digital platforms for the middle mile of the agricultural supply chain. Beyond the first mile, the rest of the actors in the supply chain have already started benefiting from the usage of technology solutions for management and communication improvements. Still, their integration into the network of actors in the agricultural supply chain through digital platforms may bring new benefits and efficiencies for them. Warehouses and distribution centres can benefit from an improved business case as aggregation points that store goods and function as information sharing hubs.
The potential to coordinate more easily with farmers and transport solution providers may allow them to concentrate on other innovations as inventory management.

Advantages of digital platforms for the last mile of the agricultural supply chain. Retail and fulfilment centres may improve their inventory management systems and access more and better products that they would not have been able to access otherwise. Consumers can see advantages in price reduction, wider product availability, and faster deliveries. These benefits can be leveraged by the specific characteristics of digital platforms, which allows them to scale more simply

Advantages for transport micro, small, and medium-sized enterprises (MSMEs). MSMEs operating as transporters in the food supply chain face several challenges. They are not always able to find loads to transport because of lack of coordination and communication, meaning their productive assets, trucks, spend time standing idle. Even when transporters are linked to aggregators who provide this coordination function for more developed value chains, these mostly tend to be within specific value chains. This means that MSME transporters' opportunities for loads is linked to the seasonality of the value chain and the productivity/resilience of those value chains. Moreover, even in relatively more developed logistics ecosystems, MSME transporters face a major challenge in finding backloads. As a result, a significant proportion of their trips are with empty trucks, driving up the costs of transporting goods. More effective, cross sectoral coordination through an on-demand matching of MSME transporters with producers and urban aggregators also can help MSME transporters to be a lot more productive. This lowers costs in the value chain, but also strengthens their own business cases as enterprises. Moreover, risks can be more easily managed for MSME transporters as the platform provides essential data points and potentially also offers the integration of risk management technologies such as tracking devices.

Opportunities from platforms beyond logistics services. In addition to efficiency improvements fostered by digital logistics platforms, many other value-added services can be integrated in such platforms, especially the provision of insurance and risk management solutions. The distribution of insurance and risk management solutions through digital platforms can increase the resilience of MSMEs in every section of the value chain which, in turn, can result in a higher demand for other services in the platform as the businesses grow. For instance, producers in the first mile are exposed to risks such as extreme weather events or produce perishability. Data collected through digital platforms can improve their access and understanding of risk prevention and management solutions. Likewise, de-risking transporters' activity can attract more drivers as value is added to the exchanges with producers and more drivers can encourage the creation of network effects, increasing the value for every actor in the platform (Dunn, Johnson, & Smit, 2019). In this context, apps such as Grab or Gojek already offer micro insurance and financial services for

drivers and users which can be directly acquired online through their platforms using their similarly embedded payment systems.

Benefits of digital platforms for the distribution of insurtech. As detailed in chapter four, risk management tools are a relevant component for scaling MSMEs in the food supply chain as such tools can increase MSMEs' chances of survival and growth. However, insurance providers struggle to reach MSMEs, especially those located in rural areas as they are usually unbanked or located in remote difficult to access areas; this makes it harder to earn a return on investment. Insurtech solutions linked to digital platforms present an opportunity to provide better insurance services more efficiently and to a broader customer base. Integrating risk management solutions into cloud-based logistics platform that aggregate producers, transporters, warehouses, and wholesalers can allow for easier distribution to all the stakeholders in the food value chain. Furthermore, linking insurance with other digital products can also enhance the perception of insurance as a product useful to meet their needs for MSMEs.

Empowering the first-mile foundations to benefit the rest of the supply chain. All the segments of the food supply chain benefit from improved coordination and better communication; however, the first mile is the one with the most significant challenges, and therefore, the highest potential to be positively disrupted through digital platforms.
The ease with which digital platforms can scale and interconnect diverse actors in the chain presents an opportunity for the overlooked first mile to connect to the global market more efficiently. However, it is first necessary to look at the key enablers that are needed for food logistics platforms to develop and scale successfully at the first mile.

Curbing negative effects of digital platforms. As illustrated through this section, there are substantial potential efficiency and productivity gains that can be derived from 3rd party platforms that support the matching and coordination of market participants. However, these efficiency gains are most pronounced through a single aggregating platform that coordinates across the entire market. It is important to mention that network effects can also be negative and their nature impacting every member of the market. They also create a space for large monopoly aggregators to emerge (Parker, Van Alstyne, & Choudaray, 2016) (Demary, 2015). As we have seen with the most developed platforms across markets – during the initial stages of development during which these platforms are building the business case and market share – they offer substantive benefits to users to encourage them to use their platform (Dunn, Johnson, & Smit, 2019) (Parker, Van Alstyne, & Choudaray, 2016). However, once these platforms are well established, are dominant market players, and reach saturation, these incentives are reduced. An example of this is Uber, as markets reach saturation, an excess of drivers could make them abandon the platform (Parker, Van Alstyne, & Choudaray, 2016). Another example are dominant marketplaces like Alibaba or Amazon that can potentially erode the producer surplus as producers have little option but to supply through these platforms.

For logistics platforms, there are benefits to a wide range of actors and to society, from more efficient coordination. Building trust and ensuring the smooth functioning across the chain of custody are essential requirements to unlock these benefits; simple yet effective regulatory mechanism(s) and payment systems also need to be integrated with the platform. However, it would be prudent for lawmakers, policymakers, and regulators to proactively consider steps that don't undermine the development of these platforms but

do curb the negative impacts. Some of these actions are centred in strong competition regulations, corporate governance, and financial support to smaller actors. This regulatory phenomenon has started to be seen in China in 2021 with important regulatory and anti-trust actions being imposed on the country's tech industry (The Economist, 2021).

3. How to scale app-based food logistics and insurtech

This section will first consider the features of digital platforms that allow them to be easily scalable by looking at the dynamics of digital platforms. Afterwards, it will introduce a framework that outlines five key enablers that need to be in place before the benefits that platforms bring can be attained by all members of the food supply chain, particularly by those participating in first-mile logistics. This is followed by a framework that maps the different stages of development of food logistics towards a fully integrated platform. The section concludes by discussing a range of key measures that can be used to strengthen agricultural logistics by supporting the five key enablers.

3.1. The importance of network effects

Scaling digital platforms: driven by different dynamics than non-platform-based businesses. Setting up and operating a platform business is comparatively easier than starting a traditional business. The cost of adding a user in digital platforms is meagre, a lot of the capital and work intensive actions are left for others to do, and almost all the operations are performed by AI and software (Feng & Lansiti, 2019). As opposed to traditional firms, the employees do not provide the products or services but manage the software, and "value creation and growth are not tied to human or organisational factors" (Feng & Lansiti, 2019). Although digital platforms are relatively easy to set up, scaling them requires a range of interventions that go beyond setting up the technology. The critical success factor for solver-seeker platforms to scale is the value proposition they offer potential users. Additionally, when breaking into new markets, digital platforms need to navigate the existing market players and structures as well as related incentives to build on existing networks and build partnerships that increase the value proposition and reach of the platform. For instance, at least six different start-ups that wanted to disrupt the Indian logistics sector shut down in 2016 as they struggled to remain viable and scale their operations in light of the fragmentation of the Indian logistics sector and other deep-routed challenges of the sector (Gaur, 2017).

Network effects as a means to scale. Network effects are the "impact that the number of users of a platform has on the value created for each user" (Parker, Van Alstyne, & Choudaray, 2016, p. 19). Digital Platforms rely significantly on network effects to scale and remain competitive. Network effects can be same-sided or direct, "when the value of a product, service, or platform increases simply because the number of users increases, causing the network itself to grow" (Stobierksi, 2020) as in the case of Facebook, or network effects can be cross-sided (or indirect) when "a platform or service depends on two or more user groups" (Stobierksi, 2020) or participants that attract each other (Feng & Lansiti, 2019), such as drivers and riders (Uber), producers and consumers (Pinduoduo), buyers and sellers (Alibaba) and users and developers (Apple IOs) (Stobierksi, 2020).

