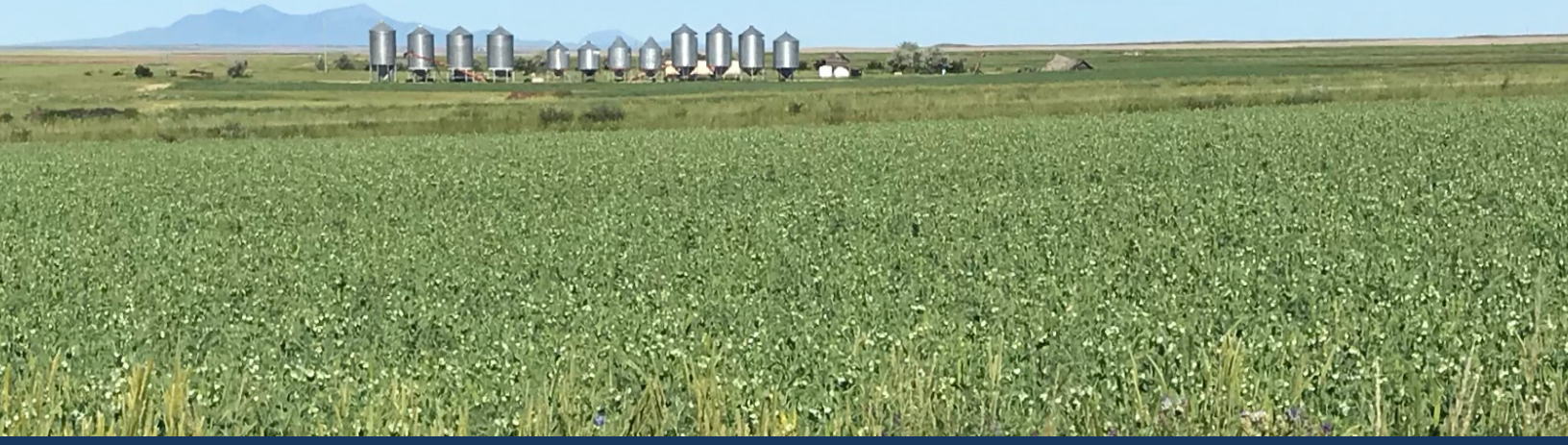
ENHANCING FARM VIABILITY THROUGH INNOVATIVE RISK & REWARD SHARING

BETWEEN FARMERS AND THE SUPPLY CHAIN FOR ORGANIC GRAINS, PULSES AND OILSEEDS



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VILICUS FARMS

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EXECUTIVE SUMMARY

Our nation's industrialized food system is designed to best serve conventional agriculture. This poses challenges for the viability of organic farms of all sizes. These farms provide unique economic and ecological benefits to their immediate communities and the nation as a whole. If barriers to their viability are not addressed, these benefits cannot be fully realized. Using Vilicus Farms, a nearly 10,000-acre dryland organic farm in north-central Montana, as an inspiration, this report focuses on the supply chain for grains, pulses and oilseeds. It is particularly promising and urgent to examine domestic production of these crops because domestic demand usually exceeds supply, indicating market potential for expanding domestic production of these crops.

This report aims to identify ways to improve the viability of commodity-scale organic grain, pulse, and oilseed farms by proposing changes to the way these farms interact with other entities in the supply chain into which they sell their products. In the current system, farmers are usually the smallest and least powerful actor, which obligates them to accept a disproportionate amount of risk. Individual farms are small and sell a relatively undifferentiated product from the perspective of a commodity buyer, providing farms limited market power as they sell their product. This report, which is the result of both academic research and numerous conversations with professionals working in organic agriculture, describes theoretical methods for more equitable sharing of risk in the supply chain and provides examples of how these methods are currently being deployed to enhance farm viability.

Farmers face two major types of risk: production risk, the threat that their crop will fail or yield will be poor, and market risk, the possibility that prices for their product will be low when they sell. Understanding production risk is particularly important because it illustrates why price premiums for organic products are not sufficient to support a farm's financial viability. Even a high premium will not benefit the farm if there is little product to sell. Production risk will become increasingly relevant as the extremes of climate change increasingly threaten agricultural productivity.

Organic agriculture is centered around long-term ecological health and profit, while the financial system is built on shorter timelines, which can pose challenges for organic farms. Some of the solutions proposed in this report draw inspiration from associative economics, a system in which producers and consumers shift from focusing on their own private interests to considering the interests and needs of the community as a whole.

Even if a farm is financially sound, this is not sufficient for it to be viable. Viability also encompasses ecological and social and institutional factors, such as soil health or the availability of organic cultivars that work in the farm's climate. Organic farmers face several unique challenges to viability compared to conventional farmers, including lending hesitancy, lack of markets for certain agronomically important crops, and crop insurance that is less well suited to their unique needs.

Ultimately, we use the term viability to mean the ability of a farm to operate in the long term while minimizing the production of negative externalities. Risk undermines farm viability, and organic farmers face particular production risks due to their inability to use certain inputs commonly used in conventional agriculture. However, in the longer term, many of the practices that organic farmers undertake reduce production risk, such as efforts to build soil health.

