

China Kiwi Case Study

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I. Executive Summary

China's efforts to roll out a comprehensive and centralized legal regime for food safety,² which include the amended Food Safety Law (2015) (FSL), are expected to have a positive impact across a number of agricultural value chains. As this case study focused on China's kiwi sector highlights, leveraging the legal system to improve food safety, quality control, traceability, and trade are particularly important for a sector with significant potential in both domestic and international markets, such as kiwi. This case study on kiwi is part of an ongoing series of work on China's legal and regulatory system for food safety done in partnership by the Syngenta Foundation for Sustainable Agriculture (SFSA) and New Markets Lab (NML). Along with the other cases studies in this series,³ it is approached through the lens of the impact the new legal framework for food safety has on agricultural development and small farmers. The series includes additional case studies on important value chains (horticulture, Chinese medicinal herbs, and potatoes), an

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² See, Katrin Kuhlmann, Mengyi Wang, and Yuan Zhou, *China Food Safety Legal and Regulatory Assessment*, March 2017, https://www.syngentafoundation.org/sites/g/files/zhg576/f/china_food_safety_-_legal_framework_2.pdf.

³ See, Katrin Kuhlmann, Mengyi Wang, and Yuan Zhou, *Chinese Medicinal Herbs Case Study*, November 2017, <https://www.syngentafoundation.org/food-safety-china>; Katrin Kuhlmann, Mengyi Wang, and Yuan Zhou, *China Horticulture Case Study*, November 2016, https://www.syngentafoundation.org/sites/g/files/zhg576/f/china_horticulture_case_study_0.pdf; Katrin Kuhlmann, Mengyi Wang, and Yuan Zhou, *China Potatoes Case Study*, Forthcoming, January 2019; Katrin Kuhlmann, Mengyi Wang, and Yuan Zhou, *Assessment of Good Regulatory Practices for Food Safety in Electronic Commerce*, Forthcoming 2019.

assessment of global best practices in food safety, and a report on China's evolving landscape for e-commerce in the context of food and agriculture.

The kiwi industry in China is booming, and in less than two decades the country has established itself and both the largest producer and largest consumer of kiwi in the world.⁴ Kiwi is becoming increasingly popular among youth, who view the fruit as a “super food.” Despite significant local production, however, China still relies on imports to satisfy a portion of consumer demand. This is due in part to the fragmented nature of the sector (kiwi production is spread across multiple provinces throughout China) and the lack of a harmonized and well enforced system of implementing measures and standards that address both quality and food safety concerns. In addition, China has yet to fully take advantage of opportunities for increased export of kiwi, which is directly linked to a number of the issues assessed in this case study.

This case study outlines key findings and associated action-oriented recommendations for four major stages of the kiwi value chain (cultivation and harvest, transport and distribution, sale and consumer use (including e-commerce and trade), and traceability). Overall, the authors noted a lack of awareness of relevant laws and standards across actors in the kiwi value chain, issues with appropriate use of agricultural inputs (including pesticide and fertilizer application), traceability challenges, and gaps in implementation and enforcement of the legal and regulatory framework. Because of the importance of quality and traceability in the kiwi sector, one overarching theme that emerged is the importance of more detailed and consistent local legal frameworks to fully implement the national food safety regime. For example, better designed and implemented local rules are needed with regard to the acceptable usage of agricultural inputs and maximum residue limits. Because opportunities in the kiwi sector exist in a range of markets (local, national, international), local standards should be pegged to leading industry and international standards. Recognizing that many farmers still have limited capacity to comply with complex legal rules, in the short term, industry-generated standards could be a good first step toward a more user-friendly and unified approach to regulating the kiwi sector. While there are many small kiwi farms operating across China, there are also established companies and industry associations that would be well positioned to help unify standards within the sector and can build the bridge between local rules and international requirements. In addition, given that kiwi is grown in multiple provinces, a harmonized scheme and consistency in requirements might better ensure quality and safety for consumers, whether kiwi is intended for either the domestic or foreign markets.

As is true within many value chains, training and capacity building will be critical to growth of China's kiwi sector and should become a greater focus; capacity building is needed not only for farmers but also for government officials and even wholesalers and retailers. This could include programs to build stakeholder awareness of relevant laws and regulations and methods for extending knowledge of the proper use and application of inputs like fertilizer and pesticides. Stakeholders such as farmer cooperatives and industry associations could be instrumental in supporting small and medium-sized enterprises (SMEs) to increase their understanding of and compliance with legal frameworks and industry best practices. This capacity building is particularly timely, as China's market for fresh produce increasingly moves online, using social

⁴ Gyanendra Mani, Ashish Kundra and Azimul Haque, “Kiwi Value Chain in Arunachal Pradesh: Issues and Prospects,” *Agricultural Economics Research Review* 2018, 31 (1), 123-130.

media platforms such as Wechat and Alipay,⁵ but also apps and platforms specific to the produce sector, including Pinduoduo⁶ (an app designed specifically for women), Meiriyouxia⁷ (a mobile app), and Tmall (an online platform).⁸ While e-commerce is still a relatively new area of regulation in China and many other countries around the world, these issues will become increasingly important as the digital market develops. Across the value chain, better implementation of rules and regulations will be vital to ensuring effective traceability, consistent quality, and food safety.

This case study presents an overview of the kiwi industry in China, including some of the main challenges associated with implementing a food safety regime that can support growth of the sector domestically and internationally. It was based on desk research and analysis of the laws, regulations, policies, and institutional frameworks surrounding the kiwi value chain in China, as well as on-site consultations with agricultural stakeholders in Beijing, Xi'an, and Chengdu. The sections below include both relevant legal and regulatory frameworks and industry perspectives, leading to several recommendations for improvement of the kiwi value chain. Table 1 below summarizes the case study's key findings and recommendations.

Table 1: Summary of Current Status of Food Safety Regulation in Chinese Kiwi Context

Regulatory Issue	Current Status	Recommendations
Cultivation and Harvest (Inputs)	<ul style="list-style-type: none"> While China is the world's largest producer of kiwi, quality remains a pervasive challenge and impacts growth of the sector across markets. Challenges are due in part to weak capacity and misuse of inputs at the cultivation stage as well as to the lack of consistent, harmonized, and well-enforced quality standards, making it difficult to ensure that produce meets the needs of consumers and destination markets. Although the current national legal system provides general guidance for activities across the kiwi value chain, details are left to implementing regulations, rules, and local standards, some of which are not yet in place. For example, local government agencies are 	<ul style="list-style-type: none"> Although a national legal framework for food safety has been put in place, it cannot be fully implemented without clearer local laws, implementing regulations, and standards on acceptable uses and types of agricultural inputs like pesticides and fertilizer, all of which will provide guidance and structure for the sector. Capacity building efforts should be put in place to increase awareness of both the requirements that do exist and the benefits of following laws and standards, linking standards to market growth potential. Customs vary within each locality, requiring tailored approaches. On-site demonstrations that cater to market specifications would be useful, as would improved communication between

⁵ The New York Times, *In Urban China, Cash Is Rapidly Becoming Obsolete*. Web. July 16 2017.

⁶ WalktheChat, Everything You Need to Know about Pinduoduo Users, <https://kr-asia.com/everything-you-need-to-know-about-pinduoduo-users>.

⁷ Rita Liao, "A Chinese E-commerce App That Lures Grocery Shoppers with Cash Just Raised \$100M in Series B," December, 2018, <https://techcrunch.com/2018/12/11/fresh-buddy-meiri-yitao-100-million-series-b/>.

⁸ See, Katrin Kuhlmann, Mengyi Wang, and Yuan Zhou, *Assessment of Good Regulatory Practices for Food Safety in Electronic Commerce*, Forthcoming 2019, for a more detailed discussion of the evolving use of e-commerce in the food industry.

	<p>expected to establish additional rules and regulations to improve fertilizer application systems and enforce pesticide residue limits, but gaps remain as noted by several stakeholders consulted.</p> <ul style="list-style-type: none"> Local legal frameworks surrounding inputs like fertilizer and pesticides also differ between provinces and localities. While different locations may require different approaches, some degree of harmonization would be beneficial with so many provinces involved in kiwi production and wide-ranging consumption. Harmonization of local standards would also be beneficial as China's kiwi sector grows to meet increasing international demand. Many stakeholders such as farmers and retailers of agri-inputs cite challenges in terms of technical knowledge and capacity to navigate the legal framework. Currently farmers often rely on personal experience and whatever information is contained on bag labels (which may or may not be suitable for the particular local climate). In addition, a number of stakeholders consulted were skeptical about the benefit and suitability of following established requirements, given cost implications and local conditions. Overuse/misuse of pesticides and fertilizers remains a problem. This is a concern for both farmers and consumers, as overuse of pesticides could result in residue levels that are too high for safe consumption. Misuse of fertilizers carries risks of over-acidification of the soil and/or lower quality produce. High-quality inputs can also be prohibitively expensive and are not always widely available. 	<p>regulators and other key stakeholders such as industry representatives, farmer cooperatives, and shopkeepers selling pesticides and fertilizers.</p> <ul style="list-style-type: none"> Brochures and posters about the latest planting standards, as well as updates on legal requirements, could also be shared with diverse stakeholders (including consumers in the market and agri-input dealers) and might be paired with a hotline to answer questions and local capacity building efforts. Local officials could also be the beneficiaries of capacity building initiatives, with a particular focus on aligning local standards with international standards and best practices. Industry associations could play a more active role, including in the development of rules and standards. Overall, drafting laws, regulations, and standards should also be a more participatory process that combines inputs from academic institutions, government, and the private sector.
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<p>Storage, Transportation, and Distribution</p>	<ul style="list-style-type: none"> • Cold chain logistics and technology are underdeveloped, and there is a lack of accepted common standards in areas such as use of anti-staling agents. The over-application of anti-staling agents and preservatives (which result in fruit that does not ripen properly) is a significant issue for both producers and consumers. • In addition to the lack of clear rules, implementation of existing requirements is a challenge. 	<ul style="list-style-type: none"> • Cold chain has not yet been a significant focus within the regulatory system, but well-defined standards based on available science and technology are needed to ensure quality and food safety. • Standard development should be benchmarked against international standards (e.g. Codex Alimentarius and International Organization for Standardization), and enforcement will need to be given greater priority. • Industry associations could play a central role in development and implementation of cold chain standards. A combination of industry self-regulation and government supervision could help address the challenge of limited infrastructure and capacity, particularly in the short-term.
<p>Sale and Consumer Use</p>	<ul style="list-style-type: none"> • Within China, fruit quality varies considerably, and wholesalers, retailers, and end consumers are often not aware of relevant safety or quality standards and requirements. • Farmers and producers note that a reliable sales channel is not always guaranteed, creating an incentives for some smaller producers to operate outside normal growing and selling windows in order to stay competitive. • While cooperatives are prevalent in the sector, smaller farmers sometimes do not see a benefit of joining farmer cooperatives, noting that the stricter quality and documentation requirements are too much of a burden if sales will remain unpredictable. 	<ul style="list-style-type: none"> • Cooperatives can help farmers access more established sale channels, reducing some of the market risk, and they can also be an important way to improve standards within the sector. However, cooperatives should actively work with farmers to reduce the perceived risks of higher compliance. • As with agri-inputs, brochures and posters about the latest standards or updates on legal issues should also be passed on to all stakeholders (including consumers in the market and agri-input dealers) and might be paired with a hotline to answer questions. Technology tools such as bar codes on products or communication through social media could also help consumers build awareness and trust.
<p>Traceability</p>	<ul style="list-style-type: none"> • The kiwi value chain is fairly fragmented, with a mix of dominant larger farms and small farmers, which makes traceability a challenge. Traceability also impacts stakeholders all along the value chain, including downstream 	<ul style="list-style-type: none"> • The MOA, CFDA, and local government branches should work together to establish a more compatible approach that reduce fragmentation in traceability systems.