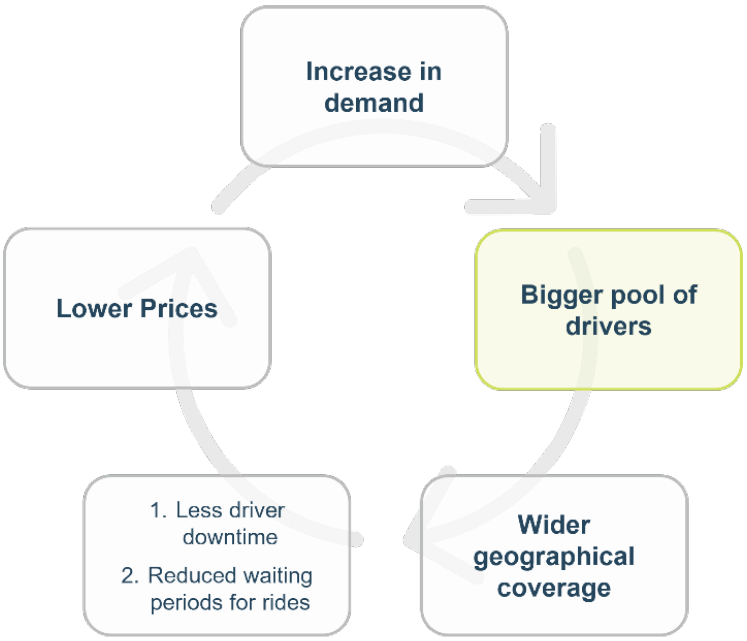

Figure 4. Network effects in the e-hailing sector

Source: (Asadullah, Fail, & Kankanhalli, 2018)

Demand economies of scale as a base for positive network effects. In contrast with supply economies of scale driven by efficiencies in production mechanisms, demand economies of scale benefit from technological advancements on the demand side and are powered by network effects through social networks, demand aggregation, and apps development (Parker, Van Alstyne, & Choudaray, 2016). As shown in the e-hailing model for network effects in Figure 4 when more users join a digital platform, the value of the interaction between actors increases, nonetheless the cost to add a new customer or consumer to the network stays extremely low. An example of how demand economies of scale work can be seen in apps like Pinduoduo, which gamifies the shopping experience in their digital marketplace. Consumers can buy goods at a lower price by inviting people in their circle to buy in groups. The digital platform has gone from zero to 800 million users since 2015 (Zhao, Wang, & Chen, 2019).

Incentives for the uptake of digital platforms and the lock-in effects. To keep the virtuous cycle of services providers and consumers supporting the scaling of the platform, it can sometimes make economic sense to accept financial losses on a consistent basis by granting discounts and give-aways (Parker, Van Alstyne, & Choudaray, 2016). Spending money on this kind of incentive for the new and current platform members is even more appealing when digital platforms lock-in effects are considered. Lock-in effects arise when changing from one platform to another is costly; leaving data behind, such as search history, emails, or reputation ratings, would entail starting over in a new platform, also having to deal with the uncertainty of the unknown (Demary, 2015). Later in this report, we will address the business case to provide financial services, especially insurance, as an incentive to increase the uptake of digital platforms.

3.2. Enablers to unlock digital platforms' benefits in the food logistics supply chain and insurtech sector

Some enablers to be put in place first to unlock the benefits of digital solver-seeker platforms. Among other relevant factors, specific infrastructural, behavioural, and financial requirements need to be put in place to unleash the full potential of digital platforms and allow for network effects to scale them. For these logistics platforms to successfully scale, logistics service providers and consumers of logistics services (i.e. the farmers) must recognise the greater value offered by these technology-enabled solutions over the traditional transport channels and modes commonly used. However, instigating this behavioural change requires a recognisable and compelling business case for providers to shift and a compelling use case for consumers. To create these incentives for different actors to use 3rd party logistics platforms first relies on the existence of key enablers being in place, upon which the requisite value to all users can be built.

Five key enablers. The five main enablers that we identified in this regard, which are displayed in Figure 3, are infrastructure and technology, aggregation points, consumer adoption, access to finance, and risk management and resilience solutions. These are considered as essential requirements for implementing digital solutions in the food supply chain. In this context, different countries and regions within countries will require diverse levels of attention on the different enablers. The fulfilment of the enablers also requires governmental intervention and private sector investment. Moreover, it is crucial to note that there are strong interdependencies between the different enablers and that all of them have to be considered for unlocking effective network effects. For instance, basic infrastructure and technology as well as aggregation points have to be in place for unlocking the access to the platform and the related value for the participants of digital food supply chain platforms which, in turn, is crucial for the consumer adoption enabler.

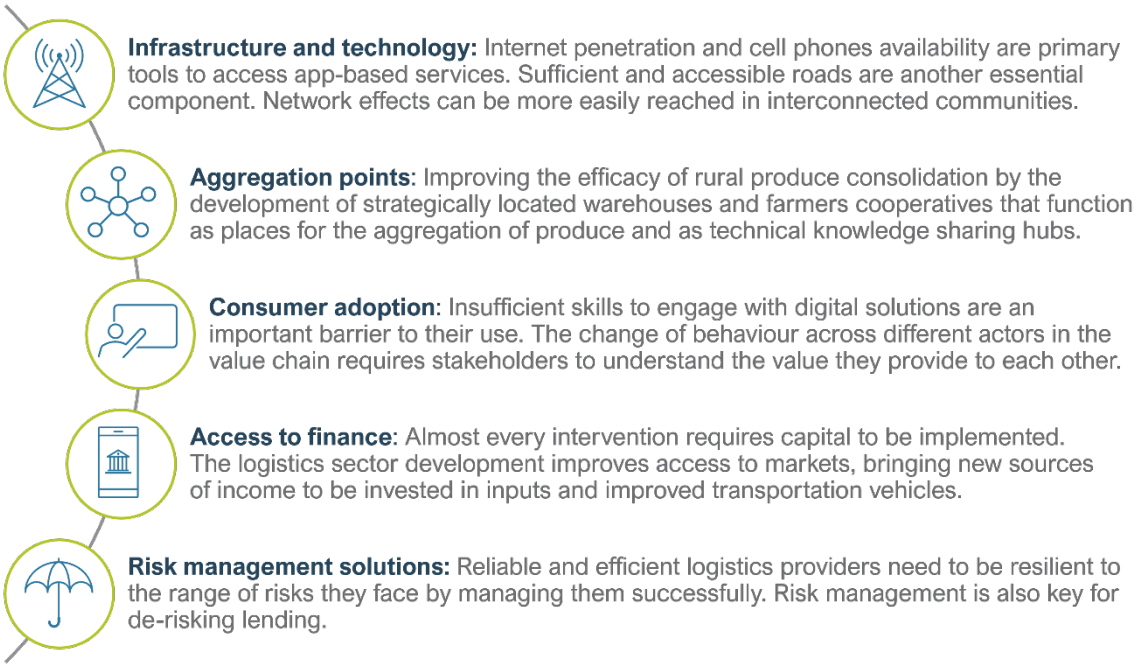

Figure 5. Enablers to unlock digital platforms' benefits in agricultural logistics

Source: Authors' own

Infrastructure and technology development. Access to the basic infrastructure necessary to interact easily with digital technology solutions is, when not yet present, the most relevant and challenging enabler to fulfil due to its high costs. The first consideration is access to electricity, a foundational aspect of using any telecommunications device[5].
A second consideration is access to the internet and mobile internet services[6], to be able to interact with other stakeholders and app-based tools, and to have access to on-demand and easily updatable services. A third infrastructural consideration is having access to cellular phones in general, and smartphones in particular, as a primary means to interact with digital platforms. A fourth consideration is sufficient and accessible roads[7], which has been reported as one of the biggest challenges for farmers in the first mile. Passable roads are necessary to transport produce to and between aggregation points[8]. Finally, cold storage and cold chain management solutions are crucial to avoid qualitative and quantitative food losses[9] (FAO, 2019), also allowing the extension of the industrial chain of agricultural products, increasing the income of farmers (PWC, Rabobank, Tamasek, 2019).

More and better-equipped aggregation points. Unlike the one-to-many nature of the last mile of the food supply chain, i.e. from an individual warehouse to multiple consumers; in the first mile the many-to-one structure requires small-scale supplies from individual farms to be bulked in lots to be "readily and economically transported, sorted, processed and sorted by processors, wholesalers, exporters, and retailers" (Wiggins & Compton, 2016, p. iii). The relevance of aggregation points lies in their role in making the interaction between the different actors in the food supply chain, but especially with logistics services providers, more cost-effective. The efficiency that well organised and distributed aggregation points bring to the food supply chain is an important requirement to scale business around this sector. These interactions can be optimised with the intervention of digital platforms.

Consumer adoption and readiness. For members of the food supply chain to be able and willing to interact with digital platforms, it is, firstly necessary for them to have access to basic infrastructure: good quality roads, electricity, a cell phone, cell phone coverage, and mobile internet which refers to the infrastructure and aggregation point enablers.
As explained in Box ***1***, most of the farmers in Southeast Asia are still only using mobile phone for calls but not to access online services. Secondly, once the infrastructure is in place, digital adoption and digital skills are a strategic imperative for stakeholders interested in delivering services through digital platforms (Voutier, 2019). Thirdly, the stakeholders must also be able to witness use cases that can show them the reasons to use

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5 **General access to electricity as a % of rural population**: Cambodia 93%, China 100%, India 97.8%, Indonesia 98.8%, Lao PDR 100%, Mongolia 99.1%, Philippines 95.6%, and in Vietnam 99.4%. **For rural population**: Cambodia 90.9%, China 100%, India 96.7%, Indonesia 97.5%, Lao PDR 100%, Mongolia 97.2%, Philippines 93.4%, and in Vietnam 99.1% (The World Bank, 2021).