We propose ten concrete methods that increase farm viability through reshaping and redistributing risk and rewards across the farm and the supply chain. These wide-ranging methods include, for example, product diversification, cooperatives, ecosystem service and carbon markets, and identity preservation. An operation's scale, its geography, and particularly the density of similar farms in the immediate area will influence the applicability of each of these methods to a given farm. Many of the methods are easier to deploy or more powerful when there is a greater density of similar farms in a given area. This results in a positive feedback loop of a greater number of viable farms leading to even more organic farms being viable. None of the methods presented in this paper are sufficient to achieve farm viability on their own. Instead, the options presented in this paper should be viewed as a menu from which multiple strategies can be selected and deployed simultaneously.

Themes of the solutions we propose include forging more direct connections between farmers and consumers, acknowledging and leveraging the importance of relationships among farms in the supply chain, adapting to nature, and identifying risk-sharing solutions that do not place additional administrative burdens on farmers. We hope that by increasing the use of the risk-sharing solutions in this report, organic farms become more viable and abundant, allowing the ecological and economic benefits of this growth to be realized in more places.

About this Project

This project was funded and sponsored by the Ucross High Plains Stewardship Initiative at the Yale School of the Environment. It was proposed by Anna Jones-Crabtree, co-founder of Vilicus Farms, a nearly 10,000-acre dryland grain, pulse, and oilseed organic farm in the northern Great Plains that employs advanced stewardship techniques with the goal of maintaining and enhancing long-term productivity of the land, as well as training a new generation of farmers in this approach to agriculture. Anna provided valuable feedback through the process of creating this report and facilitated conversations with knowledgeable sources across the organic sector.

INTRODUCTION

It is challenging to reconcile long-term human and planetary health with economic systems that rely on quarterly earnings reports, treat food as widgets, externalize long-term costs and do not adequately compensate conservation-minded farmers for the ecological benefits they create. Our current economic system does not facilitate the long-term planning and collaboration that is required to maintain the health of people, the land, and the planet. The integrated, multi-year ecological systems that the organic agriculture movement recognizes as important require correspondingly integrated market mechanisms that promote farm resilience and stability, particularly in the face of growing climate instability.

A NOTE ABOUT LANGUAGE

In this report, we will use the term "organic" for clarity, ease of reading, and because the organic certification offers a consistent framework. However, in preparing this report, we considered a spectrum of farms that use practices that promote ecological health and natural resource conservation. Many of the findings in this report are applicable to operations across this spectrum, and we do not intend the use of the word organic to imply that our findings are only applicable to farms that are certified organic under the standards of the United States Department of Agriculture (USDA) National Organic Program.

Similarly, we use the term "commodity" for ease of communication and due to the lack of a more succinct descriptor. By using the term "commodity" we hope to emphasize that our research focuses on organic products that are produced with some degree of uniformity, storable, and generally traded at a business-to-business scale, rather than direct-to-consumer. By using this term, we do not mean to endorse the current commodity system of agriculture or suggest that it is the best way forward for enhancing the viability of organic farms. In fact, the pressure for organic agricultural products to fit into a highly commoditized agricultural system has greatly contributed to many of the challenges we identify for improving the position of organic farms.

Lastly, although the paper focuses on risk's relationship to farm viability, we include reward in the title and in certain places throughout this paper for two reasons. First, reward is the inverse of risk. In the examples throughout this paper, creating and sharing rewards is often the vehicle through which risk is mitigated (e.g., improving soil health, improving the branding and consumer awareness of organic ingredients). Second, we want to emphasize that the relationship between the supply chain and farms is not zero sum. Many of the approaches outlined in this paper not only more equitably distribute existing risks and rewards between farms and the supply chain, but they also reduce risk and increase the rewards overall. Thus, while the components of risk to a farm provide the framework for pieces of this paper, the subtext is often reward.

HIGH-LEVEL GOALS

The goal of this project is to identify ways to improve the viability of commodity-scale organic grain, pulse, and oilseed farms through changing the way these farms interact with other entities in the supply chain into which their products enter. Devising ways for farmers share resources, build more equitable relationships, and gain leverage in the organic commodity supply chain can reduce risk and enhance farm viability. Improved farm viability could contribute to an expansion of organic agriculture in the United States. Increasing the number of farms and acres cultivating organic grain will in turn address the gap in the domestic supply of organic commodities and help realize the economic and environmental benefits of organic agriculture more widely.

Farms are inherently connected to society and the environment. Their activities contribute both positive and negative externalities to their surroundings. While some environmental regulations exist, conventional

farmers are largely able to externalize many of the environmental costs of their activities, from soil degradation to water contamination via fertilizer, pesticide, and herbicide runoff. The collective environmental harm is then borne by society. While not without impact on their surroundings, organic agriculture requires farmers to employ practices that reduce these negative environmental effects on public resources, benefitting on-farm resources, nearby communities, and society at large. Transitioning more acres to organic will provide these environmental benefits to more farmers and communities.