	<p>supplier and wholesale buyers, who may not have systems in place for documentation and quality control.</p> <ul style="list-style-type: none"> • Traceability not only affects growth of the domestic market for kiwi (kiwi is still imported, despite significant local production), but Chinese producers could more fully tap the export market if traceability challenges and quality control measures were better addressed. • Institutionally, the Ministry of Agriculture (MOA), China Food and Drug Administration (CFDA), and local government branches currently have overlapping mandates and powers related to traceability. However, in practice, some agencies have overlapping jurisdictions, which may lead to unclear responsibilities and weak implementation. • Although there are some newer technological approaches to traceability, such as bar codes on product packaging that provide information from farm to store, consumers are still mistrustful of the system, recognizing that certificates could be faked. 	<ul style="list-style-type: none"> • Farmer cooperatives can be a helpful intermediary and are already starting to assist with traceability and enforcement through standards and quality control measures. Cooperatives are also able to handle documentation requirements, which takes some of the burdens off of SMEs. As noted, the cooperatives address farmers' concerns, however, given that some consider the cooperatives' requirements to be too strict. Strengthened regulation and greater oversight of cooperatives may also be needed in line with global best practices. • Innovations piloted in other countries and sectors (for example, web-based monitoring software used in the grape and mango value chains in India) could be adapted to the kiwi sector.
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Source: New Markets Lab (2018)

II. Overview of China's Kiwi Industry

Historically, the agricultural sector has been a main driver of the Chinese economy. Farmers throughout the country make up a significant percentage of the population and often pass on their farms and practices throughout generations. However, expanding demand within the food market in China, coupled with higher consumer expectations for safety, quality, and specialization of agricultural products, can make it increasingly difficult for domestic producers to satisfy consumer needs. Kiwi fruit has great significance for the transformation of China's agriculture, since China is both one of the biggest producers and consumers of kiwi worldwide.⁹ This is consistent with China's overall dominant position as a producer and consumer of vegetables and fruits.¹⁰ The

⁹ Rebecca Howard, "New Zealand's Kiwifruit Heading Home to China," Rebecca Howard, *Reuters*, December 3, 2015, <https://www.reuters.com/article/us-newzealand-kiwifruit-idUSKBN0TM2QY20151203>.

¹⁰ PricewaterhouseCoopers, *Managing Upstream Risks in China's Food Safety Chain* (2015).

growth of these value chains has been driven by several variables, including land reform, new seed varieties, and increased use of inputs,¹¹ the latter of which is a particular challenge in the kiwi value chain as discussed below.

Although kiwi is typically eaten fresh, it nevertheless passes through all main stages of the value chain, and can serve as a model for other fresh agricultural produce. A diagram of the kiwi value chain is shown in Figure 1.

Figure 1: Kiwi Value Chain



Source: New Markets Lab, 2018

Cultivation of kiwi in China has a history going back over 1300 years. The fruit actually originated in China and used to be known as the “gooseberry.”¹² The fruit was brought to New Zealand in the early 1900s, where producers renamed it “kiwifruit”. New Zealand’s kiwi producers dominated global production until the mid-1980s;¹³ at its height, the island nation was producing about three-fourths of the total global kiwi output.¹⁴ New Zealand’s global share of the market has since declined gradually and now represents about 25 percent of the market, with increasing cultivation in Europe and Asia.¹⁵ By 1990, European countries, especially France, Greece, Italy, and Spain, accounted for 39 percent of total kiwi production.¹⁶ Today, amid growing domestic and

¹¹ PricewaterhouseCoopers, *Managing Upstream Risks in China’s Food Safety Chain* (2015).

¹² Kevin Lui, “This Kiwifruit Isn’t From New Zealand at All. It’s Chinese, and This is How it Got Hijacked,” *Time*, February 9, 2017, <http://time.com/4662293/kiwifruit-chinese-gooseberry-new-zealand-history-fruit/>.

¹³ H. Huang & A. R. Ferguson (2001) Review: Kiwifruit in China, *New Zealand Journal of Crop and Horticultural Science*, 29:1, 1-14, DOI: 10.1080/01140671.2001.9514154; Kevin Lui, “This Kiwifruit Isn’t From New Zealand at All. It’s Chinese, and This is How it Got Hijacked,” *Time*, February 9, 2017, <http://time.com/4662293/kiwifruit-chinese-gooseberry-new-zealand-history-fruit/>.

¹⁴ Gyanendra Mani, Ashish Kundra and Azimul Haque, “Kiwi Value Chain in Arunachal Pradesh: Issues and Prospects,” *Agricultural Economics Research Review* 2018, 31 (1), 123-130.

¹⁵ Gyanendra Mani, Ashish Kundra and Azimul Haque, “Kiwi Value Chain in Arunachal Pradesh: Issues and Prospects,” *Agricultural Economics Research Review* 2018, 31 (1), 123-130.

¹⁶ Gyanendra Mani, Ashish Kundra and Azimul Haque, “Kiwi Value Chain in Arunachal Pradesh: Issues and Prospects,” *Agricultural Economics Research Review* 2018, 31 (1), 123-130.

global demand, China has become the largest producer of kiwi, with a share of 66 percent of the market in 2014 (up from just 6 percent in 1990).¹⁷ Table 2 below compares global imports and exports of kiwi.

Table 2: Top Kiwi Exporters and Importers

Exporters				Importers			
Rank	Country	Qty (t)	Value (US\$ 000)	Rank	Country (t)	Qty (US\$ 000)	Value
1	New Zealand	574,282	1,291,993	1	China P RP	125,988	343,098
2	Italy	393,902	488,533	2	Japan	93,192	286,854
3	Chile	201,508	273,959	3	Belgium	153,155	207,777
4	Belgium	79,808	124,201	4	Germany	123,757	190,230
5	Greece	110,816	91,893	5	Spain	161,794	167,001
6	Iran	51,960	57,100	6	U S A	82,742	154,468
7	Germany	28,992	43,681	7	Other Asia	48,109	133,249
8	France	25,358	36,173	8	Netherlands	60,865	109,953
9	Netherlands	21,649	27,185	9	France	67,146	109,695
10	Spain	14,312	22,295	10	Russia	63,949	66,670
16	China P RP	2,035	3,228	18	India	24,481	32,161

Source: http://apeda.in/agriexchange/ProductSearch/Product_Detail.aspx?hscode=081050.

Kiwi has become very popular in the Chinese market for several reasons: the fruit is easy to preserve, easy to transport, and considered by consumers to be very tasty. Since 2014, kiwi sales in China have more than doubled, going from 11.4 million trays in 2014 to 23.6 million trays in 2016 (3.55kg = 1 tray).¹⁸ Despite China's large production output, it has struggled to meet growing demand. From 2012 to 2016, kiwifruit imports to China (including Hong Kong and Macau) more than doubled, rising from 72,620 MTs to 153,009 MTs.¹⁹ The bulk of this import growth occurred over a two-year period when imports saw a year-on-year increase of approximately 30,000 MTs in 2015 and 44,000 MTs in 2016.²⁰ At the same time, China's export volume in 2015 was only around 2000 MTs, accounting for less than 1/1000 of the national output, and ranking it below many other top exporting countries. The fragmented nature of the market is one reason for these challenging trade dynamics, with few brands able to capture a significant portion of the domestic market.²¹ There is significant variation among Chinese kiwifruit producers in terms of understanding of horticultural techniques; while some farmers may be able to consistently produce high-quality fruit, others continue to rely upon older, more traditional methods even when poor outputs and/or quality result. This may be due to the demographics of China's kiwi sector;

¹⁷ Gyanendra Mani, Ashish Kundra and Azimul Haque, "Kiwi Value Chain in Arunachal Pradesh: Issues and Prospects," *Agricultural Economics Research Review* 2018, 31 (1), 123-130.

¹⁸ 2017 Kiwifruit Book, New Zealand Kiwi Fruit Growers

¹⁹ "China's National Fruit: A Market Snapshot of Kiwifruit," *China Ag*, July 24, 2017, <https://www.chinaag.org/2017/07/24/chinas-national-fruit-a-market-snapshot-of-kiwifruit/>.