6 In South Asia, only 20% of the population is using the internet. For countries referenced in this study, in Cambodia it stands at 41%, China 54%, Indonesia 48% Lao PDR 26%, Mongolia 51%, India 20%, Philippines 43%, and in Vietnam it stands at 69%. (The World Bank, 2021)

7 The UNCTAD has mentioned that "a 10% improvement in transport and trade-related infrastructure quality has the potential of increasing developing countries agricultural exports by 30%" (UNCTAD, 2020)

8 It has been reported that during wet season, many rural tracks and roads become impassable. Some studies have estimated that farmers spend 20% to 30% of their income on first-mile movement in dry season and 40% to 50% in wet season. (Njenga, 2015)

9 In high income countries, the rate of post-harvest produce waste and rot is 5–10%, in China it is 30–50%; and in India 30–40% (PWC, Rabobank, Tamasek, 2019).

technology and be exposed to social influence in the shape of other farmers' pressure to use it (Voutier, 2019). A fundamental component of consumer adoption is the acknowledging of the value that the stakeholder derives from the digital platform and the value that the digital platform can derive from stakeholders. Fourthly, trust in the products and services adopted can create an environment of confidence towards the use of technology; this subcategory includes trust in the quality of the services and products received and in the actual delivery of the same (Stakeholders Interviews, 2021). In that context, understanding and leveraging existing relationships between, for instance, farmers and buyers can help to establish trust for the solution. The buyer is often the provider of funds for the various needs of farmers, without requiring any documentation or collateral. Additionally, the perceived assurance of timely payment (advance or immediate) for the produce that is sold, influences the farmer's decision on who to sell to. Hence, this relationship encompasses personal financial needs as well as agri-linked (agri-inputs, assurance of purchase for the entire produce, etc), and understanding it is fundamental to foster consumer adoption.

Box 1. Stages of engagement with digital tools

Farmers "overwhelmingly prefer to use general messaging and social media platforms – such as WhatsApp and Facebook – to support their farming operations, rather than industry-specific apps."

In Southeast Asia, small-holders transit through a five-stage timeline of digital adoption: Face-to-face interactions, phone calls with mobile devices, peer group dialogue through messaging apps, active discovery of farming-related information online, and direct digital engagement with service providers and other stakeholders using specialised apps and tools. Most farmers in the region are at the second stage in their technology adoption process.

Source: (Voutier, 2019)

Access to finance. As stated by almost every interviewee in this study (Stakeholder Interviews, 2021), and as generally reported by MSMEs in Asia (Yoshino & Taghizadeh-Hesary, 2018), access to capital is critical for growth, scaling, and resilience. In the context of the logistics sector, logistics providers need lump sums of capital to afford transportation vehicles, like trucks. The greater access to larger lump sums of capital available from lenders, the larger and newer the trucks that can be purchased by logistics providers. As general maintenance costs for newer trucks are lower (Teravaninthorn & Raballand, 2009), access to finance can have a long-lasting impact on business-case sustainability for individual operators and hence impact the potential development of MSMEs across the transport sector. Additionally, the transparency of value chains and the interest of people in Asia for environmentally friendly products is rising (PWC, Rabobank, Tamasek, 2019), so newer and less polluting vehicles should be considered in the business case of logistics sector actors. Some of the stakeholders interviewed for this report declared an increasing interest from consumers in knowing that their food is produced and transported in an environmentally friendly way (Stakeholder Interviews, 2021).

Risk management and resilience solutions. Less than 50% of new companies survive for longer than five years (OECD, 2009) and some estimate that less than 2% of all MSMEs have any form of insurance to help them cope with emerging risks that can allow them to focus in an eventual scaling process (Sahler & Gray, 2020). In this regard, considering appropriate risk management tools from food value chain platforms' inception as part of their business model is key for their success as they are exposed to several risks in diverse stages of the supply chain and need to maintain a constant and reliable supply. This is particularly relevant in the context of the increasing impact of extreme weather events. In the context of the food value chain logistics, as the means for transporting goods represent one of the most expensive assets for farmers and transporters to acquire (Sieber, 2009), having access to essential risk management solutions to reduce the impact of damage or loss of vehicles and other assets is vital to scale the logistics value chain successfully. In this regard, reliable and efficient logistics services need to be resilient to the range of risks they face. Insurance providers, both established insurers and insurtechs, have a key role to play in developing and distributing solutions. However, for these solutions to be effective and valued by platform participants will, in most cases, require a paradigm shift among insurance providers to offer holistic risk management solutions that tangibly and effectively manage and mitigate the risk as well as offer traditional risk transfer insurance policies. Examples of this could include technological risk management solutions such as tracking devices and temperature monitors being bundled with more traditional insurance. Furthermore, effective and holistic risk management solutions can de-risk lending, allowing logistics MSMEs to acquire larger lump sums of capital from lenders and in turn acquire better and newer vehicles. Agricultural MSMEs, even when they do not own vehicles, can also benefit from the impact of insuring against production risks, such as droughts, floods, or price fluctuations. Integrating risk management solutions and access to risk financing instruments such as point to point weather index-based insurance for transport, as a form of business interruption insurance, can help producers better manage their risks increases the platform's value proposition to farmers and can be crucial for ensuring that the supply of products through the farmers is relatively stable and reliable.

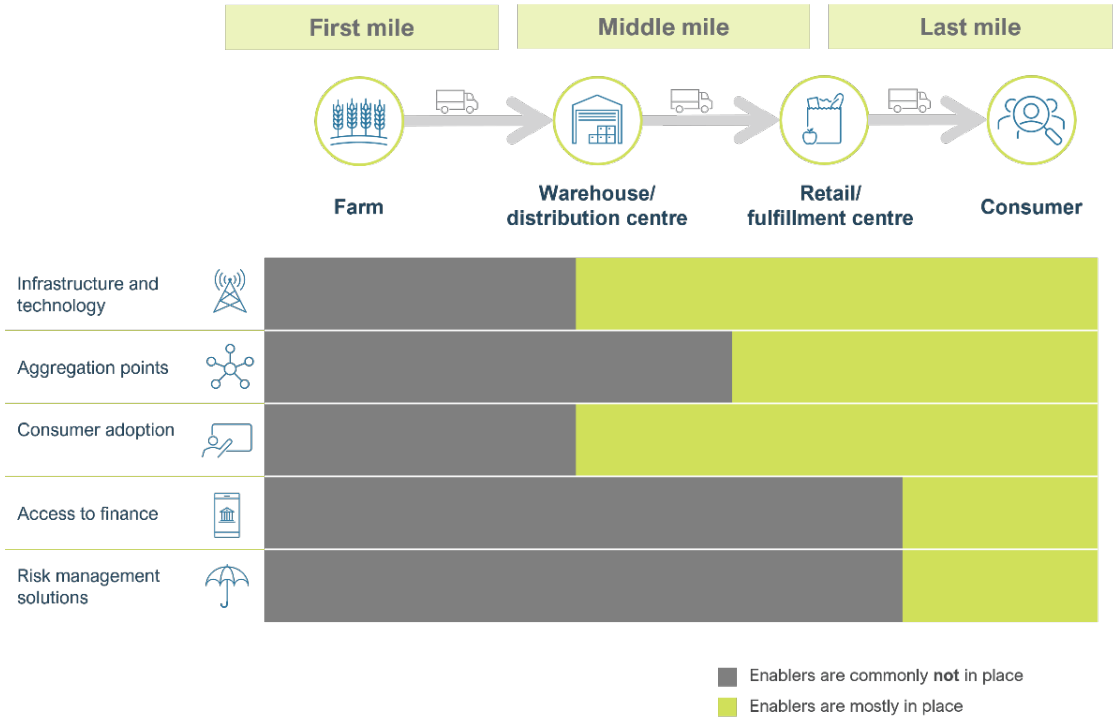

Figure 6. Enablers for the integration of different agricultural value chain actors through on-demand apps

Source: Authors' own

The development of the logistics value chain not symmetric. The agricultural industry's complexity in Asia and the smaller average size of their farms make it harder for them and investors to implement technology (PWC, Rabobank, Tamasek, 2019). Investment focus has been put in less complex segments of the value chain (PWC, Rabobank, Tamasek, 2019) that require less disruption of legacy structures than the first mile, such as the quick response to consumers' demand in the last mile. Implementing tools for the consolidation and digitalisation of the supply chain can be positive for smallholder farmers and transporters at the first mile if they have the means to access basic infrastructure that can connect them to the global value chain as permitted by digital app-based solutions. However, the digitalisation of the first mile can also be damaging if some producers are excluded from this modernised value chain because they cannot meet the conditions for entry (UNCTAD, 2020). As shown in Figure 6, there are differences in the level to which the enablers are in place depending on the segments of the food supply chain, being the first segment the one with the greatest needs in this regard.

The five enablers: fundamental for unlocking the network effects of platforms. Network effects rely on the foundations set by the key enablers described in this chapter to stay prevalent and expedite the scaling of digital platforms. Some enablers are correlated, such as access to finance that allows to establish better aggregation points. Figure 7 depicts the influence that the enablers have on the different stages of the network effects cycle. Enablers such as basic infrastructure and better access to finance, and risk management solutions can attract a bigger pool of logistics services providers, one of the first steps to trigger network effects. Moreover, improved access to finance and access to risk management solutions can enable transport MSMEs to finance newer and more reliable trucks, and reduce driving related risks. This in turn can result in faster processing of transport requests. Improved and better-distributed aggregation points allow for broader geographical coverage, permitting faster processing of larger shipments. The adoption of digital platforms by consumers is positively affected by the perception of quicker and more reliable deliveries; it also benefits from the lower prices supported by the economies of scale. Greater adoption of digital platforms translates in the increase of the demand for logistics services, another essential component of this framework.