Some of the solutions proposed in this report draw inspiration from associative economics, a system in which producers and consumers shift from focusing on their own private interests to considering the interests and needs of the community as a whole. In this model, associations of businesses and consumers cooperate to support their mutual interests. Associative economic principles are particularly relevant for agriculture, given that a resilient, reliable, sustainable agricultural supply chain requires complex coordination and is strongly in the interest of society at large.[1,2]

While farmers receive a premium for organic products compared to conventional, these price premiums do not necessarily improve farm viability by themselves. Despite receiving higher prices for their products, certified organic farms are still exposed to price fluctuations, and can experience crop failures or other risks that they have to bear without support from other actors in the supply chain. In the current organic commodity supply chain, farmers are often the smallest and least powerful actor. They interact and do business with large, concentrated entities, both as suppliers and buyers, that aggregate products grown on many farms. This places individual farms in a weak negotiating position and necessitates acceptance of unfavorable structures and terms set by the more powerful actors like processors and food manufacturers. Often, accepting these unfavorable terms undermines the farm's long-term viability. Yet, in the current system, farmers have little choice but to accept in order to survive in the short term. This report examines the existing structure and proposes a menu of solutions that rebalance power back towards farmers, providing them the opportunity to receive the economic resources necessary to make a farm viable in the long term.

Research Approach

Our research approach consisted of three primary elements: a review of academic and grey literature, interviews with numerous stakeholders across the organic supply chain and system at large, and an examination of examples of successful risk and reward sharing.

We began this project with a general review of academic literature on risk management in agriculture. Due to notable differences in risk management tools available to organic farms, such as a paucity of well-tailored crop insurance, academic research we read examining conventional farms' risk was often not highly applicable to organic operations. The literature we did locate on risk management in organic agriculture largely focused on relatively small-scale, direct-to-consumer operations.

Due to the lack of substantial academic research on risk management in organic agriculture at medium and larger scales and the quickly changing landscape of the organic sector, we primarily gathered information for this analysis by speaking with over a dozen employees and representatives from organizations across the spectrum of organic stakeholders and across multiple organic commodity supply chains. We allowed these

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[1] Bloom, 2010

[2] Karp, 2008

conversations to flow naturally according to the unique perspective and concerns of the stakeholder. In many cases these conversations yielded useful examples of successful approaches as well as existing barriers to risk and reward sharing, which we describe in this report. A complete list of experts consulted for this report is included in the acknowledgments section.

Current State of Organic Markets

While consumer interest in organic products has grown considerably over the past two decades, the United States has not seen a proportional increase in production of organic grain or expansion of organic farmland. While roughly 6% of food consumed in the U.S. is organic by dollar value, less than 1% of U.S. farmland is organic.[3,4] Between 2016 and 2019 alone, sales of organic commodities rose by 31%, while acres of organic crop and pasture land rose by just 10%.[5] The disparity between domestic production and demand is even greater in organic grain. While sales of organic livestock, which must be raised on organic feed, grew by nearly 300% in the 2010's, acres of organic grain cultivated rose by just 30% over the same period.[6]

Imported organic products generally make up this gulf between domestic supply and demand.[7] This is significant because a longer supply chain generally increases the product's natural resource demands. This forgone domestic organic production essentially represents an ecological and economic opportunity cost for rural communities who would have benefitted from converting conventional acres to organic. Finally, imported organic products, particularly organic grain, have been plagued by concerns of fraud, earning both the attention of Congress and USDA National Organic Program regulators.[8,9] Increasing domestic production of organic grains, pulses and oilseeds helps address these concerns associated with imported products.

Additionally, the number of Americans directly involved in farming has reached historic lows. Currently those who own farms make up about 1% of the U.S. population.[10] Among households who do farm, agriculture is rarely the only source of income, particularly for smaller and mid-size farms. A typical household operating a mid-size farm derived about a third of its income from off-farm sources in 2019.[11] The proportion of off-farm income is even higher for smaller operations.[12] While driven by an array of factors, these trends demonstrate the substantial challenges to financial viability in the current system and the strong disincentives to enter agriculture that these viability challenges create.

Sustainable agricultural practices lie on a spectrum, and organic producers are certainly not the only farmers employing conservation practices. Many conventional farms are adopting select conservation practices. On the other end of the spectrum, some farmers are moving beyond organic requirements. Biodynamic is one such system of practices that goes beyond organic standards, viewing the farm as part of an integrated

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[3] Organic Trade Association, 2019
[4] USDA Economic Research Service, 2019a
[5] USDA National Agricultural Statistics Service, 2019a
[6] USDA National Agricultural Statistics Service, 2019b
[7] Reaves, Healy & Beach, 2019
[8] Federal Register, 2020
[9] Baldwin, 2018
[10] USDA Economic Research Service, 2020
[11] USDA Economic Research Service, 2019b
[12] USDA Economic Research Service, 2019b

agricultural ecosystem. It encompasses organic practices, but its philosophy includes a more holistic approach to farming that explicitly values cooperative relationships, social responsibility, and minimizing off-farm inputs. Though it is a certification system, it currently serves a small U.S. market and is not tied to U.S. law nor administered by a government entity. It is much more prevalent in Europe than the U.S., but has potential to grow in the U.S. as consumer interest in the connection between agricultural practices and environmental conservation grows, as has already occurred in Europe.[13]