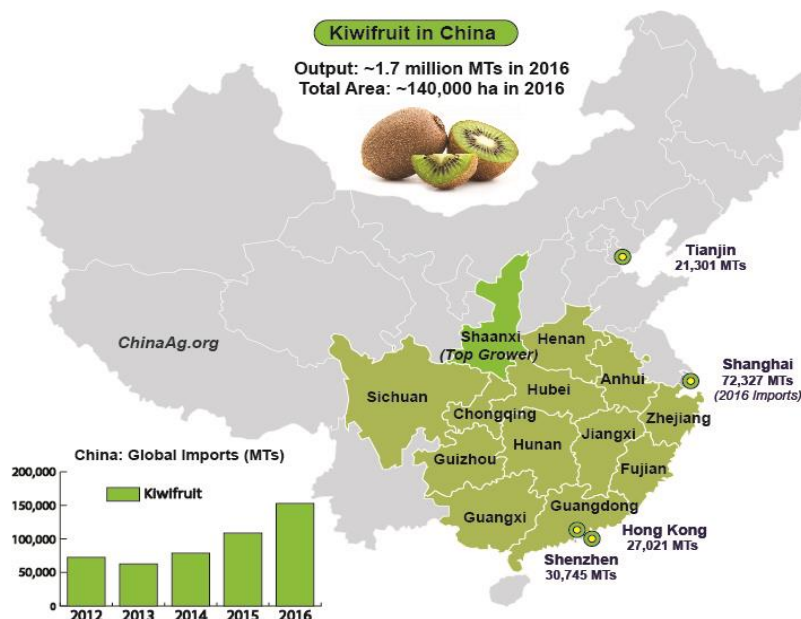
²⁰ "China's National Fruit: A Market Snapshot of Kiwifruit," *China Ag*, July 24, 2017, <https://www.chinaag.org/2017/07/24/chinas-national-fruit-a-market-snapshot-of-kiwifruit/>.

²¹ Dan Siekman, "Exclusive Analysis: The Obstacles Facing China's World-Leading Kiwifruit Industry in 2018," *Produce Report*, October 11, 2018, <https://www.producereport.com/article/exclusive-analysis-obstacles-facing-chinas-world-leading-kiwifruit-industry-2018>.

according to a 2015 survey, the average kiwifruit grower was 56 years old or older, with fewer than 10 percent of farmers falling within the ages of 18-35.²²

According to the Chinese Kiwi Development Report, there are five kiwi production areas in China: 1) the Dabie, Funiu, and Baitong mountains in Henan province; 2) the northern area of Shan'xi province; 3) the Guizhou and Eastern parts of Hunan province; 4) the Heping county of Guangdong province; and 5) the Northwestern area of Sichuan and the Southwestern area of Hubei provinces.²³ Globally, China ranks number one in both acres planted and output.²⁴ Figure 2 below maps out the main producers of kiwi in China. In 2016, China's total production of kiwi was 2.37 million metric tons (MT).²⁵ Of this total output, 85.2 percent came from the Shaanxi (1.31 million MT), Henan (490,000 MT) and Sichuan (220,000 MT) provinces.²⁶ Despite these high output volumes, the average output per acre in China is only around 800-1000 kg, which is far lower than the worldwide average (1000-1500kg) and only one third that of New Zealand.²⁷ Thus, China requires far more acreage than other countries to produce large volumes of kiwi.

Figure 2: Areas of Kiwi Production in China



Source: “China’s National Fruit: A Market Snapshot of Kiwifruit,” *China Ag*, July 24, 2017, <https://www.chinaag.org/2017/07/24/chinas-national-fruit-a-market-snapshot-of-kiwifruit/>.

²² “China’s National Fruit: A Market Snapshot of Kiwifruit,” *China Ag*, July 24, 2017, <https://www.chinaag.org/2017/07/24/chinas-national-fruit-a-market-snapshot-of-kiwifruit/>.

²³ Stakeholders were consulted in Beijing, Xi'an (the capital of the top grower province of Shaanxi), and Chengdu (located in another top grower province of Sichuan).

²⁴ The Chinese Kiwi Development Report (2017); http://www.360doc.com/content/17/1207/09/1264837_710714059.shtml

²⁵ The Chinese Kiwi Development Report (2017); http://www.360doc.com/content/17/1207/09/1264837_710714059.shtml

²⁶ The Chinese Kiwi Development Report (2017); http://www.360doc.com/content/17/1207/09/1264837_710714059.shtml

²⁷ <http://wemedia.ifeng.com/72408604/wemedia.shtml>

According to industry reports, the lack of clear standards, technical capacity, and management techniques are among the main challenges facing the sector.²⁸ These issues, coupled with poor post-harvest treatment, undermine quality and trust among domestic consumers. When looking to markets outside of China, it can also be difficult for Chinese exporters to pass other countries' testing requirements and quality control standards. In contrast, foreign companies such as Zespri, an established New Zealand brand, are better able to control the quality of their products on the market and, as a result, see a market benefit from brand recognition.²⁹

Institutional and Regulatory Framework

China's institutional and regulatory framework related to kiwi sets the foundation for food safety, food quality, and more sustainable agricultural production. Because of the significant domestic market for kiwi, the legal framework directly impacts domestic consumers, who will increasingly demand safe, high-quality produce. Kiwi also has great potential as an export product, although at present it exports only account for a negligible part of China's total output largely due to food safety issues throughout the kiwi value chain.

A number of laws, regulations, policies, and standards govern food safety in China.³⁰ One legislative pillar is composed of the amended *Food Safety Law (2015)* and its Draft Implementation Regulation, along with subsequent administrative measures. In addition, China's *Agri-Product Quality and Safety Law (2006)* articulates rules for the production, supervision, and inspection of agricultural products.³¹ In particular, Article 11 explicitly recognizes all agricultural product quality safety criteria as mandatory technical regulations. Article 21 governs the establishment of licensing systems for pesticides and fertilizers, regular and random inspections, and publication of inspection results.³²

Several aspects of the FSL apply directly to kiwi and other fruits and vegetables. In particular, the FSL covers quality and safety standards and standards on agricultural inputs. In particular, the FSL mandates that producers must use agricultural inputs in accordance with food safety standards and follow application intervals and non-application provisions; the use of certain pesticides is also prohibited under the FSL.³³ Food producers and distributors must have self-inspection

²⁸ Dan Siekman, "Exclusive Analysis: The Obstacles Facing China's World-Leading Kiwifruit Industry in 2018," *Produce Report*, October 11, 2018, <https://www.producereport.com/article/exclusive-analysis-obstacles-facing-chinas-world-leading-kiwifruit-industry-2018>.

²⁹ Gerard Hutching, "Zespri Heads for Record China Kiwifruit Export Season," *Stuff*, April 25, 2018, <https://www.stuff.co.nz/business/farming/103328152/zespri-heads-for-record-china-kiwifruit-export-season>.

³⁰ It is helpful here to briefly note the difference between laws, regulations, policies, and standards. Laws or acts create a framework for governing the market and often relate to a particular sector or activity along the value chain. Regulations are created, often through administrative action, to implement laws. Policies are the broadest category of measures and provide guidance to stakeholders and government officials on what objectives laws and regulations should seek to achieve. Policies are not binding on their own. Standards are often, but not always, voluntary requirements set by industry representatives or another authoritative body that set baseline acceptable threshold of a products quality, safety, or similar characteristic. When created by a government regulatory agency, standards create binding requirements.

³¹ The Law on Agri-Product Quality and Safety (2006).

³² The Law on Agri-Product Quality and Safety (2006)

³³ The Amended Food Safety Law (2015), Article 49.

systems in place and conduct regular inspections and assessments,³⁴ and wholesalers have inspection obligations as well.³⁵ Producers, cooperatives, and distributors must also keep records, as mandated by the FSL.

Apart from laws and regulations, several recently updated standards are integral to the regulation of agricultural products.³⁶ These measures affect all stages of the kiwi value chain, including: methods of production (especially the nature of agricultural inputs such as fertilizers and pesticides); packing, storage, and transport (such as requirements for cold chain storage); and market sales and consumer concerns. Two examples include *GB2763-2016* on maximum pesticide residue limits in food (replacing an older standard from 2014), and *GB2760-2014*, the national standard governing food additives.³⁷

In addition to these formally promulgated standards, different industry associations, especially farmer cooperatives, have established their own standards and requirements for kiwi, which are applicable to cooperative member. While these rules are voluntary from a legal perspective, they create very real requirements for farmers and do establish thresholds for safety and quality control. Currently, there is little to no government oversight of the specific rules and standards created by farmer cooperatives, and a number of stakeholders consulted noted that these additional standards can pose challenges for farmers who have limited resources and often cannot see the immediate benefits of stricter quality controls.

The primary institutions responsible for the safety and quality of vegetables and fruits, from farm to fork, are the China Food and Drug Administration (CFDA) and the Ministry of Agriculture (MOA). Generally, the MOA oversees production of agriculture products, including agricultural inputs, and the CFDA is responsible for processing, marketing, and distribution stages of the value chain.³⁸ An exception, due to historical reasons, is that the MOA's administrative arm continues to supervise the distribution of edible agricultural products, alongside local branches of the CFDA.³⁹ In addition, the Institute for Control of Agrochemicals (ICAMA), a subordinate institution under MOA, is particularly relevant at the production stage, as it is in charge of pesticide registration, provision of guidance on pesticide application, and monitoring of pesticide residues.⁴⁰ Another subordinate institution under MOA, the China Green Food Development Center (CGFDC), oversees organic food standards and has established local food regulatory agencies, inspection agencies, and green food producing environmental monitoring agencies.⁴¹

³⁴ The Amended Food Safety Law (2015), Article 47.

³⁵ Administrative Measures for the Supervision of Markets of Edible Agricultural Products (2016), Article 8; the Amended Food Safety Law (2015), Article 64.

³⁶ Katrin Kuhlmann, Mengyi Wang, and Yuan Zhou, *China Horticulture Case Study*, November 2016, 5, https://www.syngentafoundation.org/sites/g/files/zhg576/f/china_horticulture_case_study_0.pdf.

³⁷ Katrin Kuhlmann, Mengyi Wang, and Yuan Zhou, *China Horticulture Case Study*, November 2016, 5, https://www.syngentafoundation.org/sites/g/files/zhg576/f/china_horticulture_case_study_0.pdf.

³⁸ Katrin Kuhlmann, Mengyi Wang, and Yuan Zhou, *China Horticulture Case Study*, November 2016, https://www.syngentafoundation.org/sites/g/files/zhg576/f/china_horticulture_case_study_0.pdf.

³⁹ Katrin Kuhlmann, Mengyi Wang, and Yuan Zhou, *China Horticulture Case Study*, November 2016, https://www.syngentafoundation.org/sites/g/files/zhg576/f/china_horticulture_case_study_0.pdf.