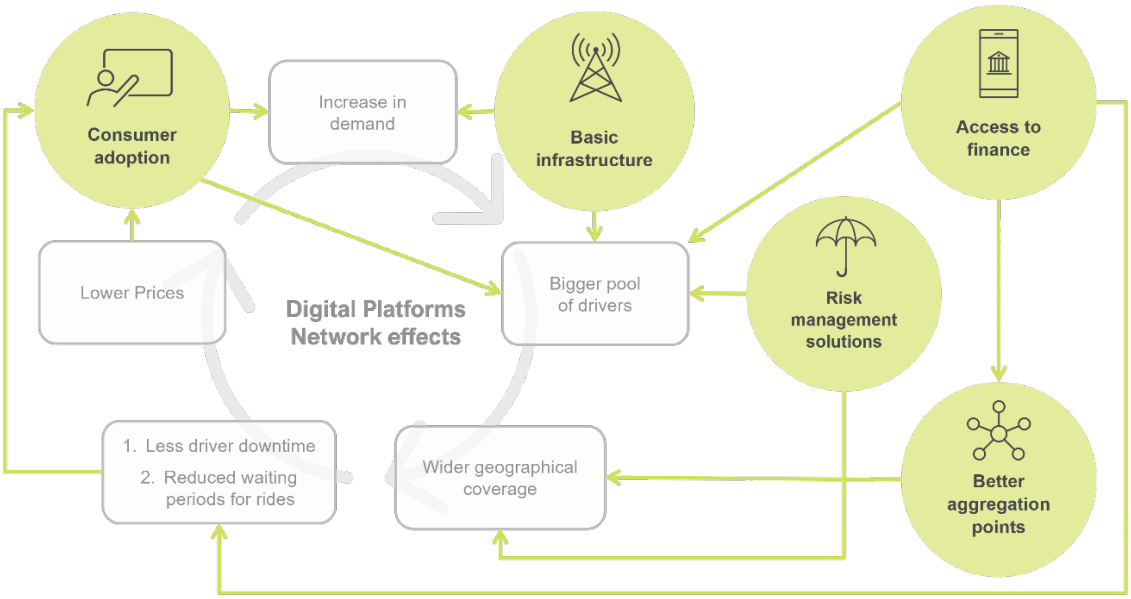

Figure 7.The role of enablers in unlocking network effects

Source: Authors' own

3.3. The stages of first-mile logistics development through app-based platforms

The first mile as a dynamic concept towards digital platforms adoption. As farmers and logistics services providers have access to broader infrastructure, better aggregation points, cheaper credit, and improved technologies, it will be more feasible and attractive for platforms to integrate them into their platforms and farmers and logistics service providers will be more likely to participate in platforms. Once the key enablers are more developed, app-based food logistics platforms can scale and enable the actors of the value chain to improve their coordination and drive further the integration of respective value chains. This, in turn, could mean reduced farm produce waste and a lower cost of

transport. This dynamic understanding of the way the actors of the food supply chain can reap the benefits from employing digital tools is represented in Figure 8, which shows how the proportion of farm produce spoiled and the cost of transportation fall as the farmers and logistics services providers reach new levels of development.

Mapping the pathway of a first-mile logistics system. Figure 8 maps out a potential pathway of development to a fully integrated, platform-based food logistics system. This framework is built on observations from Asia and across other parts of the developing world and breaks down the development of these systems into five distinct stages. The relative lack of examples of logistics platforms and ecosystems in the latter stages of development means that it is possible that developing ecosystems may follow somewhat divergent paths and develop alternative solutions to some of the challenges to reach a comparable degree of integration seen in these most developed stages. However, the objective of this framework is to present an initial mapping that can be further built on and adapted through further research. In addition, it can be used by policymakers or actors within first-mile logistics ecosystem to diagnose their current level of development and consider the most critical levers and priority interventions or actions required to progress to the net stage. As illustrated in Figure 8, the development of agricultural logistics for the first and middle miles, including the farmers, the initial aggregation points, warehouses, and distribution centres closer to the cities and retailers, is divided into five consecutive phases. Figure 8 also shows the features that characterise each phase in terms of their general characteristics, the enablers necessary to reach each stage, and the level of farmers' adoption and behavioural change towards on-demand platform networks.

First mile				
		Last mile		
1 Traditional logistics	2 Siloed value chains	3 Integrating formal logistics	4 Scaling the network	5 Professionalisation and specialisation
Proportion of farm produce spoiled before consumption//Cost of transport				
Description				
• Ad hoc/ 'traditional' logistics predominates through small scale agent aggregation • No central coordination	• Individual value chains, particularly for high value exports. • Logistics development for their own value chain	• 3rd party app(s) emerge to coordinate 1st mile logistics : – Biggest initial benefit to transporters – Geographic reach is usually limited to most lucrative transit corridors or peri-urban	• Focus is on scaling the logistics network to directly reach farmers • Integrating formal and informal transport provider networks • Encourage farmers to adopt behavior change	Focus is on enhancing reliability, transparency and traceability through value chain and the development of specialist services – monitored cold chains, supply chain management optimization etc.
Key enablers to reach respective stage				
• Use of informal borrowing and risk management mechanisms • Basic transportation means • Pre-cold chain solutions (sheds)	• Formal financing and risk management mechanisms are used for high value crops • Strong value chain aggregators • Farmers Skilling • Refrigerated trucks exclusively for high value crops.	• Initial formal financing mechanisms are available for platforms • Incentives for transporters to join network • Effective farmers coordination • Cold storage facilities close to farms	• Transporters, platforms and warehouses have access to sufficient amounts of capital and to insurance • Pre-first mile aggregation • Rural physical infrastructure • Digital skills and adoption • Full farm to table cold chain availability	• Risk management and access to capital for farmers • Enabling ecosystem for technological innovation and adoption across the entire supply chain.
Farmers up-take and integration to on-demand platforms networks				
Not yet possible	Indirectly possible through intermediaries	Use is possible through intermediaries.	Farmers use platforms without intermediaries	Farmers fully integrated to the platforms.

Figure 8. Dynamic representation of the prerequisites for the first and middle mile.

Source: Authors' own

Deep dives into the different phases. The initial phases illustrate the early stages of development of a logistics ecosystem, irrespective of any potential platform or digital solution. The first two stages capture simplified versions of what first-mile logistics looks like for most sectors across most of the developing world. In the developed world (and some emerging markets) large, formal logistics companies often dominating the market and development of the logistics sector beyond Stage 2 has often looked quite different to what is illustrated in Figure 8. In much of the developing world, however, much of the economy relies on informal and fragmented transport networks. The emergence of app-based platforms therefore offers an alternative pathway to the development of the sector by aggregating and coordinating these existing networks and infrastructure to more efficiently meet the logistics needs across sectors, rather than only in specific value chains. The later stages of the framework illustrate how this pathway of development through app-based logistics platforms can develop. The five phases of developing the first-mile logistics of the food supply chain are as follows:

The five phases of developing the first-mile logistics of the food supply chain are as follows:

- **Phase one:** Phase one describes the initial state of traditional logistics, with small-scale agent aggregation and an almost total lack of centralised coordination. In this first phase, basic transportation means, such as head lodging, are prevalent (Sieber, 2009) and some intermediate means of transport (IMT)[10] and pre-cold chain solutions are available, such as cooling sheds. This implies that the different stakeholders create small scale aggregation points at different locations and extract substantial premiums for them but, generally, connections between value chain participants are fragmented. At this stage, farmers adoption and integration of on-demand platforms is not possible yet.
- **Phase two:** The second phase is characterised by siloed value chains, resulting from the dual structure of rural transport markets, which are either traditional, as in the first phase in Figure 8, or modernised (Sieber, 2009). In this phase, the crop is usually a high-value product, with higher transport, management, and financing requirements (Sieber, 2009), all of which are concentrated in a single crop. The second phase requires more substantial aggregation points and more advanced farming skills. The integration of farmers to more significant markets over digital on-demand platforms happens mostly indirectly through intermediaries.
- **Phase three:** The third phase in Figure 8 is defined by the utilisation of third-party apps that allow higher levels of coordination among farmers and transport companies in the field of first-mile logistics. This is the new phase of development in which the development of first-mile logistics is beginning to diverge from traditional development pathways, as new technologies enable centralised coordination across different value chains through digital platforms and online marketplaces. This stage shows how benefits start to manifest for participants of the middle mile, specifically for transporters, which focus within a limited geographical reach where the most lucrative corridors are. To access this stage, it is necessary to create incentives for transporters to join the network and effective coordination among farmers; both enablers are facilitated through the digital environment created in digital platforms. At this stage, the integration of farmers to digital networks is partially possible with only minor interventions of intermediaries such as warehouses operators and aggregation points with internet access. Farmers start to acknowledge the potential value of exchanges through the platform.
- **Phase four:** The fourth phase of Figure 8 is where logistics companies focus on scaling to reach directly to farmers. This stage seeks to integrate formal means of transport with intermediate means of transportation and requires implementing mechanisms to encourage a behavioural change around the adoption of digital platforms. The integration of farmers and transporters through digital tools requires better aggregation at the first mile, the development of rural infrastructure, such as specialised cooperatives, and digital skills adoption. In the fourth phase, digital platforms are used by farmers without the need of intermediaries but for the assistance necessary to develop digital skills and uptake of new tools.
- **Phase five:** The fifth phase shown in Figure 8 is characterised by stakeholders taking actions to enhance reliability, transparency, and traceability throughout the value chain. This stage requires the successful interoperation of digital ecosystems where the value chain actors can quickly adopt new technologies. At this stage, farmers have integrated digital platforms as a fundamental part of their business model and digital

10 Intermediate means of transport are defined as "small motorised or non-motorised transport modes that fill the gap between human walking and carrying and large-scale transport. IMTs include bicycles, motorcycles, pack animals and carts" (ReCap, 2014)

platforms are able to integrate a range of advanced risk management technology solutions into their service offerings.