FARM VIABILITY

FARM VIABILITY DEFINED

In academic literature, the term "viability" is often used in a strictly economic sense, with a narrow focus on farm level income. Some papers also include income fluctuation and the level of debt,[14] or a farm's capacity to generate returns on non-land assets.[15] Economic viability is sometimes differentiated from economic sustainability, which focuses on the farm household rather than the business and includes off-farm income.[16,17,18] More recent articles call for the inclusion of factors beyond finances in defining farm viability. Graddy-Lovelace and Diamond, for example, define viability as the ability to "maintain a decent livelihood and farm in a way that does not degrade ecosystems or rural communities", and emphasize the importance of economic and social relationships to increase farm resilience. [19] Christensen and Limbach use a stakeholder engagement process to develop a common understanding of agricultural viability. [20] In addition to the economic prosperity of local farms, stakeholders placed an emphasis on farm retention and expansion, farm stewardship that maintains or increases natural resources and is adaptable to climate change, a supportive regulatory environment, and the social value of local food systems. As Scott summarizes in her report on farm and community viability, viable farming rests on the four columns of economic viability (economic efficiency, fair prices, income and income support programs, and debt), ecological viability that sustains a productive farm operation, human capital that allows the farm to persist, and social capital (which is defined as the ability of farmers and their community to work and live together). [21]

Viability is also connected to resilience. Resilience can be characterized by three features: a high degree of self-organization, a capacity for learning and adapting, and the amount of change a system can undergo while maintaining its performance.[22] In order to be viable in the long term, a farm needs to be resilient in the face of challenges such as harvest fluctuations, and adaptable to change in both environmental factors, such as climate change, and economic factors such as consumer preference or market situations. The social element in viability is especially important in enhancing resilience. For example, a functioning social network across

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[13] Chhabra, 2017
[14] Vrolijk, de Bont, Blokland, & Soboh, 2010
[15] Frawley & Commins, 1996
[16] Spicka et al., 2019
[17] O'Donoghue et al., 2016
[18] Hanrahan, Hennessy, Kinsella, Moran & Thorne, 2014
[19] Graddy-Lovelace & Diamond, 2017
[20] Christensen & Limbach, 2019
[21] Scott, 2005
[22] Milestad & Darnhofer, 2003

different actors along the agricultural value chain can help overcome short-term harvest failures or help bridge financial emergencies.[23]

Two promising concepts that propose holistic approaches to agriculture are "Agriculture of the Middle" and multi-functional agriculture. 'Agriculture of the Middle' highlights the need for a transition to a value-based supply chain that goes beyond purely transactional relationships. It implies a profound cooperation of farms that lie between direct and commodity marketing operations with other supply chain actors and calls for a commitment to the welfare of all through business agreements that embrace approaches such as extended contract durations.[24] Multi-functional agriculture expands the traditional role of agriculture from simply producing food to include biodiversity and landscape protection, farms' contribution to thriving rural communities, and the management of renewable natural resources.[25]

For the purpose of this report, based on the literature outlined above and conversations with experts, we use the term farm viability to mean the ability of a farm to operate in the long term while minimizing the production of negative externalities.

This includes:

1. Economic aspects, i.e. the availability of adequate and accessible income and operating capital; the presence of labor capacity; the availability of key physical resources; price stability; flexible buyers in regards to both quantity and quality of grain; and compensation for positive externalities;
2. Social and institutional aspects, i.e. close consumer relationships; the health of farmers and farm workers; the availability of cultivars that work in the farm's climate; and the retention of technical knowledge in farm communities;
3. Ecological aspects, i.e. crop stability in terms of yield and quality; climate stability or the capacity to adapt to climate variability; soil health; and ecosystem health, including biodiversity, and clean air and water.

Economic prosperity is a necessary but not sufficient condition for declaring a farm operation viable. At the same time, ecological and social factors affect economic viability, because farms rely on ecological conditions like fertile soils and social capital such as collaboration between farmers, for example to advocate for beneficial policies. Figure 1 gives an overview of the market, social and institutional and ecological forces that we refer to in this report. While the diagram does not represent an exhaustive list of forces that influence farm viability, it shows the connection between them and the need to regard farming in a holistic way as part of a system of market and institutional actors that operate within the natural environment.