⁴⁰ MOA website, http://english.agri.gov.cn/aboutmoa/ium/201301/t20130115_9535.htm

⁴¹ Katrin Kuhlmann, Mengyi Wang, and Yuan Zhou, *China Horticulture Case Study*, November 2016, https://www.syngentafoundation.org/sites/g/files/zhg576/f/china_horticulture_case_study_0.pdf.

Food must be labelled, with three labels common in the market: “organic food,” “green food,” and “no-public harm food.”⁴² Organic food follows organic farming standards, which prohibit the use of synthetic fertilizers, pesticides, growth regulators, and the use of genetically engineered organisms and their products.⁴³ Certification agencies, approved by China’s Certification and Accreditation Administration (CNCA), are authorized to certify organic labeling.⁴⁴ The credibility of all three labels has decreased, however, mainly as a result of weak enforcement and use of fraudulent and purchased labels.⁴⁵

There are several overarching challenges related to the implementation of the legal and regulatory system with regard to development of the kiwi value chain. One is the discrepancy between the legal framework at the national (or State) level versus the local level. Not only do national and local laws and regulations sometimes conflict, but often national rules are too general to serve as practical guidance. The lack of clear, detailed, and harmonized guidelines at the local level makes it challenging for producers from different provinces to meet quality standards and other requirements both within China and in export markets. This limits the industry’s capacity to improve competitiveness in the global market and is one reason why international producers, such as brands from New Zealand, have performed better among Chinese consumers. Several industry representatives consulted during the field visit noted the importance of clear rules, guidelines, and standards to the healthy growth of the sector.

Due to the many variable and unexpected factors facing the agricultural sector more broadly, some farmers continue to perceive some standards as too rigid in their practical application. This issue arose in particular in the context of standards imposed by cooperatives. For example, existing cooperative standards require that the farmers shall not pick fruits before a certain time to ensure quality; however, under certain circumstances, especially unpredictable weather, farmers have had to ignore this standard either for their own benefit or based on quality concerns.

Each stage of the value chain presents unique challenges related to implementation of legal frameworks. The remainder of this section details these specific challenges across key stages of the kiwi value chain and includes the perspectives of producers, industry associations, wholesalers, and other stakeholders consulted in the development of this case study.

MOA website, http://www.greenfood.agri.cn/jg/zxjj/201110/t20111018_2358700.htm

⁴² See Katrin Kuhlmann, Mengyi Wang, and Yuan Zhou, *China Horticulture Case Study*, November 2016, https://www.syngentafoundation.org/sites/g/files/zhg576/f/china_horticulture_case_study_0.pdf.

⁴³ Liaoning Food and Drug Administration website, <http://www.lnfda.gov.cn/CL1462/36153.html>; Zhanjiang Food and Drug Administration website, <http://www.gdda.gov.cn/publicfiles/business/htmlfiles/fdazj/pspszs/200810/179435.htm>

⁴⁴ CNCA website, <http://ffip.cnca.cn/ffip/publicquery/certSearch.jsp>

⁴⁵ See Katrin Kuhlmann, Mengyi Wang, and Yuan Zhou, *China Horticulture Case Study*, November 2016, https://www.syngentafoundation.org/sites/g/files/zhg576/f/china_horticulture_case_study_0.pdf.

A. Cultivation and Harvest (Inputs)

Soil Quality and Fertilizer Use

Due to its unique geography and natural ecology, the fertility of China's farmlands is not ideal in many parts of the country. In part because of the limited amount of arable land, post-harvest quality and safety of kiwi fruit are highly affected by fertilizer management. Kiwi grows best in acidic soil, and nitrogen-heavy fertilizer is recommended to ensure a good harvest.⁴⁶ However, farmland soil in China has been overly acidified due to a large amount of fertilizer (especially nitrogen (N) fertilizer) misuse.⁴⁷ Overall, China is one of the world's most significant users of fertilizer and pesticides, by far exceeding use in both the United States and EU.⁴⁸ As this case study highlights, misuse of both fertilizers and pesticides is a serious concern. Since the 1980s, a series of farmland policies have been implemented in China to stabilize the balance of farmland quantity and quality against accelerating urbanization, industrialization, and misuse of fertilizer. Several sets of law and regulations have been enacted to address these challenges.

The history of China's fertilizer regulation dates back to 1989, when the MOA issued the *Interim Provision of Inspection and Registration on Fertilizer, Soil Conditioner and Plant Growth Regulator*. This interim provision has since been replaced by new laws and regulations. On 12 June 2000, the Ministry promulgated Order 32, "Administrative Measures for the Registration of Fertilizers", which serves as the legal basis for the fertilizer registration system. By the end of 2017, China had put in place a basic legal and regulatory system to manage fertilizer registration, labeling, safety and efficacy evaluation, as well as other issues related to fertilizer sales and use.⁴⁹

Article 49 of the amended *Food Safety Law* clearly requires that producers of edible farm products use pesticides and fertilizers in accordance with the food safety standards and relevant provisions of the State, as well as implement the provisions on the interval period for the safe use of agricultural inputs. It also specifies that expressly prohibited agricultural inputs and extremely or highly toxic pesticides shall not be used by producers. This rule is further emphasized in Article 29 of the *Soil Pollution and Prevention Law*, whereby the State "encourages" the agricultural producer to take actions such as using pesticides with lower toxicity and lower residue levels, applying organic and high-efficiency fertilizers, and improving overly acidified soil according to standards.

⁴⁶ Beutel, J.A. 1990. Kiwifruit. p. 309-316. In: J. Janick and J.E. Simon (eds.), *Advances in New Crops*. Timber Press, Portland, OR, <https://hort.purdue.edu/newcrop/proceedings1990/V1-309.html#Soil%20and%20Water%20Needs>.

⁴⁷ Shulan Zhang; Pengcheng Gao; Yanan Tong; David Norse; Yuelai Lu; David Powlson, "Overcoming Nitrogen Fertilizer Over-Use Through Technical and Advisory Approaches: A Case Study from Shaanxi Province, Northwest China," *Agriculture, Ecosystems, & Environment*, Vol. 209, pp. 89-99, November 1, 2015, <https://doi.org/10.1016/j.agee.2015.03.002>.

⁴⁸ PricewaterhouseCoopers, *Managing Upstream Risks in China's Food Safety Chain* (2015).

⁴⁹ Lin Fang; Overview of Fertilizer Registration in China; <https://agrochemical.chemlinked.com/agropedia/overview-fertilizer-registration-china>.

Further, according to Article 5 of the *Administrative Measures for the Management of Fertilizers Registration*, fertilizers must be registered to be on the market. The *Administrative Measures on Fertilizers Registrations*, together with *Documentary Requirements on Fertilizers Registration*, further illustrates how fertilizer registration is to be implemented. All of these rules are designed to prevent unregistered fertilizers from entering the market and eliminate the misuse and overuse of fertilizers for the purpose of improving farmland. However, gaps and unaddressed issues remain. MOA has also taken steps to curb the use of fertilizers and pesticides, including through the 2015 Action Plans for Zero Growth in Application of Pesticide and Fertilizer.⁵⁰ Some local MOA branches have partnered with multinational pesticide companies to encourage the adoption of low-toxic and low-residue pesticides, yet challenges with pesticide use remain, as several stakeholders consulted noted.

Building implementation capacity at the local government level will be particularly important to growth of the kiwi sector. Although state-level rules provide general guidance for agricultural producers, more detailed guidance on standards/requirements and instructions for farmers are needed. This is consistent with the purpose of State-level laws and regulations in China, and local government agencies are expected to establish additional rules and regulations to improve input application systems as well as provide guidance on the application of agricultural inputs.⁵¹

Inconsistencies in standards and their application within provinces are especially challenging for kiwi production, given that production is spread across different provinces. A more harmonized system might make it easier for kiwi farmers and sellers to market their products both within China and abroad.

Second, the system for fertilizer registration is multi-tiered and can be complicated to navigate. There are three categories of registration: (1) registration with the provincial agricultural department, (2) registration with the MOA, and (3) registration not required (exemptions). It is not easy for farmers to identify properly registered fertilizers, often because they have no or limited access to such information. One industry representative did note that the government has begun making more of this type of information accessible to farmers. According to this representative, there is now a list of allowed kiwi fertilizers accessible to all local kiwi growers.

Third, many of the industry representatives consulted noted that fertilizer application standards and instructions for use are not clear. Agricultural producers normally get their fertilizers from the local authorized agricultural input stores and rely on the advice/instructions from the store staff. There is no way for a farmer to check whether the storekeeper and staff provide accurate instructions for use, nor is it possible to determine whether the fertilizer is counterfeit. Further, although bag labels explain application methods and dosages, these may not fit with the particularities of the local environment. Without detailed instructions tailored to the ecology of different areas, agricultural producers (especially SMEs) have to combine the label instructions with personal experience or custom to determine how to apply the fertilizers. Beyond this, even if farmers know the amount to be applied, access to application technology is a problem. Many farmers cannot afford advanced application equipment, and they have to resort to traditional application methods instead.

⁵⁰ Institute for the Control of Agrochemicals, MOA website, <http://www.icama.org.cn:8080/doc15/15030301.html>

⁵¹ See, Article 22 of the *Agri-Product Quality and Safety Law*.

For example, industry Representative A is a technical expert employed by a medium-sized state-owned enterprise (SOE) located in Province A, which is a company that produces, packages, and sells kiwi fruit online. According to Representative A, the PH value of the soil in this area reaches a bit less than 7, appropriate although not ideal for kiwifruit to grow. The company uses both organic and compound fertilizers to improve soil fertility and provide kiwi trees with nutrients. While instructions for dosage, timing, and application are printed on each bag of fertilizer, Representative A seldom follows these instructions, preferring instead to refer to individual experience and expertise, with the belief that the instructions are not well-suited for this orchard. Interestingly, Representative A also noted that soil quality is routinely assessed by the company itself, rather than by the local government.

Other experts consulted reported similar challenges, including industry Representative B from a well-known international kiwi company. Representative B said although the soil condition in the area is not perfect for kiwi based on soil fertility and PH value, it could be improved by applying acidic fertilizer, organic fertilizer, and compound fertilizer.⁵² According to Industry Representative B, all fertilizers are purchased from certified local agricultural input stores, which are under the supervision of the local government. Representative B also noted that there are few circumstances under which the fertilizers will be overused because fertilizers are so expensive, and negative effects such as soil hardening outweigh the presumed benefits such as output increases. Instead, *misuse* of fertilizer is a bigger issue.