3.4. Examples from Asia of measures and tools for enabling logistics platforms to scale

Measures for farm-to-table integration of on-demand apps. Considering the identified enablers and stages of development for logistics platforms, a range of different measures exist that can address the different challenges and help to put the different enablers in place. Figure 9 displays some of the key measures that have been identified through stakeholder interviews and how they support the implementation of the enablers. Additionally, it is important to note that most of the enablers require support within the non-digital realm as transformation is needed around infrastructure, aggregation as well as behavioural changes in order to enable platforms to scale and to realise their full potential. This implies that the development of the platform technology is not the key challenge to the development and scaling of digital platforms. An appealing user interface will not be sufficient to enable a logistics platform to scale. Section 4 of this report will explore how platforms can be utilised to serve MSMEs with risk management solutions and to enhance their access to capital. The enablers discussed in this section primarily refer to the non-financial sector solutions – as enhancing access to financial solutions requires consideration of the financial services providers approach and business model as much as the logistics ecosystem – hence they are largely discussed in the following section.

	Infrastructure and technology	Aggregation points	Consumer adoption and readiness	Access to finance	Risk management and resilience solutions
Encourage community group purchasing and create inner city pick-up locations		✓	✓		
Leverage farmers specialized cooperatives	✓	✓	✓	✓	✓
Implement suitable and innovative cold chain management solutions	✓	✓			✓
Invest into the establishment of fulfilment and delivery centres	✓	✓			
Leverage a bilateral model for strengthening local logistic networks	✓	✓			
Attract young talent to rural areas	✓		✓		

Figure 9. Overview of measures and the enablers that they can support to unlock

Source: Authors' own

Encouraging community group purchasing and creating pick-up locations. Group purchasing is a model that organises people living within proximate locations to collectively bargain on grocery items through bulk purchases. This tool allows consumers to acquire produce directly from farmers at lower prices and hence enables consumer adoption through the reduction in costs. After the bulk order is submitted, it is delivered to a designated pick-up location, where the community leader divides and distributes the products. These pick-up locations are aggregation points that establish the linkages between consumers and farmers. Community leaders are crucial as they act as the sole intermediary between the producer and the community buyers (Haliciogiu, 2021). The community leader is also responsible for creating the group chats, gathering customers, and placing and picking up orders. This tool reduces the number of intermediaries and the delivery prices, as customers usually fetch their groceries from a predetermined community centre or the community's leader house. Moreover, digital platforms can work with community leaders to onboard the community on to the platform. This would enable the platforms to access the respective customer and farmer networks and to leverage the existing pick-up location infrastructure as aggregation points. Platforms can also put tools in place that encourage community purchasing and create pick-up locations themselves, as outlined in Box 2, which describes how the Chinese e-commerce platforms Pinduoduo implemented bulk purchasing models.

Box 2. Pinduoduo and Duo Duo Grocery: Community Bulk Purchasing

Pinduoduo is an e-commerce platform that offers a wide range of products from groceries to electronics. Pinduoduo arrived at the Chinese market without an app and was based exclusively on WeChat an instant messaging app. Initially, the platform only commercialised fresh produce because its consumption is universal and has a high repeat purchase frequency. Fresh produce commercialisation allowed them to accumulate users. Once Pinduoduo had a sufficiently big platform of customers that trusted the platform, it started commercialising higher-value products such as clothes and electronics.

Pinduoduo also offers a gamified social team purchasing model. The platform offers discounts and specials that can only be unlocked if the purchaser finds at least another member from their social network who also buys the products (the merchant sets the minimum "team" size). Then the items are shipped independently. This has helped to pull in traffic and build economies of scale as producers have more access to data and more customers purchase one product at once.

Source: (Lim, 2021) (Pinduoduo, 2021)

Leveraging farmers' specialised cooperatives (inter-village cooperation). Farmers' specialised cooperatives (FSCs) can "increase agricultural efficiency through integration both horizontal — by combining small farms into larger, more efficient entities — and vertical — by bringing together the production, processing, storage, transportation, and sales into one industrial chain" (Yue, 2019). Vertical integration of FSCs can add bargaining power for farmers to negotiate inputs' and outputs' prices, reduce the distance that farmers must transit in the first mile, allow for the realisation of economies of scale as well as permit smallholder farmers to enter and adapt to big markets (Zuhui, 2014), and provide for an aggregation point for produce and knowledge sharing. Although FSCs face

some consumer adoption issues (e.g. lack of trust from some farmers, fears of profit loss) (Yue, 2019) and a lack of capable management causing issues, they can be a crucial entry point for a platform to connect to farmers and to aggregate and transport their produce in an efficient way. FSCs are trusted institutions among farmers and support farmers in adopting new technologies and so can be leveraged for driving the consumer adoption of a digital logistics platform. For instance, the FSC Baimeng provides farmers with a space to share knowledge and enables them to jointly determine how to transport and sell their produce, as outlined in Box 3. Moreover, through being such a key and trusted aggregation point and by vertically integrating the value chain, financial service providers will find it easier to provide their services to the farmers. As a result, value chains that have FSCs are more likely to have key enablers for scaling digital platforms such as risk management solutions and credit access for farmers in place.

Box 3. FSC: Baimeng

Baimeng is an FSC, an entity regulated by Chinese law. There are about 2 million FSCs in China, with over 117 million rural households being members (approximately 48% of all rural families). Baimeng was founded in 2011 to improve the economic situation of the area where it is located, and now it has 100 member households. Before the establishment of Baimeng, the community was in crisis, with no opportunities for young people, little cultural life, and scarce resources.

Since 2011, the Baimeng cooperative has built several greenhouses that can withstand the cold winter temperatures. The land the greenhouses are built on is voluntarily transferred by villagers that are often too old to farm. The greenhouses are then leased to residents to grow vegetables.

The cooperative has also provided its members with a space to share knowledge and collaborate, creating a sense of collective identity, and facilitating groups of farmers acquiring inputs such as fertilisers and seeds. This hub also allows the members to jointly determine when to harvest and how to transport and sell their produce.

One of the main drivers for the creation of FSCs is a program from the Chinese government to recruit young, talented people to return to their homes in rural areas and join the political structures there while focusing on strengthening their local FSC.

Source: (Yue, 2019)

Implementing suitable and innovative cold chain management solutions. High food waste has happened because of Asia's lower cold chain capacity (PWC, Rabobank, Tamasek, 2019). While big companies are implementing advance cold chain storage and management solutions, smallholder farmers in Asia frequently lack access to such technologies (PWC, Rabobank, Tamasek, 2019). The implementation of cold storage solutions needs to be done from the first mile and throughout the value chain, however it commonly entails high energy consumption, which makes cold storage innovations that could improve energy efficiency relevant to reduce costs and emissions. As it is mentioned in the case study in Box 4, cold management solutions are a fundamental piece of infrastructure to preserve the quality of fresh produce. Cold storage spaces are also suitable aggregation points and a good risk management tool in terms of reducing food spoilage.

Box 4. Ecozen's solar cold storage rooms

Ecozen, an Indian company, has develop a solar cold storage room called "Ecofrost" that charges completely within six hours and can operate from a generator on cloudy days. Its solar capacities are also relevant due to unreliable power supplies in rural areas. The technology does not require lithium batteries or petrol to operate and allows farmers to store goods for several days, which allows them to wait for better prices if necessary.

The system connects to a mobile phone app that permits farmers to choose the kind of crop they are keeping cool, while the software sets the ideal temperature for it. The room temperature and humidity and the weight of the produce can also be monitored from the app. As of 2018, 100 Ecofrost systems had been installed, benefiting a thousand farmers, with reports of increased profits of up to 40% for farmers.

Source: (Ecozen, 2021) (Ashden, 2018)

Investing into the establishment of fulfilment and delivery centres. The creation of fulfilment centres in the form of warehouses is crucial for a well-functioning food logistics supply chain. Through fulfilment centres, produce can be aggregated and then delivered on-demand for customers. Investing into the establishment of fulfilment and delivery centres and combining them with other value-added services, such as refrigerated storage and walk-in supermarkets, puts the key infrastructure and aggregation points in place for a digital food logistics platform to operate successfully. Box 5 outlines how a Lao PDR based online supermarket platform, Shopping-D, created fulfilment centres in consumer areas and offers additional services to producers such as refrigerated space. These fulfilment centres enable Shopping-D to offer in-house and on-demand delivery customer services.