[23] Hooks et al. 2017
[24] Hooks et al., 2017
[25] Brown, Goetz & Fleming, 2012

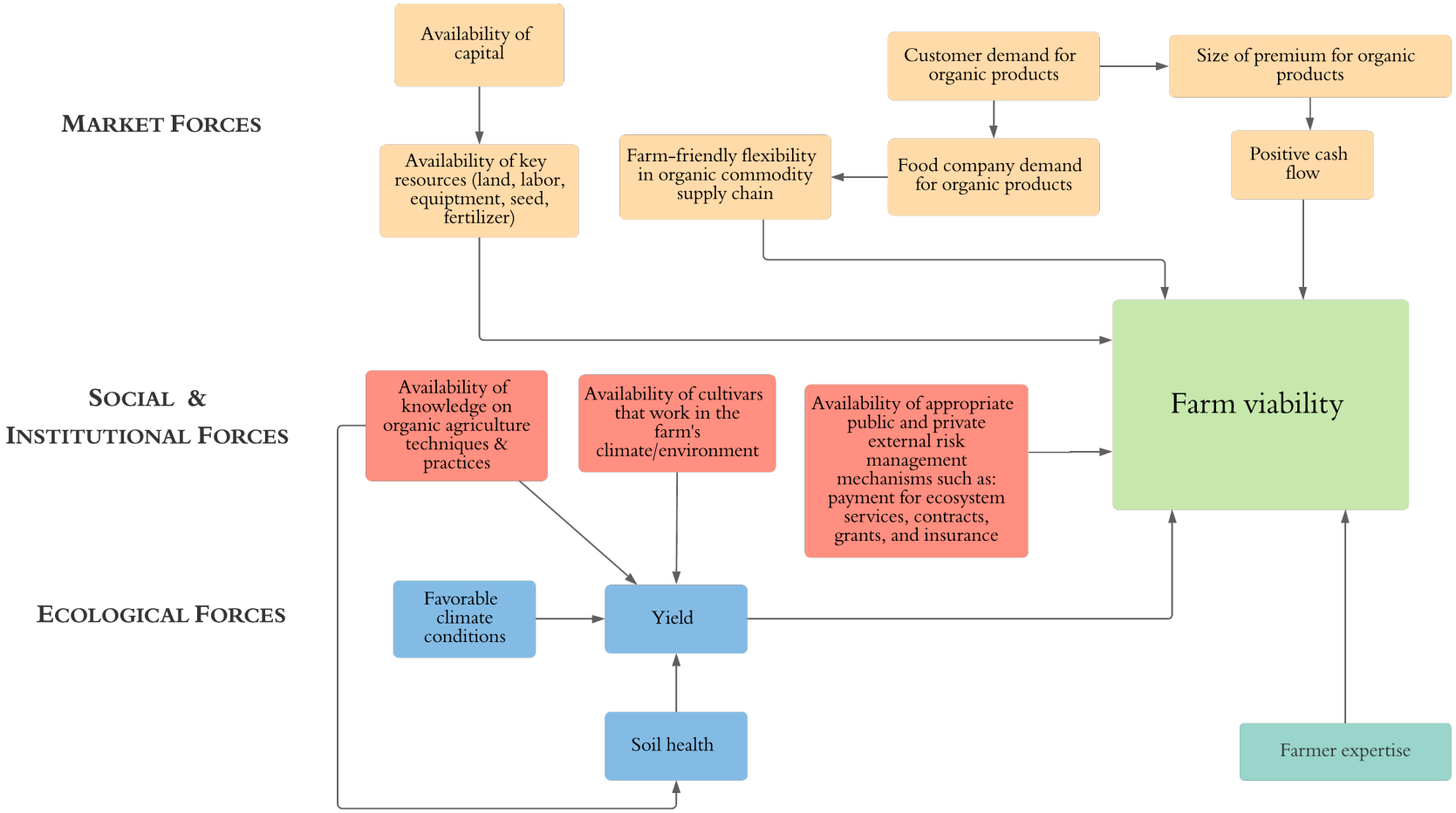

Figure 1. Market, social and institutional, and ecological forces that influence farm viability.

Key Risks and Challenges

The Connection Between Risk and Viability

Risk fundamentally undermines farm viability, and in the current system, organic operations generally face more risk than conventional ones. Farmers face two primary forms of risk: production risk and market risk. Market risk is related to the unit price a farmer receives for their product. Uncertain or volatile market prices increase market risk. Production risk concerns the amount of product produced. This is influenced by a number of factors including weather, disease, farmer expertise and soil health. Overall risk to a farm as a business is a function of both types of risk. For example, even if prices are high when a farmer markets their product, the crop may have yielded poorly or costs of production were higher than usual, limiting the farmer's ability to benefit from high prices.

While risk can be reduced by addressing either production risk or market risk, as long as production risk is steadily increasing due to climate change, addressing market risk alone will not enhance farm viability. The anticipated weather volatility and extremes that are likely to occur due to climate change will increasingly exacerbate production risk. If product prices are stable and high but a crop is wiped out due to a drought or cannot be planted because of heavy rain, the farmer will not realize the benefit of these high prices. One does not have to look back far to find examples of this dynamic playing out. In 2019, farmers nearly doubled the previous record for the number of acres of commodity crops that could not be planted due to heavy spring rains.[26]

Agricultural conservation practices common in organic agriculture such as complex crop rotation and the use of cover crops can help build soil health and improve long-term resilience, decreasing production risk.[27,28] This can reduce production risk for organic farmers relative to conventional operations. However, organic farmers also face increased risks by forgoing certain agronomic tools that protect crops from short-term threats and losses, such as synthetic fertilizers, pesticides, and herbicides.[29] Based on our research and interviews, we estimate that organic farmers face greater overall production risk than their conventional counterparts, particularly in the short term. The increased risk that organic farmers assume by forgoing agronomic tools that produce negative environmental externalities are reflected in part by higher prices and value for their products.

Narrow specifications in contracts also increase production risk. This risk is especially acute for organic producers. Large-scale commodity processors often establish narrow specifications for the product they purchase from farmers because their customers, large food companies, also establish narrow specifications for the processed product they wish to buy. This is a result of the highly industrialized, standardized nature of the U.S. food system and illustrates a fundamental challenge for organic products to be integrated into this system. Since variability is a part of nature, forcing uniformity in turn forces more man-made inputs that fight nature. Multiple industry experts consulted for this report shared that the physical characteristics of organic products can vary more widely than conventional products because organic agriculture does not rely on

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[26] USDA Farm Service Agency, 2020
[27] Bowles et al., 2020
[28] Basche & Edelson, 2017
[29] Berentsen & van Asseldonk, 2016

pesticide, herbicide, fertilizer, and GMO inputs that can increase uniformity. This creates unique challenges for organic operations. If both organic and conventional products are required to meet certain narrow specifications to be accepted by a large food manufacturer, organic products are more likely to fall outside of the specification. In most contracts, if the product does not meet the specification, then the buyer is not obligated to purchase it. The farmer may then sell the product into an alternative, lower value market, such as for feed, forgoing substantial potential revenue.