Perspectives such as those shared by Industry Representative B show that further detailed, instructive laws and regulations should be promulgated by the local agriculture ministries to provide more detailed and locally suitable guidance for producers. These rules should not only address use and application for farmers, but could also contain more stringent supervision on the operation of agricultural stores. Building capacity among stakeholders (both farmers and store staff), including on how to properly comply with the baseline application methods listed on fertilizer packaging in a way that is suitable for the particular needs of the local environment, would also be beneficial.

Industry Representative C, the head of a local kiwi industry association, mentioned that although local soil conditions were not ideal in the past, the government has invested significant funds into soil improvement and has led growers to use environmental-friendly agricultural inputs such as pesticides and fertilizers. As for access to application technologies, further government support policies could be a solution, as could farmer cooperatives.

For example, Industry Representative C mentioned that although there are some national standards specific to kiwi, there are also regional and local standards drafted and promulgated by the local governments, which are based on input from the relevant industry association and local academic institutions. These local standards are more detailed than the national standards and act as both general and practical guidance for local kiwi growers. Local government, industry association, and academic institutions will work together to share information, including through the dissemination

⁵² Representative B mentioned that compound fertilizer is needed because compound fertilizer and organic fertilizer serve different functions, with the former supporting soil improvement and the latter mainly providing the plants with microelements such as Nitrogen (N), Phosphorus (P), and Potassium (K).

of brochures to local growers so that they are aware of the standards and guidance. Enforcement is also stricter under this model, meaning that more growers are compelled to follow the guidelines.⁵³ According to Industry Representative C, the industry association has also played an important capacity building role and provides regular training for kiwi farmers, either by way of lectures or on-site technical demonstrations alongside technical experts selected by the government.

Pesticides and Maximum Pesticides Residues

Pests and diseases impact the yield and post-harvest quality of fruit and vegetables. As mentioned above, pesticides are one category of agricultural inputs used at the production and harvest stage, which, like fertilizers, are also regulated by relevant laws and regulations. For example, Article 49 of the amended FSL imposes responsibilities on producers to use pesticides in accordance with food safety standards and relevant state provisions and to avoid using highly toxic pesticides. Article 22 of the *Agri-Product Quality and Safety Law* also establishes that relevant local authorities should release more detailed guidance on appropriate levels of pesticide use and residues. Like fertilizers, according to Article 7 and Article 24 of *the Regulation on Pesticide Administration*, pesticides must be registered with the relevant authorities, and a business permit is required for pesticide sellers. Articles 30, 31, and 32 elaborate on the responsibility of local agricultural branches with respect to issuing guidance on the application of pesticides, providing relevant training, and implementing pesticide reduction plans. The requirements for growers and producers to properly apply pesticides in terms of the scope, method, and dosage are regulated by Article 34 of the *Regulation on Pesticide Administration*. Pesticide labels must contain the proper application and usage methods.

Similar to fertilizers, pesticides are also sold in authorized agricultural input stores, with many of the same challenges noted above. Only registered pesticides are allowed on the market, and the registration process is especially costly, complicated, and time-consuming. In practice, this means that some enterprises choose not to apply for registration. Although farmers may prefer pesticides that are more efficient and less toxic, they may not have access to them because of the limited availability of registered pesticides.

Overuse and misuse of pesticides is common in terms of excess dosage and application during banned periods, which can result in higher pesticide residues on fruit. These practices might be motivated by economic reasons⁵⁴ or because farmers disagree with the blanket instructions listed on pesticide packaging labels. Clearer application guidance and standards could better achieve regulatory goals rather than just expecting farmers to follow the labels as stipulated by the *Regulation on Pesticide Administration*, because the changing climate, emerging new diseases, and local environment require more tailored standards and technological guidance, making it neither practical nor effective for all producers to apply pesticides the same way. In addition, local government officials lack the capacity to adequately carry out supervision duties, and the lack of standards results in officials having no rules to resort to for guidance. That said, creating unified

⁵³ According to Representative C, if the growers do not follow the guidelines, then it is impossible for their kiwifruit to meet purchase requirements, and the growers cannot make profit by selling kiwifruit.

⁵⁴ Katrin Kuhlmann, Mengyi Wang, and Yuan Zhou, *China Horticulture Case Study*, November 2016, 9, https://www.syngentafoundation.org/sites/g/files/zhg576/f/china_horticulture_case_study_0.pdf.

standards and rules across the sector will be an important factor in increasing fruit quality and consistency, so regulators and other officials will need to work to create a balance between consistency and flexibility.

Another prominent issue caused by overuse and misuse of pesticides is that growers will apply pesticides beyond maximum residue limits. These limits are covered by a few different laws and standards. One example is the newly released *GB2763-2016 for maximum residues limit*, which illustrated the maximum residues for various categories of fruit and vegetables. However, maximum residue lists exist for both general and specific categories of plants, and are not always consistent. For kiwi, for example, there are pesticide residue limit data for 11 pesticides that apply only to kiwi and another 52 that apply for all berries (kiwi is regarded as one type of berry); however, there are only 7 registered pesticides that can be used for kiwi based on the ICAMA website. Further, it is reported that the residue limit is incomplete since there is no data for certain registered pesticides. This inconsistency has caused confusion for producers and implementation difficulties for the local governmental agencies, which may not have clear guidance on which standards are authoritative. Further, although more standards are being made accessible to producers and wholesalers, many remain unaware of the applicable legal framework, especially SMEs.

For example, although Industry Representative B knows about the national standards for maximum pesticide residues, he mentioned that these are outdated and incomplete, which has mitigated their role as practical guidance for agricultural stakeholders. Further, although there are residue limits for at least 11 pesticides that apply only to kiwi, Representative B was not aware of maximum pesticide residue standards applicable to kiwi growers. Another problem is that the registered pesticides that are allowed for kiwi are quite limited and incomplete, meaning that the pesticides that are used by most of the growers are not on the registered list, especially the ones that have lower toxicity and higher efficiency. This can be traced back to problems with the pesticide registration process.

Public perception of pesticides is fairly negative. In one recent study, consumers were most concerned with understanding more about what kinds of pesticides were used on vegetables, which go through a similar production process as kiwi.⁵⁵ The Chinese public is also skeptical of plant growth regulators (PGRs), which, both within China and internationally, are considered pesticides.⁵⁶ Technically speaking, PGRs do not protect plants from pests and diseases (instead they are plant hormones that help, hinder, or change the pattern of plant growth), but they are still regulated in terms of acceptable residue levels and appropriate use. PGRs must be registered with the competent authority before application in agriculture, during which their safety and efficacy is meant to be thoroughly assessed. The overuse or misuse of PGRs will lead to exceeding maximum residue limits and decreasing fruit quality.

⁵⁵ Liu C, Li J, Steele W, Fang X (2018) A study on Chinese consumer preferences for food traceability information using best-worst scaling. *PLoS ONE* 13(11): e0206793. <https://doi.org/10.1371/journal.pone.0206793>

⁵⁶ Joan Yao, "Food Safety Focus: What Are Plant Growth Regulators," *Centre for Food Safety, The Government of the Hong Kong Special Administrative Region*, July 2011, https://www.cfs.gov.hk/english/multimedia/multimedia_pub/multimedia_pub_fsf_60_02.html.

In a response letter from the MOA to the People’s Representatives dated July 10, 2018,⁵⁷ the MOA reiterated the importance of registration and the appropriate application of PGRs and added that there has never been a PGR-related safety accident in the world in past years. MOA statements highlight that PGRs are considered to be relatively safe compared to pesticides because of their low toxicity and low residue (farmers tend not to overuse the PGRs), but there is still a risk of misuse and implications at the transportation, storage, and distribution stage of the value chain.

Stakeholders who were consulted commonly noted that they use personal experience and local customs when determining how and when to apply pesticides, much like fertilizer. Industry Representative A noted that although instructions are printed on pesticide packaging, he prefers individual methods of adjusting the concentrations of pesticide. Similarly, Farmers A and B grow kiwi fruit on their ‘own’ land, which is less than 4 acres in size. They generally rely on experience to determine the dosage and application of fertilizers (mainly compound fertilizers) and pesticides. Sometimes they use less fertilizer than the instructions on the package indicates because they want to save as much money they can. Pesticides and plant growth regulators are certainly used, but the farmers will stop spraying pesticides one month before the picking date to limit the residue. During the whole process, they are seldom supervised by the local government.

In addition, according to Industry Representative A, like fertilizers, pesticides are mainly supplied by the local authorized agricultural inputs stores, which are under the supervision of the local government. In most cases, farmers get genuine products, even though sometimes they may encounter counterfeit or poor-quality products. Interestingly, the stakeholders seemed to have differing opinions about the relationship of the legal and regulatory framework to the misuse of pesticides and the availability of banned substances.

For example, as for banned pesticides, Industry Representative A said the government should regulate them from the source so that they are not available for sale at the stores. To his knowledge, no one monitors and tests the pesticide residues of kiwi fruit except when the fruits are destined for export and subject to inspection by foreign customs officials. He also thinks that it is difficult and impractical for the local government to supervise pesticide residues since the main producers of kiwi fruit are scattered around the mountainous area and are also unaware of the standards and unwilling to follow those rules. As for the plant regulator which makes fruits appear larger and more attractive, it is sometimes used by Industry Representative A because currently there is no scientific research proving that it is harmful to health.

On the other hand, according to Industry Representative C, it is rarely possible for the growers, especially farmers, to purchase unregistered pesticides. Local governments issue lists of both registered and banned pesticides, and only registered pesticides are allowed to be sold at the certified agricultural input stores. Industry Representative C highlighted that the growth regulators are not restricted, but, on the contrary, are commonly applied (even worldwide). The challenge, however, is not to overuse them. According to Industry Representative C, pesticide residues should not be an issue; as long as the farmers follow the rules/instructions in the brochure, the pesticide traces will go away before the picking date. Further, there are special patrol squads sent to the orchards to check that the rules are followed.