Box 5. Shopping-D: Fulfilment centres

Shopping-D is the first online and app-based supermarket in Lao PDR. The supermarkets stock up to six thousand different items, including fruits, vegetables, fresh meat, and cleaning products and beverages. Products can be delivered at USD2 per delivery or picked up from their fulfilment centre in Vientiane within two hours of ordering. Customers can see in real-time how many products are left in stock.

The fulfilment centre is a warehouse where producers ship their products, and from which the online orders are fulfilled. Shopping-D's fulfilment centre is located inside a shopping mall, so shopper can also walk in the shop. Shopping-D rents shelves, pallets, refrigerated space and freezers to the diverse producers and vendors. They also charge the vendors a small fee for every order they fulfil. The fresh produce for sale is sourced from markets around the city but mainly from the central market. They offer an in-house green delivery service, free of plastic bags, that uses electric tricycles that get some of their power from a solar panel on their roofs. They sometimes use external delivery providers for smaller orders, but they try to avoid them as they are not as green as the in-house service.

Source: (Stakeholders interviews, 2021)

Leveraging a bilateral model for strengthening local logistics networks.
The foundation of the bilateral model is the view that farmers are not only suppliers but also consumers. This means that aggregation points within the local logistics networks are not only built for the aggregation produce but for the internal exchange of goods as well. Through strengthening logistics for farms, farmers can be included in delivery systems that enable them to have quicker access to technology and inputs. Moreover, it significantly strengthens the value proposition of farmers participating on food logistics platforms. Benefits also materialise for transport MSMEs that are less likely to have to drive empty vehicles from urban aggregators to farmers as they are utilised to transport goods from urban aggregators to farmers (Stakeholders interviews, 2021). The Chinese platform Cainiao successfully utilised this model, as outlined in Box 6, which has allowed it to scale its operations around the food sector.

Box 6. Cainiao's two miles model (bilateral model)

For the food supply chain, much of Cainiao's success is explained by implementing a bilateral delivery system. First, the model consists of connecting communities of farmers through logistics by improving the transportation of products inside villages and towns. This network is then linked to Alibaba' existing infrastructure for branding, e-commerce, and last-mile logistics. The bilateral system contemplates implementing express deliveries available to rural shoppers in the first mile and farm-to-hub pick-up services for farmers interested in selling online. These measures are trying to reduce geographic isolation and shipping costs.

Source: (Campbell, 2020) (Li, 2021) (Stakeholders interviews, 2021)

Attracting young talent to rural areas. "New farmers" is a term used to describe well-educated, middle-class young agricultural entrepreneurs (Scott, Si, Schumilas, & Chen, 2018), who quit their jobs in the cities to move to the countryside and initiate farming businesses (Yu, 2015). They normally focus on sustainable farming and growing organic produce and have good knowledge of digital tools that they apply to connect to other farmers and improve the efficiency of their yields. This has contributed significantly to the digitalisation of villages and the adoption of new technologies in farming (Stakeholders interviews, 2021). Attracting young talent to farms can reduce the digital divide and improve consumer adoption of digital tools in rural areas, as the new farmers can physically show the use cases for these tools to other less, technology-savvy, farmers.

Box 7. Cainiao's one young person, one laptop and one internet connection per village project

Cainiao, one of the biggest logistics platforms in China, initially experienced difficulties when it came to motivating farmers to adopt technology as they are often old and have not engage with technological solutions before. One successful strategy has been to implement the "one young person, one computer and one internet connection per village" approach. This created small hubs to provide farmers with access to the internet and allowed unskilled farmers to learn digital skills from a trained person. Farmers started to witness the use cases of joining digital platforms as their neighbours engaged with online retail services, transport services, and real-time agricultural and market information providers.

Source: (Stakeholders interviews, 2021)

4. Insurtech in app-based logistics

The COVID-19 crisis resulted in a severe disruption of domestic and international food supply chains due to transportation delays, trade measures, movement restrictions and other factors. The integration of risk management solutions within app-based food logistics systems can increase the capacity of different players along food supply chains to cope with the multitude of risks they face. Moreover, effective risk management is a one of the five key enablers for scaling food logistics platforms and a crucial element of the business model of digital food logistics platforms. As has been highlighted throughout the preceding sections, the success of third-party, first-mile logistics platforms is closely integrated with the development of appropriate and holistic risk management solutions. Insurance providers and insurtechs need to make these solutions available to help facilitate logistics' providers access to credit, mitigate their risks and ultimately enable the scaling of the platforms. At the same time this sector, and particularly the development of 3rd party logistics platforms, do offer a substantial potential market growth opportunity for innovative providers willing to invest the necessary time and capital.

In this section we outline the business case for insurance providers to implement risk management solutions through digital platforms in the food supply chain. We then discuss the provision of risk management solutions for three target groups: transporters, producers, retailers, and credit providers.

4.1. Business case for integrating risk management solutions into app-based food logistics platforms

An evident need for risk management among MSMEs engaged in the food supply chain. MSMEs make up more than 97% of companies in the ASEAN region and are the backbone of Asian economies (ADB, 2020). In comparison to larger enterprises, MSMEs are more vulnerable to financial volatility and to the personal risks of their owners and their family members, compounded by the personal risks of their employees. This is in addition to the various business-related risks the enterprise faces. The situation is aggravated by the fact that MSMEs face a higher exposure to threats and disasters while operating with limited funds for emergencies (Sahler & Gray, 2020). De-risking tools are essential for scaling the businesses of the different actors that are involved in the food supply chain. Both farming and logistics MSMEs can use risk management solutions to improve their current risk mitigation and coping mechanisms and as a result increase their chances of survival and growth. Risk management solutions can smooth consumption, allow for superior assets acquisition, absorb shocks, and manage risks linked to unpredictable income (ADB, 2017). However, MSMEs engaged in food logistics are underserved by insurance.

Insurance providers struggling to reach MSMEs, especially rural ones. MSMEs differ vastly based on size, age, sector, and a multitude of other factors. Hence, they are highly heterogenous in the activities that they undertake and the risks that they face. Disaggregation is crucial to understand the risks, needs and contextual realities of different MSMEs but insurance providers often lack the data to disaggregate and segment

MSMEs. As a result, only standardised products are usually available to MSMEs, which do not do justice to the diverse needs of MSMEs. Moreover, a high proportion of MSMEs are unbanked or inaccessible, which makes it difficult to reach this target market to sell policies, provide post-sale service, collect premiums and pay claims. The aggregators and distribution partners that work for microinsurance do not necessarily work towards reaching different segments of MSMEs (Sahler & Gray, 2020). This is particularly valid in rural areas where the return on investment is lower than in more urbanised areas due to the lack of distribution points for financial services. This requires insurance companies to build and run offices that are not profitable due to the low concentration of people in rural zones (Stakeholders Interviews, 2021). In addition to these challenges, regulatory and consumer education challenges adversely impact the viability of the business case for insurance providers to serve MSMEs. It is complex for insurtech companies in some Asian countries to obtain brokerage licences; in countries like the Philippines the waiting time to obtain this kind of permits is up to a year (Stakeholders interviews, 2021).

Improving the efficiency of distribution by integrating risk management solutions into food logistics platforms. Digital platforms offer the opportunity to provide and distribute insurance products more efficiently. Insurance services can be offered directly embedded in apps, as a service that can be acquired for limited periods of time and related to the main service offered within the app. An example of this is companies offering car or health insurance through e-hailing platforms or delivery insurance offered on e-commerce sites. The distribution of insurance is also easier as the contracting of a policy can be done completely online, allowing in some instance instant comparison of different insurance services providers (Stakeholders interviews, 2021). As described in Box 8, cloud-based logistics platforms can seamlessly coordinate producers, transporters, warehouses, and wholesalers. This implies that platforms can act as suitable distribution points for insurance services for reaching different groups of MSMEs.

Box 8. Cainiao: Cloud-based logistics platforms

In May 2013, Alibaba, China's largest e-commerce company, along with a group of leading Chinese last-mile logistics corporations established Cainiao Network Technology Co. Ltd. Cainiao's vision is to build a smart logistics network through an open platform. Cainiao's plan is to create an ecosystem that every logistics firm in China, and in the rest of the world, could connect to. Their concept is to connect independent logistics firms to operate within a system, "sharing everything from labelling standards to customs information". This allows businesses to select the most efficient delivery option based on a real-time data analysis of providers and routes.

To endorse digital inclusion, Cainiao is rolling out more than 20 smart logistics centres in remote areas of China and revamping existing processing warehouses, from where they collaborate with farmers and local logistics companies. Farmers deliver and process their products in those centres and warehouses, and the logistics companies distribute from or to them.