An alternative way to address both production and market risk and enhance farm viability is to provide more opportunities for farmers to receive income that is not exclusively tied to yield and price. Some of the risk sharing examples detailed later in this report apply this concept. On a very small scale, this is how community-supported agriculture programs function. Subscribers pay up front for a farm share, and the producer keeps this revenue received prior to production regardless of whether they are able to produce the agricultural products. While this model is likely infeasible on a commodity scale, it provides an excellent illustration of what fully decoupling production and income might look like.

Power Dynamics and Challenges in the Current System

The laws of economics are stacked against commodity farmers. First, commodity farms are small relative to the size of commodity buyers, leading to minimal selling power. Second, a lack of perceived differentiation at the consumer level restricts competition beyond price and advertising. Together these two factors lead to near-perfect competition, which economic theory tells us leads to near zero profit. Beyond low profit, this economic and power dynamic enables buyers to structure terms that shield themselves from agricultural risks, leading farms to bear nearly all market and production risks. To continue with the example above, industrial food processes have tight production specifications, and in many contracts if those aren't met, a farm must find a low-price alternative market to sell into, such as a nearby feed elevator.

Organic farms in particular have less supportive infrastructure to withstand low margins and high risk than conventional operations. In terms of physical infrastructure, in many regions few elevators and processing facilities are dedicated to organic products.[30] In addition, soft infrastructure such as organic research, cultural acceptance among farming communities, and supportive crop insurance and financial institutions lag behind conventional farming. In addition, lending agencies often view organic operations as non-standard, leading organic farms to face greater challenges accessing credit.[31]

The combination of low margins, high risk, and a lack of soft (cultural, intellectual, and political) and physical supportive infrastructure has caused the organic movement to struggle to translate consumer interest up the supply chain, back to the farm. The forces of consumer interest and ecological need will be insufficient to expand organic farming until long-term planning and inherent year-to-year variability are financially supported. Our paper focuses on what farms and the supply chain can do in tandem to mitigate agricultural risk and increase organic farm viability, ultimately enabling organic farming to expand.

Key Hurdles Facing Organic Farms

The federal crop insurance program generally covers conventional commodity agriculture more effectively than diverse agricultural systems. This leaves organic growers with diverse production more exposed to

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[30] James & Storey, 2017

[31] Escalante et al., 2014

market and production risk, since insurance can protect against both market price drops and low production years. However, it is important to note that organic field crop farmers use crop insurance at high and comparable rates to conventional growers. A survey by NCAT (National Center for Appropriate Technology) of 319 organic farmers found that 82.8% of organic field crop growers surveyed said "they considered crop insurance either moderately (25.0%) or extremely (57.8%) important for their success and survival."[32] Yet the survey also found that use of insurance decreased as farm size shrunk, the proportion of specialty crops grown increased, and crop diversity increased.[33]

The lack of a supply chain and markets for agronomically important rotational crops and cover crops also limits the financial incentive and ability to plant long-term crop rotations that benefit the soil. Particularly in certain regions in the U.S., the local markets, aggregation and processing facilities, and distribution networks may be few and far-between for crops other than the regional cash crops. For example, markets for oilseeds, pulses, cover crops, and smaller-market small grains such as oats, flax, and buckwheat are not yet mature, which creates a major roadblock to employing a diversified and long-rotation farm plan.

The lack of organic cultivation and breeding research and extension services are also key factors that have historically limited the growth of organic agriculture. The disproportionate agriculture research and extension services supporting conventional agriculture leaves organic agriculture at a competitive disadvantage. Fortunately, federal funding for sustainable agriculture is growing. The USDA funded and administered Organic Agriculture Research & Extension Initiative (OREI) has been growing and is expected to increase in funding from $20 million in recent years to $50 million by 2023.[34] Improved research and services targeting organic agriculture can both increase farms' profitability and resilience.

Traditional lenders may be hesitant to lend to small farms, new farms, and farms with less common growing practices (e.g., organic and/or complex rotations). Lack of capital to collateralize can limit a public or private lending agency's ability and desire to lend credit. Organic business models are also less common, so lenders have less experience valuing them. Lastly, the other risk factors mentioned above (specifically limited access to robust, subsidized insurance) lead to increased lender hesitancy. Without comparable access to credit, organic farms are left particularly exposed to financial shocks, and lack the ability to invest in resiliency building infrastructure.

Importantly, key risks and issues are interconnected. Consider the following examples. Increased climate variability without comparable access to subsidized insurance leads to greater lender hesitancy for organic farms. In addition, lack of technical assistance and research to respond to variable climate can slow the speed of inventions of mitigation strategies. In combination, a lack of credit access and consecutive years of low crop prices or yields can lead to insolvency. Addressing each risk is important not only in and of itself, but also due to its impact on the web of connected other risks. Figure 2 outlines the grain supply chain and highlights key risks and opportunities to overcome those risks at various nodes along the supply chain.

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[32] Morris, Belasco, & Schahczenski, 2019

[33] Morris, Belasco, & Schahczenski, 2019

[34] National Sustainable Agriculture Coalition, n.d.