⁵⁷ “Reply to Recommendation No. 3281 of the First Session of the 13th National People’s Congress, July 10 2018, http://www.moa.gov.cn/govpublic/ncpzlaq/201807/t20180711_6153933.htm.

B. Storage, Transportation, and Distribution

Thanks to cold chain logistics, many previously rare local products are now available at the national market level; cold chain logistics also underpin international trade in fresh produce. A cold chain is a system for transporting fresh produce through unbroken refrigeration.⁵⁸ Many stakeholders have noted that a lack of advanced cold chain technology and accepted standard practices make it difficult to be successful in the Chinese market for perishable goods.⁵⁹ In 2016, only 20 percent of fresh products in China circulated through the cold chain (compared with 95 percent in developed countries).⁶⁰ While there are many important aspects of the cold chain, including technologies for warehouses and refrigerated trucks, this case study examines only the anti-staling agents and preservatives that are sometimes used in storage and transportation. According to Art. 66 of China's amended FSL, food additives such as anti-staling agents and preservatives are acceptable for use on edible, fresh, farm products in the course of packaging, preserving, storage, or transport only if the national food safety standards are met. This is further illustrated by Article 29 of the *Agricultural Product Quality Safety Law*, which states that the anti-staling agents, preservatives, and additives used in edible farm products during packing, preservation, storage, and transportation shall be in compliance with relevant mandatory technical specifications.

Despite these state-level rules, in practice, consistent enforcement remains a challenge. Anti-staling agents and preservatives are two kinds of PGRs, and they function to stall ripening for the purpose of transportation and preservation. Because they are PGRs, there are similar issues with public perception as noted in the section on pesticides above. Although not harmful to the product, the overuse of such chemicals could lead to agricultural products that are over-preserved and under-flavored. A 2017 news story reported that a customer purchased kiwi fruit and kept it for 138 days, yet it was still too hard to eat. Improper application of anti-staling agents and PGRs may also lead to food waste, a pervasive problem with underdeveloped cold chain systems. One solution could be increased communication and collaboration between actors up and down the value chain.⁶¹ Well managed farmer cooperatives can be a natural way to strengthen these connections.⁶²

In response, detailed mandatory technical specifications should be drafted and published by local governmental agencies and made accessible to stakeholders at both production and transport stages. Linking these local rules with accepted international standards, for example the Codex

⁵⁸ "The Cold Chain," *Global Cold Chain Alliance*, 2017, <https://www.gcca.org/about/cold-chain>.

⁵⁹ See, e.g.: "Cold Chain Market in China – Between 20% and 50% of Food Gets Wasted in China, Reports Technavio," *Business Wire*, May 16, 2018, <https://www.businesswire.com/news/home/20180516005617/en/Cold-Chain-Market-China---20-50>; Greg Knowler, "China's Growing Cold Chain Needs Better Industry Standards," *JOC.com*, July 13, 2017, https://www.joc.com/international-logistics/logistics-providers/china%E2%80%99s-growing-cold-chain-needs-better-industry-standards_20170713.html.

⁶⁰ Academic Room, *Cold Chain Logistics Industry in China*, April 21 2017; Katrin Kuhlmann, Yuan Zhao, and Mengyi Wang, *China Potatoes Case Study*, Forthcoming 2019.

⁶¹ Emma Cosgrove, "Supply Chains Could Help Spare \$270B of Food Waste with a Few Fixes," *Supply Chain Dive*, September 4, 2018, <https://www.supplychaindive.com/news/food-waste-supply-chain-solutions/531509/>.

⁶² Huang Zuhui, "Farmer Cooperatives in China: Development and Diversification," Paper Presented at the Economic and Management of Networks Conference, November 21-23, 2013, https://emnet.univie.ac.at/uploads/media/Huang_Zuhui.pdf

Alimentarius and International Organization for Standardization, would be beneficial to development of the local market and broader trade. In addition, international initiatives such as the GLOBALG.A.P., the Global Cold Chain Alliance, and the World Food Logistics Organization offer guidance and even international certification for proper cold chain techniques. In addition, the International Air Transport association is considering establishing a certification program for perishable food items.⁶³ Producers could become more familiar with the standards necessary for international sale, while keeping abreast of new developments for international standards. This could allow domestic producers to become more competitive both nationally and internationally.

Building capacity with stakeholders will also be especially important. Given that the cold chain industry in China is still very new, regulators and enforcement authorities have conflicting roles and may not be up-to-date with different technologies and standards. Laws, regulations, standards, and policies should also be communicated in a way that is timely, widely accessible, reliable, and clear. This would help stakeholders, especially SMEs, stay abreast of key developments and provide feedback. This would also build up consumer trust and knowledge, for example with respect to appropriate and safe levels of anti-staling agents and preservatives. Capacity building would also help producers improve competitiveness in global markets. Again, industry associations could play a central role, both in terms of technology improvement and capacity building.

C. Sale and Consumer Use

The laws, regulations, and standards that apply to kiwi are often meant to ensure consumer safety and quality at the end of the value chain. Many of the challenges related to the implementation of the legal and regulatory framework were most obvious when speaking with wholesalers, retailers, and market consumers. During the field visit, it was often difficult to find quality products in the various markets. Interestingly, it was also clear that not many of the wholesalers and retailers were aware of the relevant laws and regulations, despite the fact that they are responsible for ensuring that what they sell meets food safety requirements.⁶⁴ For example, at a local supermarket chain, only one type of kiwi fruit was available, and it was of poor quality. The size of the kiwi ranged greatly, from very large to very small, and some fruit offered for sale was rotten, albeit at a lower price. When approached for more information, such as the source or the breed of kiwi for sale, the supermarket did not respond. However, based on consultations with industry experts, it is highly possible that the fruits had been sprayed with too much plant growth regulator.

At another local vegetable and fruit market, two sellers provided information on fruit quality. The first one was an elderly man standing alongside the road with two big baskets of kiwi, which appeared to be of very low quality. The seller shared that the kiwi was from a neighboring farm, which was all the information he had. We watched as several customers passed by; they stopped, touched the fruits, asked the price, and decided to buy or not to buy, with no further questions asked. The owner of a small-sized fruit store in the same market area was also consulted. The quality of this fruit was better, but the price was also higher compared with the supermarket and fruit stand. The owner said the fruit was sourced from local farmers and that purchase decision

⁶³ Jennifer MCKevitt, "IATA Considers Cold Chain Standards for Perishable Foods," *Supply Chain Dive*, August 23, 2017, <https://www.supplychaindive.com/news/IATA-cold-chain-standard-food/503235/>.

⁶⁴ PricewaterhouseCoopers, *Managing Upstream Risks in China's Food Safety Chain* (2015).

was based on appearance, price, and size of the fruit. She did not know whether PGR had been applied or whether pesticide use conformed with the national standard. She said she had never been asked these questions by customers.

Another small retailer, the owner of a small-sized fruit store along a business street in a central area of the city in Province A, also noted that use of growth regulators or pesticides were not a factor in what she purchased from wholesalers, despite accountability for these factors. She was selling three different kinds of kiwi with different prices, all of which had come from wholesalers, and did not ask about use of growth regulators or pesticides. Once again, customers did not inquire about the nature of the fruit either.

For small farmers, finding wholesalers and buyers to purchase their fruit can be a challenge. Farmers must make decisions about when to sell that may be outside the acceptable sale periods. For example, farmer A and Farmer B sell their fruits to downstream purchasers in late July, three months earlier than the normal picking date of kiwi fruit. Although the fruits are sold at a lower price, they will sell as purchasers make an offer, because they think waiting increases the uncertainty of sale. If they pick the fruit late, they fear that there will be no purchaser, and it may be quite difficult for them to find a willing buyer, because the output is very limited and the orchard in a remote area.

One way to address the concerns of product quality and safety at the wholesale and retail end of the value chain is through greater coordination, participation, and standard setting. While local governments play a central role, other stakeholders like farmer cooperatives can play a role as well. Although cooperatives themselves are regulated, the standards set by cooperatives are not regulated by law, and exact requirements will vary across different cooperatives. Still, cooperatives set mandatory requirements for members ranging from soil condition, farm size, brands of inputs used, and application methods. As a result, they can reduce some of the fragmentation that currently affects the sector.

Cooperatives are not without challenges, however. Although farmer cooperatives that combine multiple small farms are becoming a trend in China, SMEs may perceive cooperative requirements as too stringent for them to meet. This was true for Farmers A and B, who are not able to meet the many requirements of their local cooperative, such as the minimum area of land owned by the farmers, the picking date, and the restricted use of fertilizers, pesticides, and plant growth regulators. In addition, and perhaps more concerning is that not all farmer cooperatives operate legitimately.⁶⁵ While the *Law of the People's Republic of China on Specialized Farmers Cooperatives (2007)* governs the structure and intended goals of farmer cooperatives, incentives such as tax breaks and subsidies have attracted misuse and abuse.⁶⁶ Cooperatives are nevertheless pervasive; in 2016 it was reported that 47 percent of Chinese farmers were members of

⁶⁵ HU, Zhanping, ZHANG, Qian Forrest, & DONALDSON, John A..(2017). Farmers' cooperatives in China: A typology of fraud and failure. *China Journal*, 78, 1-24; Huang Zuhui, "Farmer Cooperatives in China: Development and Diversification," Paper Presented at the Economic and Management of Networks Conference, November 21-23, 2013, https://emnet.univie.ac.at/uploads/media/Huang_Zuhui.pdf.

⁶⁶ HU, Zhanping, ZHANG, Qian Forrest, & DONALDSON, John A..(2017). Farmers' cooperatives in China: A typology of fraud and failure. *China Journal*, 78, 1-24.

cooperatives.⁶⁷ The main risks are that some cooperatives operate de facto as large conglomerates, completely ignoring the intended benefits for smallholder farmers or over-favoring large-scale growers.⁶⁸ More oversight may be needed going forward to ensure that SMEs are really gaining from the cooperative structure.