Source: (Campbell, 2020) (Li, 2021) (Stakeholders interviews, 2021)

***Offering products that bring more value*.** Digital platforms can create a space where it is easy and affordable to reach MSMEs, however, the offerings will only translate into uptake and usage if the customers perceive the insurance services as valuable (Sahler & Gray, 2020). As consumers often have negative perceptions of insurers' willingness to pay claims, insurers must improve their claims experience, boosting their payment ratios and speed. Moreover, insurance providers should offer solutions that are designed to meet the needs of MSMEs, which will likely call for insurers to develop more holistic risk management solutions than pure insurance, becoming risk management partners, rather than just insurance providers (Sahler & Gray, 2020). To add tangibility to the insurance offering, it is necessary to work with MSMEs to evaluate their risk and help them implement risk prevention and management mechanisms, and bundling those tools with traditional risk transfer solutions (Sahler & Gray, 2020).

Access to data from digital platforms able to improve the value proposition.
The provision of tailored risk management solutions means that insurers need to understand the challenges and risks experienced by MSMEs operating in the food logistics supply chain. Consumers' data protection should be carefully guarded by any of the digital platforms in this and any other markets. However, the anonymised data on riskiness and other behaviour collected from the interactions of stakeholders on the digital logistics platforms can allow for continuous, faster and holistic risk assessments and the understanding of specific products need from MSMEs. This may result in better-tailored and more valuable insurance services and products to attract more consumers, which can increase the incentives for insurance providers to serve MSMEs. Enabling effective sharing of this data between different service providers and new entrants is therefore important to ensure that each provider is able to most effectively tailor their solutions to their specific consumers. Emerging digital technologies such as IoT sensors, telematics, and artificial intelligence offer increasingly practical and affordable tools that supplement traditional instruments like insurance and driver training to proactively build resilience.

***Digital platforms able to support the consumer adoption of insurance products*.**
A combination of the digitalisation of the economy in Asia and the transition to digital mechanisms to provide financial services, accelerated mainly by the COVID-19, have created an environment where acquiring insurance through digital channels has become a more compelling option (Stakeholders interviews, 2021). Increasing insurance uptake among MSMEs can be achieved by offering affordable products that bring additional value to the consumers. However, a good understanding of insurance is still shallow among MSMEs (ADB, 2017). To facilitate their adoption of these platforms, embedding insurance solutions in digital platforms accessible through smartphones will allow the stakeholders in the food value chain to access digitalisation learning tools and visualise insurance use cases. It will also enable stakeholders to acquire insurance products that can be contracted for limited amounts of time and are designed specifically for their needs. This framework has already been successfully implemented through platforms such as Grab (GRAB, 2021) and Gojek[11] (GOJEK, 2020), which have significantly increased the uptake of digital platforms and the acquisition of insurance products by MSMEs in Asia (ADB, 2020).

11 Gojek drivers can access private health insurance in Indonesia at a cost of USD0.16 per day for them and their families. (ADB, 2020)

Box 9. Expanding PasarPolis insurtech services

PasarPolis is an Indonesian-based start-up focused on making insurance policies more accessible in Southeast Asia. They aim to make insurance more accessible by reaching first-time insurance buyers such as delivery couriers, ride-hailing drivers, and online shoppers with microinsurance products. Using advanced technology, it aims to deliver a seamless customer experience from product selection to claims. Since its founding in 2015, PasarPolis has expanded its regional footprint by establishing business operations in Vietnam and Thailand.

Insurtech companies like PasarPolis can expand their services by integrating easily accessible services to digital logistics and agricultural platforms. Using indirect data on customers' behaviour, insurtech companies can tailor their services and pricing to align them to customer needs better. They can also further integrate their services to platforms, allowing companies to offer incentives in the shape of insurance services to foster network effects. Finally, Insurtech companies should provide products that offer value to consumers beyond insurance services. Examples of this can be seen in the implementation of tracking devices that allow for a more precise calculation of insurance premiums based on driving patterns and permit users better control of vehicle fleets.

Source: (Stakeholders interviews, 2021)

4.2. Embedding risk solutions into platforms for the different target groups

Insurtech solutions for drivers and transporters. Drivers face risks in the shape of damage to their vehicles, and bodily injuries to themselves, their passengers, or the goods they transport. This requires them to acquire risk management solutions. Digital platforms that settle transactions such as e-hailing and on-demand transportation apps can unlock additional value for platform participants through enabling access to inexpensive and suitable financial services (Dunn, Johnson, & Smit, 2019). Food logistics platforms require a stable pool of drivers, and it is essential for them to effectively attract more drivers. Providing tailored insurance products can attract more drivers by adding value to the exchanges between transporters and producers through de-risking drivers' actions (Dunn, Johnson, & Smit, 2019), which turns insurance into a desirable product that is easily acquired and paid for digitally. Moreover, through de-risking the drivers' actions through insurance and vehicle tracking and monitoring, the products can be transported more efficiently and reliably, which is crucial for adoption among both producers and end consumers. Additionally, platforms can provide benefits linked to the level of engagement the members have within the platforms; as their usage increases, the insurance and other financial benefits surge as well (Dunn, Johnson, & Smit, 2019).

Insurtech solutions for producers. Producers are constantly exposed to risks related to the crops they plant, such as droughts and flooding. Agribusiness products have three specific characteristics that make risk management for agricultural supply chains more complicated when compared to risk management for typical manufacturing supply chains: seasonality, as the growth is seasonal, but the consumption is permanent; supply spikes,

harvesting and post-harvesting activities can be very demanding if there are supply or demand spikes, and perishability since delays in transportation services can cause substantial losses in the product's value. Since food logistics platforms want to ensure a stable supply to reliably satisfy consumer demand, there is a clear incentive for them to promote risk management solutions for producers through their platform. In addition to embedding crop and transport related insurance services to their platform, they could also offer tools to improve the risk management mechanisms of farmers. These tools can range from simple solutions enabling communication and coordination among farmers around yield quality, inputs acquisitions, and market information to the integration of more advanced technologies, such as soil quality trackers and GPS crops monitoring, that help to manage risks more effectively.

Insurtech solutions for retailers. A large proportion of MSMES in developing countries operates in the retail sector. They face substantial challenges and risks regarding inventory management such as lack of inventory management systems, risks related to perishable goods and cash flow challenges as well as property related risks. If the food logistics platform is a business-to-business marketplace, there is a clear incentive for the platform to support these MSMEs in coping more sustainably with these risks as this incentives retail MSMEs to become users of the platform. Moreover, the integration of risk management solutions for retail MSMEs into the platform, supports these enterprises in growing their business which, in turn, can result in an increased demand for inputs through the platform. The resilience needs of MSMEs could be served by insurance providers through the platform in the form of stock- and property-related insurance in combination with risk management solutions such as enabling the digitalisation of inventory and payment systems or fire detection systems.

Insurtech solutions for credit providers. Lenders and investors face substantial real and perceived risks when lending to MSMEs that are operating in agricultural and food logistics supply chains. However, MSMEs require access to capital to scale their operations. Traditional insurance and risk management and mitigation solutions offered by insurers offer the opportunity to de-risk credit and capital provision. Credit providers can be both the direct beneficiary through meso-level insurance or the indirect beneficiary and aggregator through which insurance can be distributed to the end consumers. Holistic risk management solutions offer even stronger potential for de-risking credit. With the implementation of risk management technologies such as tracking technology for vehicles and weather conditions sensors for crops, credit providers have access to the driving patterns and routes of a vehicle and the incoming weather patterns; this gives banks and other credit providers the confidence to lend money as they can better manage and model risk. Providing insurance through digital platforms connected to sensors that measure diverse conditions in real-time across the food supply chain could reduce the risk lenders have to face and potentially reduce the interest rates for the stakeholders of the chain.

Despite the opportunities, the business case for insurtechs and insurers remaining largely untested and therefore perceived as risky. As outlined in this chapter, there is a clear business case for insurance and insurtech providers to provide value-added services to the different stakeholders involved in digital food logistics platforms. However, the provision and distribution of risk management solutions through digital platforms implies the implementation of a new, innovative business and operating model, which entails risk and uncertainty for providers entering this market for the first

time as well as patience. This study found very limited evidence of insurtechs or innovative insurers considering holistic risk solutions or first-mile logistics as a viable market, outside of China. Demonstration cases will therefore be important to illustrate the viability of targeting this market segment in this way. Given the political and societal imperatives related to the role of first-mile logistics to enable efficient food production, there may also be a case for both development partners and Government to consider both financial and non-financial support to de-risk investment by private sector actors into this segment.

Accommodative policy and regulatory environment crucial for unlocking the business case. Furthermore, the implementation of a new, innovative business and operating model also poses risk to providers if they are faced with operating in an environment of regulatory uncertainty. For instance, product and licensing approval are often perceived as a major barrier to market entry and product innovations and this new operating model might not fit neatly into the existing license categories for insurance business. As a result, they could be subject to the burden of disproportionate or inappropriate compliance requirements for their operations which, in turn, would disincentives them from offering risk management solutions through digital food logistics platforms in the first place. Therefore, regulators and policymakers have a key role to play in supporting an enabling environment for innovation and the development of innovative solutions which will be further discussed in Chapter 5 (Grey, De Waal, Hougaard, & Beyers, 2021) .