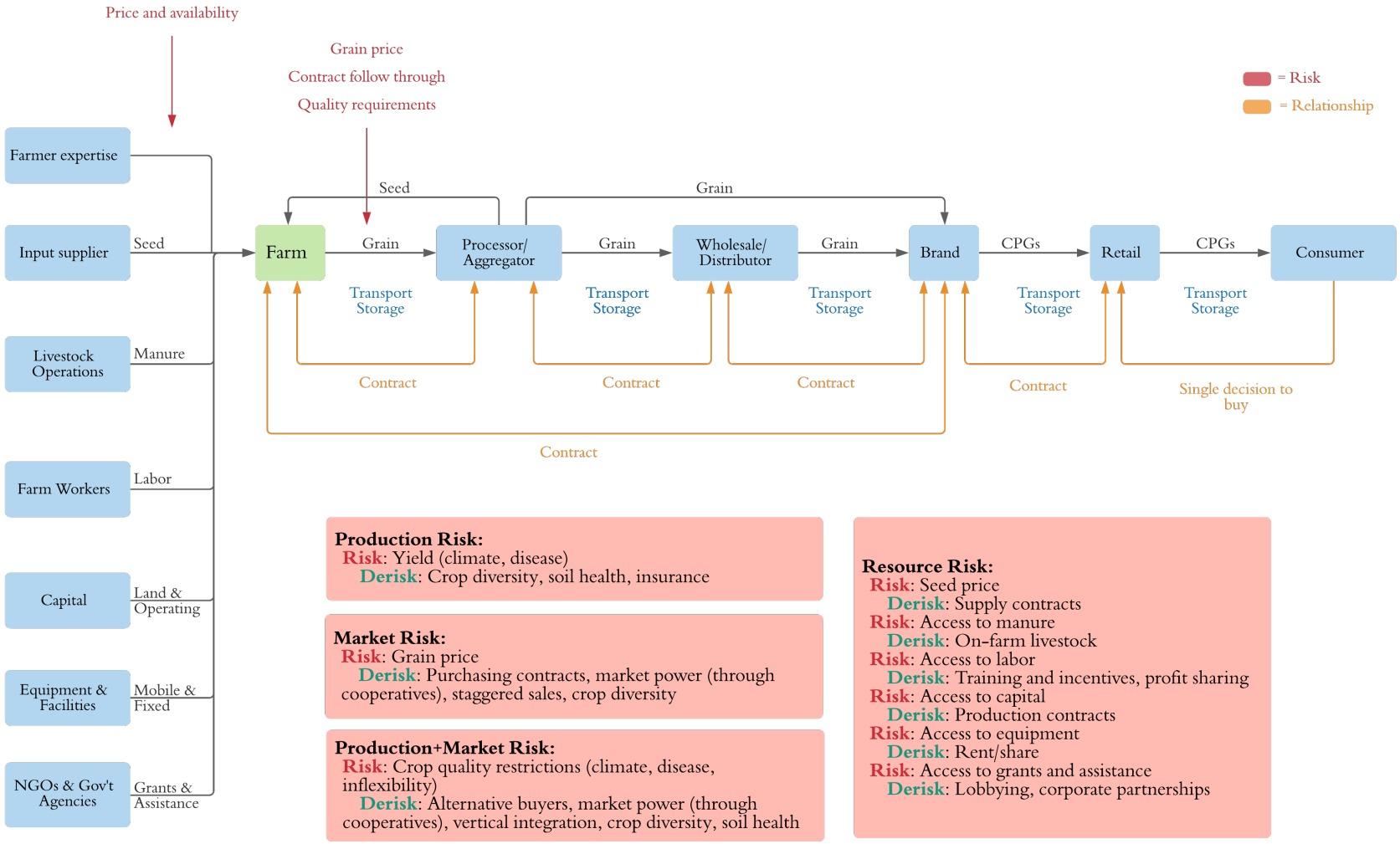

Figure 2: Risks and relationships in the current supply chain

Concrete Risk & Reward Sharing Methods

Risk & Reward Sharing Benefits

To increase farm viability and align risks and rewards more equitably between farms and supply chain entities, the adoption of innovative approaches and the applicability of existing practices to the complexity of diverse organic farms have to be enhanced. In the following, we will present a variety of solutions that address the issues outlined above. These solutions create economic models of collaboration and creative partnerships that take a longer-term view and recognize value beyond what is currently monetized. They increase price stability, allow for greater producer power, compensate farmers for the benefits they create, establish partnerships between farmers and buyers, and enhance resiliency.

We discuss ten concrete methods in this paper that increase farm viability through redistributing risk and rewards across the farm and the supply chain. We also describe seven examples of organizations that employ these methods. Figure 3 highlights the primary connections between the example organizations, methods, and seven specific mechanisms through which they mitigate and share risks and increase and share rewards. Note two caveats: first, while these lists are substantial, they are not exhaustive, and second, the arrows show only the *primary* drivers and give a false sense of linearity. The reality is more interconnected and complex. For example, custom contracts (method) may enable credit access (method) through price stability (mechanism), and together all three may increase revenue stability (mechanism) and enable practices that improve soil health (mechanism).