The rise of e-commerce has the power to transform the fresh produce industry even further. A recent study predicted that by 2020, online sales will reach US\$ 52 billion.⁶⁹ There are many benefits to online and app-based produce purchases for both consumers and sellers. Online sales are quick and easy,⁷⁰ and there are a large variety of store options for both individual consumers and wholesalers. Vendors and buyers can use social media platforms such as Wechat and Alipay,⁷¹ but increasingly apps designed specifically to buy and sell fresh produce or appeal to certain demographics are becoming more popular. These include Pinduoduo⁷² (an app designed specifically for women in smaller cities), Meiriyouxia⁷³ (a mobile app), and Tmall (an online platform used by kiwi producers).⁷⁴ Consumers on popular app-based sites such as WeChat also tend to be less price conscious.⁷⁵

The information provided by small and local sellers and farmers stands in contrast with the focus and capacity of some of the larger companies active in China. As in other markets, larger companies tend to be much more focused on compliance with both domestic and international laws, regulations, and standards, and, as a result, are better able to compete in the global market. Qifeng Fruit is one example, which operates across multiple provinces in China as well as internationally. The company obtained a GLOBALG.A.P. Certificate,⁷⁶ which establishes the company as a qualified producer with products that meet international standards. The GLOBALG.A.P. Certificate sets out Good Agricultural Practice (G.A.P.) standards for produce, livestock, and fisheries.⁷⁷ The certificate controls for over forty standards and has a program for incremental certification through localg.a.p.⁷⁸ International standard setting bodies such as

⁶⁷ HU, Zhanping, ZHANG, Qian Forrest, & DONALDSON, John A. (2017). Farmers' cooperatives in China: A typology of fraud and failure. *China Journal*, 78, 1-24, 2.

⁶⁸ HU, Zhanping, ZHANG, Qian Forrest, & DONALDSON, John A. (2017). Farmers' cooperatives in China: A typology of fraud and failure. *China Journal*, 78, 1-24, 2.

⁶⁹ "Tech Development Bears Fruit," *HKTDC*, January 17, 2018, <https://hkmb.hktdc.com/en/1X0ACPEJ/inside-china/Tech-Development-Bears-Fruit>.

⁷⁰ "Tech Development Bears Fruit," *HKTDC*, January 17, 2018, <https://hkmb.hktdc.com/en/1X0ACPEJ/inside-china/Tech-Development-Bears-Fruit>.

⁷¹ The New York Times, *In Urban China, Cash Is Rapidly Becoming Obsolete*. Web. July 16 2017.

⁷² WalktheChat, Everything You Need to Know about Pinduoduo Users, <https://kr-asia.com/everything-you-need-to-know-about-pinduoduo-users>.

⁷³ Rita Liao, "A Chinese E-commerce App That Lures Grocery Shoppers with Cash Just Raised \$100M in Series B," December, 2018, <https://techcrunch.com/2018/12/11/fresh-buddy-meiri-yitao-100-million-series-b/>.

⁷⁴ See, Katrin Kuhlmann, Mengyi Wang, and Yuan Zhou, *Assessment of Good Regulatory Practices for Food Safety in Electronic Commerce*, Forthcoming 2019, for a more detailed discussion of the evolving use of e-commerce in the food industry.

⁷⁵ "Tech Development Bears Fruit," *HKTDC*, January 17, 2018, <https://hkmb.hktdc.com/en/1X0ACPEJ/inside-china/Tech-Development-Bears-Fruit>.

⁷⁶ *Qifeng Fruit*, "Our Advantage," <http://www.qifengfruits.com/our-advantage>, last visited January 10, 2019.

⁷⁷ GLOBALG.A.P., "GLOBALG.A.P. History," https://www.globalgap.org/uk_en/who-we-are/about-us/history/.

⁷⁸ GLOBALG.A.P., "GLOBALG.A.P. Certification for Producers," https://www.globalgap.org/uk_en/what-we-do/globalg.a.p.-certification/.

GLOBALG.A.P. can be helpful ways to benchmark domestic industry standards to assist Chinese producers reach a more global market.

As a top kiwi producer, China should be able to take advantage of nearby trading partners and increase its global exports. However, underdevelopment of necessary market and legal structures and under-enforcement of standards impede exports to countries that mandate higher quality and food safety thresholds. For instance, while China has signed free trade agreements with some countries in the Association of South East Asian (ASEAN),⁷⁹ it has not been able to fully take advantage of these treaties to export kiwis because of standards noncompliance. There are a few regional agreements in place that have established channels for increased trade in kiwifruit, but these tend to be underutilized. The ASEAN-China Agreement on Trade in Goods, signed in 2004,⁸⁰ is one example, and in 2007 China additionally took steps to address food safety through the Nanning Joint Statement,⁸¹ which established a common understanding to work toward compatible food safety laws and policies. ASEAN's Food Safety Policy and policy document on Harmonization of Food Standards in ASEAN⁸² could also serve as useful starting points for industry members seeking to comply with the requirements of other nearby countries.

D. Traceability

Traceability is an issue that cuts across the entire kiwi value chain. Traceability is important not only to track the implementation of requirements at the production, processing, and distribution stages but also to help minimize the occurrence and extent of foodborne illness, especially during product recalls. While Chinese consumers are acutely aware of the dangers of food borne illness, which exists throughout the food industry, less clear are what types of traceability systems will work best given consumer preferences.⁸³ Although China does have legal requirements in place that provide traceability measures for kiwi, many consumers primarily shop based on appearance of fruit or, in the case of more sophisticated consumers, brand recognition, and they are often completely unaware of specific traceability efforts. Without question, effective traceability systems are an increasingly critical element for quality control and consumer protection, but they will only be successful with proper implementation and if consumers consider traceability programs to be legitimate.

As stipulated in Article 42 of China's amended FSL, the State shall establish a comprehensive food safety tracing system. The FSL requires both private and public traceability systems, and State and local authorities are expected to actively undertake rulemaking and supervision of both of these systems. Article 42 also makes producers and traders responsible for establishing a

⁷⁹ ASEAN- China Free Trade Agreements, *ASEAN*, https://asean.org/?static_post=asean-china-free-trade-area-2, last visited January 10, 2019.

⁸⁰ <https://www.asean.org/wp-content/uploads/images/2015/October/outreach-document/Edited%20ACFTA.pdf>

⁸¹ ASEAN Food Safety Policy, available at https://asean.org/storage/2012/10/ASEAN-Food-Policy-030516_2.pdf

⁸² Harmonisation of Food Standards in ASEAN: A Shared Vision for Regulatory Convergence, available at <https://foodindustry.asia/documentdownload.axd?documentresourceid=659>

⁸³ Liu C, Li J, Steele W, Fang X (2018) A study on Chinese consumer preferences for food traceability information using best-worst scaling. *PLoS ONE* 13(11): e0206793. <https://doi.org/10.1371/journal.pone.0206793>.

traceability system to ensure food safety and quality for both upstream and downstream actors. Further, gathering and retaining production and trade information by digital means is encouraged under Article 42. Despite this central legal framework, traceability systems vary considerably between provinces and cities.⁸⁴

As mentioned above, the effectiveness of the traceability system depends upon good record keeping and the implementation of relevant laws. The legal framework does anticipate these challenges. For example, Article 36 of *Administrative Regulation on Pesticide Administration* requires that agricultural producing companies and farmer cooperatives keep records of pesticide application including the date, location, name of pesticide, dosage, etc. and that such records shall be kept for more than two years. However, other pesticides users are only “encouraged” to keep such records. Similar provisions are applied to fertilizers. Especially considering that most agricultural products are produced by SMEs, it is not surprising that record keeping is difficult.

In addition, numerous layers of transactions exist between producers and wholesale distributors, and a lack of resources and technology make it harder for SMEs to implement traceability requirements. For example, Industry Representative A mentioned that the company has its own general recording system, although this is not required and supervised by the local government. Industry Representative A admits that the company’s traceability system is not so detailed and specific as other well-known multinational kiwi companies, but it at least records issues such as pests and diseases, pesticide application, and picking date. Careful recordkeeping is vitally important to ensuring food safety, as evidenced during the 2012 norovirus outbreak, when German officials were able to determine that the shipment in question had come from China but could not pinpoint where or how the contamination happened.⁸⁵ Due to the limited availability of uninterrupted arable land, farms border industrial zones more and more frequently, heightening the risk of contamination from outside factors.⁸⁶

At the same time, these legal provisions do not always address the particular concerns of consumers. Many consumers are skeptical of the validity of the record keeping system and accompanying documentation. Some see technology as a potential solution, especially blockchain, given that it is less susceptible to fraud than other paper-based traceability solutions.⁸⁷ Still, using emerging technologies like blockchain is not foolproof, given that there are high investment costs, and the technology does not completely prevent fraud.⁸⁸ Walmart China has chosen to put the

⁸⁴ ChemLinked, *Gradual Progression of Food Traceability System in China*. Web; Jfdaily, 上海肉奶酒等食品追溯系统相对完善. Web. March 14. 2017.

⁸⁵ PricewaterhouseCoopers, *Managing Upstream Risks in China’s Food Safety Chain* (2015), 5 <https://www.pwccn.com/en/food-supply/food-supply-chain-risk-aug2015.pdf>.

⁸⁶ PricewaterhouseCoopers, *Managing Upstream Risks in China’s Food Safety Chain* (2015), 5 <https://www.pwccn.com/en/food-supply/food-supply-chain-risk-aug2015.pdf>.

⁸⁷ Dan Siekman, “Blockchain: What It Is, What It Isn’t, and What It Means for the Produce Industry,” *Produce Report*, April 11, 2018, <https://www.producereport.com/article/blockchain-what-it-what-it-isnt-what-it-means-produce-industry>; “Blockchain and Food Traceability in China,” *ChemLinked*, October 9, 2018, <https://food.chemlinked.com/market-insights/blockchain-and-food-traceability-china>.

⁸⁸ “Blockchain and Food Traceability in China,” *ChemLinked*, October 9, 2018, <https://food.chemlinked.com/market-insights/blockchain-and-food-traceability-china>; Amanda Lee, “Cold Blockchain Solve China’s Food and Drug Safety Problems?” *South China Morning Post*, August 2, 2018, <https://www.scmp.com/business/china-business/article/2156722/could-blockchain-solve-chinas-food-and-drug-safety-problems>.

power directly in the hands of consumers and uses an app-based technology that allows shoppers to scan QR codes on their phones.⁸⁹

Smaller producers who do not have the same capacity as large downstream companies may be able to work with cooperatives to ensure they are meeting traceability requirements. Industry Representative C also noted that cooperatives take traceability issues very seriously. For example, each producer in Industry Representative C's local area is required to have and keep its own production records, which will be examined by the local authorities. Almost all the local farmers are members of the farmer cooperative, and the cooperative is responsible for the management of these records. In terms of enforcement, anyone who breaks the rules of the cooperative is blacklisted for three years and cannot enjoy its benefits. The cooperative also uses barcodes on each box of kiwi that clearly describe the growing process, from the first bearing of fruit to full maturation. The information contained in this barcode includes plant diseases, fertilizers and pesticides applied, packing location, and more. There are also some specialized teams for the supervision of this process. Thanks to these detailed records kept by growers, the cooperative has a much easier time meeting traceability standards.