5. Implications for policymakers and development partners

First identifying the current state of development to determine priority intervention focus. The first task for policymakers and development partners to answer, when considering the key interventions required to develop first-mile logistics within a given context, is to determine the existing level of development of the logistics and transport sector. Development partners can support evidence-based policymaking by developing an understand of the phased nature in the development of digitally interconnected food supply chains. These tools should allow them to identify the state of modernisation in their jurisdictions' different food value chains and the enablers that need to be in place to reach a higher level of development. Policymakers and development partners in countries like China, where the enablers discussed in this document are in place for several regions, can choose to mainly focus on digital platforms financing, consumer adoption improvement, and digital skills education programs. On the other hand, lower-middle-income countries such as Cambodia should focus on offline infrastructural solutions, as better aggregation points, financing MSMEs in the transport sector at the beginning of the value chain, or even basic road infrastructure upgrading. Figure 6 illustrates the vast differences in development and illustrates the relatively different priorities for logistics ecosystems at different stages of development. Assessing the current stage of development will therefore provide an indication of which of the enablers are likely to be most critical to target initially.

Interventions that target the five key enablers are likely to be the most impactful in contributing towards the development of the logistics ecosystem to enable the growth and scaling of first mile.

Coordinating public and private sector actors. Some of the focus countries considered in this study, or some regions within those countries, have not reached the level of infrastructural and technological maturity for efficient farm-to-table integration. Developing partners can work together with local organisations, such as cooperatives and local governments, to help them put the enablers for digital integration of the value chain in place. This strategy may be more effective than just direct capital investment in digital platforms. In the absence of some of the enablers presented in chapter 3, investments in digital platforms may show significantly lower returns on investment. The present study can be used as a starting point to explore the opportunities institutional actors have in supporting initiatives at the local level, for instance, implementing better aggregation points or implementing ecologic cold chain management solutions to integrate key networks and stakeholders better

Supporting the development of innovative infrastructure. The lack of national infrastructure across many developing countries requires enormous capital investment to address – often something that is neither feasible or necessarily the most appropriate use for those funds. However, technologically enabled innovators are increasingly developing solutions to overcome gaps in macro-level infrastructure – such as the growth in micro-scale solar power as an alternative to national electricity grids. Identifying innovations

globally that can solve specific infrastructural gaps within local contexts and supporting or incentivising the application of those locally can support ecosystem development.

Supporting aggregation at the beginning of the value chain. Strengthening the linkages between Farmers, local MSMEs, transporters, wholesalers, and retailers is a crucial first step to fix supply chain gaps. Policymakers and development partners can work to create spaces that allow stakeholders to understand the needs of each other as well as to identify potential services overlapping and coordination improvements. Once apparent gaps and overlaps are identified, financing can be directed explicitly to projects related to measures to implement the enablers necessary for digital integration of the food supply chain. Strengthening local cooperatives and other, existing, local structures to effectively adapt to a digital ecosystem can be an impactful intervention to support aggregation with supply chains and facilitate consumer adoption.

Digital skills development to support consumer adoption. One of the fundamental components for consumer adoption of digital platforms throughout the food value chain is for consumers to have the requisite digital skills. Digital skills can be unpacked into different categories that the development partner or policymaker may wish to address. Potentially the most relevant category, consumer skills, are the capabilities for individuals to function socially, economically, and politically in a digital society (Bester, 2020). As seen throughout this study, consumer adoption is a central enabler to unleash the benefits of digital platforms. Development organisations and Governments need to first identify the level of existing digital skills among key target groups and then support the development of programmes and initiatives that develop and disperse these skills within these key target groups.

Incentivising appropriate financial services. Financial services providers such as banks and insurers are not generally willing to engage with agricultural value chains, in part due to a lack of understanding of the several actors, sections, and transactions it entails, but also due to the high costs and perceived risks of engaging stakeholders in rural areas (Stakeholders interviews, 2021). This implies a role for development partners and/or policymakers to intervene by de-risking investment through consumer research, better value chain transactions understanding, or direct investment. Governments and developing agencies can ensure that the financial systems within each country meet the demands that come from growing modern food supply chains (Miller, 2012). They can do that by helping policymakers understand the gap in the enablers, as presented in this study, to reach better-integrated food value chains. For instance, publicly available research and data on farmers' specialised cooperatives and their potential as financial services provision points can incentivise investment to implement them. Implementing specialised cooperatives will also help put in place some of the enablers mentioned in this study, such as better aggregation points and higher consumer adoption.

Policy leadership and support. Regulators and policymakers have a key role to play in supporting an enabling environment for innovation and the development of innovative solutions like digital platforms and insurtech. The path to facilitating and encouraging innovation starts at the policy level. Policymakers can "set the tone" for supporting innovation through policies and stated public objectives and by providing a clear mandate to regulators. Furthermore, supporting the development of the other key pillars of a conducive enabling environment is a critical role for policymakers, including: investing in key national infrastructure, supporting the development of required skills and ensuring

support (both financial and non-financial) is available to early stage innovative players and start-ups.

Enabling regulatory approaches. Regulators also have a key role to play in supporting an enabling environment for innovation and the development of innovative solutions.
For regulators this means finding a balance between supporting and encouraging innovation, while still ensuring market stability and consumer protection objectives are maintained. This typically requires regulators to have a flexible and accommodative approach to encourage responsible innovation and to respond to innovative developments (Beyers, Gray, & Hougaard, 2018). This is particularly pertinent in the financial services sector where regulatory constraints are often substantial for new entrants. For instance, having a consistent, transparent and easy to follow product and licensing approval process in place and effectively communicating the process and related requirements is essential for overcoming regulatory uncertainty and enabling innovation (De Waal, Gray, & Hougaard, 2019). Moreover, the application of a test and learn approach allows the regulators to observe an innovator or innovation's impact on the market ("test") and to then, based on their understanding of its effect, to modify the way in which they regulate the innovator or the innovation ("learn") (De Waal, Gray, & Hougaard, 2019).

6. Conclusion

This document explored the potential of digital solutions to link the different stakeholders in the food supply chain with on-demand platforms and discussed the potential of distributing resilience solutions through food logistics platforms in Asia.

Asia's food supply chains are going to face higher pressures in the next decade due to high urbanisation and growing populations. The prevalence in the region of smallholder farmers, fragmented supply chains, an absence of scale economies, and global warming adds to the challenges that an agricultural sector with already stretched and broken supply chains must tackle.

Digital platforms offer great potential to overcome some of the issues of Asian food supply chains. Their low barrier to entry grants the potential to be broadly implemented and scaled quickly. The instantaneous nature of digital communications will improve information flows for better coordination and more valuable interactions among stakeholders which is posed to reduce transport costs and food spoilage.

However, digital platforms technology for logistics and e-commerce has been mainly implemented at the last mile, far from the farms. Enablers such as adequate infrastructure and technology, better and more aggregation points, higher consumer adoption, risk management solutions, and sufficient access to finance are necessary to unlock the benefits of digital platforms in the entire food supply chain. These, mainly non-digital, enablers are also fundamental to unlocking the network effects of platforms, as more users join the digital platform, more value is also added to existing users on the platform.

The enablers mentioned are often not present along the first mile. Different measures implemented across Asia have been identified to address the challenges and to help put the enablers in place, particularly in the first mile, such as:

- Encourage community group purchasing and create inner city pick-up locations
- Leverage farmers' specialised cooperatives
- Implement suitable and innovative cold chain management solutions
- Invest into the establishment of fulfilment and delivery centres
- Leverage a bilateral model for strengthening local logistics networks
- Attract young talent to rural areas

By increasing the resilience of MSMEs in the food supply chain, the implementation of risk management solutions through insurtech can help to unlock the opportunities that digital platforms bring to the different actors in the logistics sector. Insurtech solutions offer the opportunity to provide and distribute insurance products more efficiently and to attract new users and customers. However, an increase in the uptake of insurance also depends on improved claims processing and risk-management products being tailored to the specific needs of consumers. Data collected from digital platforms allows for better understanding of customers behaviours, and to perform risk assessments that translate in

the de-risking of credit provision. The value proposition for insurance becomes stronger when offered jointly with other services provided by digital platforms.

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Annex A: Stakeholder interview list

#	Country	Organisation	Sector	Date
1	**Mongolia**	Tenger	Insurance	28 June 2021
2	**Mongolia**	Monre	Insurance	29 June 2021
3	**Laos**	Shopping-D	E-commerce / Last-mile logistics	1 July 2021
4	**Nepal**	Geokrishi	Farmtech	2 July 2021
5	**India**	GIZ	Insurance	7 July 2021
6	**Indonesia**	PasarPolis	Insurance	8 July 2021
7	**China**	Cainiao	Logistics	12 July 2021
8	**China**	University of Economics and Business (Cainiao)	Logistics	13 July 2021
9	**Cambodia**	Bloc	E-commerce	19 July 2021
10	**Philippines**	Kwik Insure	Insurance	22 July 2021

Table 3. Stakeholders' interview list

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Green Innovation Centres for the Agriculture and Food Sector
I https://snrd-asia.org/green-innovation-centres-for-the-agriculture-and-food-sector-india/

Local and Provincial Economic Development (LPED)
I https://www.giz.de/en/worldwide/17956.html