In international markets, traceability is critical, particularly given past food quality scares, and keeping records of pesticide and fertilizer use, storage conditions, and adherence to quality standards will be necessary if China's producers are going to break into larger markets. Kiwi destined for export markets will be subject to multiple checks and inspections, and producers will need to build greater capacity for compliance.

There are a variety of examples both inside and outside of China where industry representatives and local governments have come together to meet international standards. India's *GrapeNet* Initiative, for example, is one good example which covers all stakeholders in the export supply chain and centers around monitoring software with a centralized web-based database to help ensure that international standards are met for Indian table grapes.⁹⁰ Based on the success of this initiative, the Indian government later replicated it through *HortiNet*, which includes mangoes and vegetables.⁹¹ Similarly, Qifeng Fruit, a large Chinese kiwi company, is exploring a variety of technologies to improve traceability among the varieties of kiwi it produces and sells.⁹² Since larger companies are often the first to take blame in the event of a food safety incident, it is not unwise for them to become more involved in traceability up and down stream in the value chain, as well as taking on responsibilities for monitoring, enforcement, traceability, and knowledge of the supply chain.⁹³

III. Findings and Recommendations

⁸⁹ Dan Siekman, "Walmart China Unveils Consumer Traceability Initiative," *Produce Report*, May 25, 2018, <https://www.producereport.com/article/walmart-china-unveils-consumer-traceability-initiative>.

⁹⁰ Shukla, Danashree and Elisa Sabbion. *Electronic Traceability of Agricultural Products in India: The Case of GrapeNet*. Brief No. 15. United Nations Network of Experts for Paperless Trade and Transport in Asia and the Pacific, Aug. 2015. Web. 13 May 2017. *GrapeNet: Traceability Solution for Fresh Grapes Exported from India*. Logicsoft International Private Limited. Web. 12 May 2017.

⁹¹ APEDA has GrapeNet for grapes and AnarNet for pomegranate, while mango and vegetables exporters are registered with State Horticulture Department.

⁹² *Qifeng Fruit*, "Our Advantage," <http://www.qifengfruits.com/our-advantage>, last visited January 10, 2019.

⁹³ PricewaterhouseCoopers, *Managing Upstream Risks in China's Food Safety Chain* (2015).

Food safety is a critical area of regulation, as it not only concerns public health but also impacts social and economic development. China is on its way to fully implementing its new national agricultural food safety system. However, how the new institutional and legal framework will develop in practice over the next few years will determine the efficacy and long-term viability of China's agricultural food safety regime. The recommendations outlined below highlight interventions that could help facilitate implementation of the FSL, strengthen the agricultural food safety system in China, and improve development of the kiwi value chain.

1. Develop Detailed and Tailored Rules and Standards

First, although the current national legal system provides general guidance for activities across the kiwi value chain, details are left to implementing regulations, rules, and local standards. This issue is particularly important at the production stage related to the regulation of inputs such as fertilizers and pesticides, although it cuts across many other aspects of the kiwi value chain. In order to address gaps in this regard, the following actions are recommended:

- In the short term, industry promulgated standards (as opposed to local rules/administrative measures) could be used as a good form of guidance for farmers, since they are more flexible and can be implemented faster than formal laws and regulations. Further, although some standards are not mandatory from a legal perspective, they can be instrumental in a market context. Industry associations have more on-site experience working with farmers and greater in-depth knowledge about the industry, which places them in an ideal position to develop local standards, and leading local companies also have experience that would enable them to be a resource for the development of appropriate standards. International standards should provide a reference point and would help the domestic kiwi sector become more competitive in the global market. Cooperatives, which are already involved in standard setting, could also play a constructive role.
- Over the longer term, in order for the FSL to be most effective, it will be important for local governments to enact clear and direct laws and regulations, especially with regard to agricultural inputs. Given that kiwi is grown throughout multiple provinces, a harmonized scheme throughout China, with consistency in how requirements are developed and applied, would be beneficial to ensure quality and safety for consumers in both domestic and foreign markets.
- Drafting laws, regulations, and standards could be done in a more practical way rather than merely as a paper exercise. Research done by universities or agricultural research institutes could help lay the foundation for changes to rules and standards, but feedback from producers is perhaps even more important. As a number of the industry representatives consulted suggested, collecting and compiling information from producers could be beneficial in the rulemaking process, and industry associations could play a more direct role. New rules or standards should then be published and widely disseminated after rounds of discussion and comment.
- Although well-drafted laws and regulations will provide kiwi growers (especially SMEs) with some guidance, enhanced capacity to apply and follow laws and standards is needed.

Because customs vary within each locality, this is a particular challenge for both fertilizer and pesticides. On-site demonstrations that cater to local specifications would be useful, as would increased communication between regulators and other key stakeholders such as industry representatives, farmer cooperatives, and shopkeepers selling pesticides and fertilizers.

- Brochures and posters about the latest planting standards or updates on legal issues could also be passed on to all stakeholders (including consumers in the market and agri-input dealers) and might be paired with a hotline to answer questions. Local governmental agencies could administer training programs for local farmers, with industry experts and agronomists as trainers. Because each locality has different customs and conditions that could impact both fertilizer and pesticide use, training and on-site demonstrations that cater to local specifications are vital. For example, while standards may suggest that fertilizers shall be applied a certain number of times throughout a year, farmers in a particular location might need clearer guidance on application for their own orchards.

2. Improve Implementation of Laws

- Laws, regulations, standards, and policies should be communicated in a way that is timely, widely accessible, reliable, and clear. This would help stakeholders, especially SMEs, stay abreast of key developments and provide feedback. Options including diligently updating official websites with the latest news or publishing changes in an eye-catching way; collaborating with search engines to ensure the official website appears prominently in web queries; and making full use of social media and chat apps such as WeChat to post the most recent news.
- The implementation/supervision functions among local government agencies should be streamlined. In the current situation, local branches of agricultural, trade, industry and commerce, environmental protection, and sanitary agencies often have overlapping and vague responsibilities. Addressing these functions at this stage in the implementation of the FSL framework would be beneficial for the long-term growth of China's kiwi sector in order to meet growing domestic and international demand.
- Industry associations could also play a central role in implementation of standards, including in areas such as storage and distribution (where the cold chain remains a major gap). A combination of industry self-regulation and government supervision could not only help address the challenge of limited government capacity but would also help farmers comply with standards without the fear of excessive penalty.

3. Build Capacity across Value Chain Stakeholders

As highlighted in the consultations for this case study, farmers, retailers, wholesale buyers, and end consumers are often unaware of the relevant rules, regulations, and standards that apply along

the kiwi value chain. A greater focus on education and capacity building for various stakeholders along the kiwi value chain will be vital moving forward. In order to address capacity gaps, the following actions are recommended:

- Capacity building for farmers and kiwi growers could be strengthened through various methods. This might include the use of posters in supermarkets and local markets, meetings with industry associations, and posting through social media apps. Information on the latest planting standards or updates on legal issues could also be passed on through publications and social media (a government hotline could also be helpful), or broadcast through WeChat groups (which are widely used in China, even in remote rural villages, due to the widespread internet infrastructure in China). Village leaders could manage these groups and post relevant information online. Further, training could be done in various forms to attract farmers and build their understanding, such as using animation videos to help illustrate the proper use of inputs.
- Increased training for enforcement officials and enhanced capacity of local government are also needed. For example, the national agencies should design training procedures for local officials, which would promote more uniform understanding of the new system. This would strengthen implementation of the FSL as well as help promote consumer trust in product quality and safety throughout China.
- Industry associations and farmer cooperatives could better communicate incentives for farmers to comply with standards and rules. For example, cooperatives offer farmers an established sales channel, provided that certain standards can be met. This could help with enforcement of market standards, taking some of the burden off of government officials while also reducing farmer anxiety about connecting with suitable market demand. A balance could be struck through the development of voluntary standards and capacity building, which could be adapted to local conditions and farmers' needs.

4. Improve Traceability Systems

Finally, traceability is an important cross-cutting issue that deserves greater attention across the board. In order to address gaps in traceability, the following actions could be explored:

- Farmer cooperatives and other industry associations could be strengthened to help reduce the risk of low quality and/or counterfeit inputs through programs that would help screen and source agricultural inputs as well as the produce itself. This would not only ensure that the appropriate fertilizers and pesticides are used at the beginning of the value chain but also facilitate proper enforcement and documentation at the end of the value chain. Farmer cooperatives can also act as a liaison between farmers and the government to encourage better implementation of laws and regulations. These groups are also able to handle more demanding documentation requirements, which takes some of the burdens off of SMEs.
- Downstream suppliers, retailers, and wholesale buyers should also receive further capacity building. The law places a burden on retailers and wholesalers to check the source of

products, but many market participants consulted for this study were not aware of the relevant laws and standards, which is reportedly a pervasive issue.

- Industry associations could also play a central role in implementation and enforcement. Innovative ways of cooperating between local government agencies and industry associations could combine industry self-regulation with government supervision. Specifically, industry associations that have contributed to the drafting of standards could act as a link between farmers and government agencies to help monitor whether standards have been followed and urge non-compliant enterprises to address any issues. If no steps are taken, the industry association could, at its discretion, decide whether to take action and/or involve the government. This public-private collaboration could not only help address the challenge of limited government capacity but could also help farmers comply with standards and save them from unnecessary penalties.
- Finally, greater support for more innovative approaches to improve traceability, including those that have been piloted both within and outside of China, and technologies such as barcodes on products and phone apps that allow consumers to see related documents would be helpful. Still, consumers often remain mistrustful, noting that these can be faked, so it will be important that regulators and government authorities actively review and oversee the development and enforcement of these new technologies.