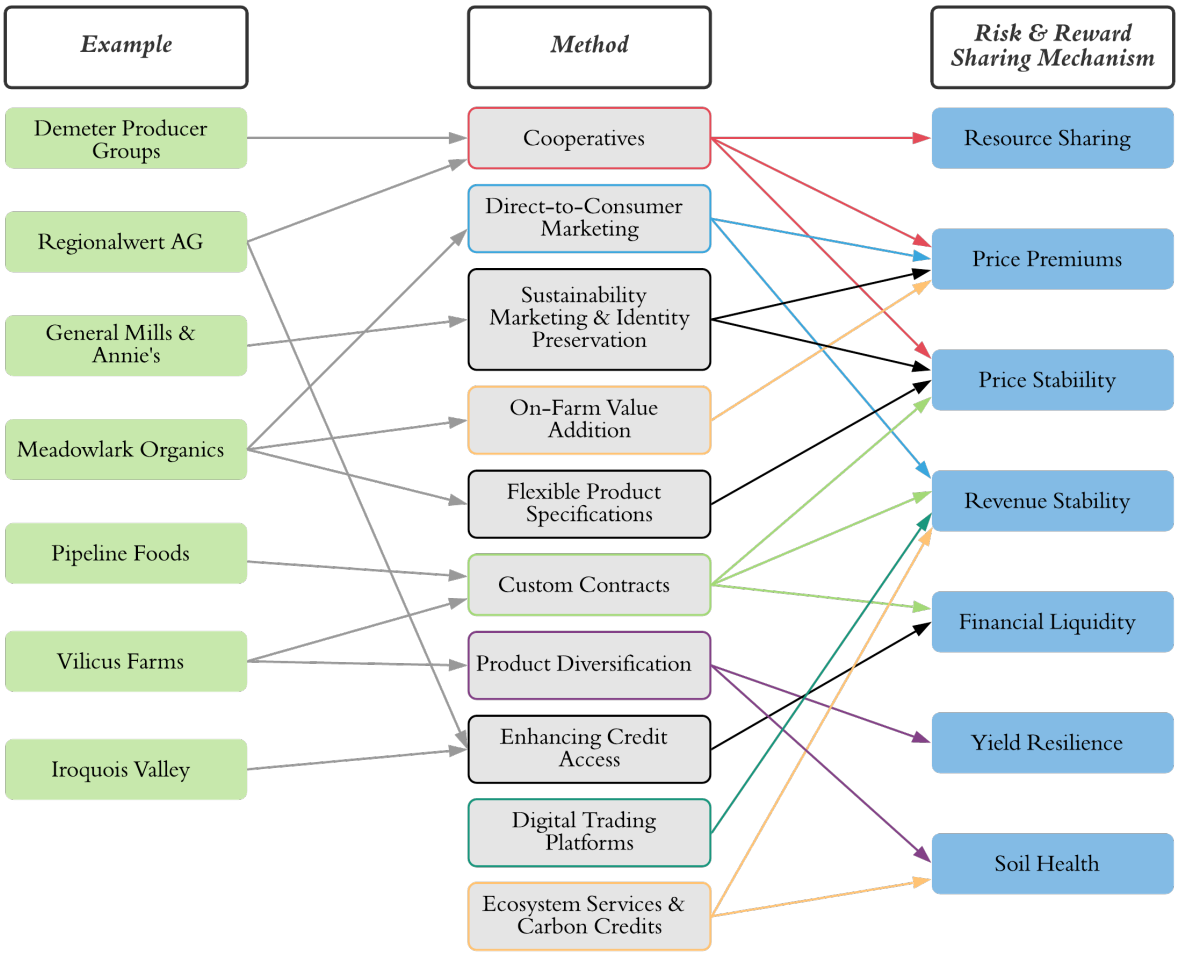

Figure 3: Mapping examples, methods, and risk and reward sharing mechanisms.

Factors Influencing Applicability of Risk & Reward Sharing Solutions

While the following methods have been applied in different regions and contexts, their success often depends on the scale of the farm and regional farm density. For example, the number of acres available influences the size and types of contracts the farmer can enter. Similarly, the volume of product produced determines whether establishing on-farm processing facilities to create value-added products or pursuing direct-to-consumer marketing is economically feasible. Farm size and production relative to the market size also determines negotiating power with buyers.

Surrounding geography and farm density in a given location can also affect the suitability of various solutions. Some approaches like cooperatives are most effective in the presence of other farms relatively nearby. Similarly, coordinated efforts to become independent from powerful industrial actors further down the supply chain are only feasible if alternative infrastructure is present in the region. For example, an adequate density and availability of storage space and processing facilities nearby or on the farm can facilitate formal or informal producer-buyer relationships that enable flexibility in terms of quality and quantity of the processed product as well as reciprocal support in the case of yield or market fluctuations.

The presence of a local network of other farms with a similar production philosophy and goals can also be important for social resilience and support. This is not easily measurable, but is often a critical source of support for farmers who operate in a way that is atypical for their region. Not only does this allow for an exchange of practical knowledge and experience with local conditions such as climate and soil characteristics, it can also create a network of like-minded farmers and promote mutual solidarity.

Figure 4, below, illustrates which aspects of farm viability are directly supported by each risk sharing method described in this report. Farm viability is highly complex, and many of the aspects of farm viability are interconnected. Due to this structure, supporting a single aspect of farm viability will likely also indirectly support another (e.g., financial benefits realized from custom contracts may enable farmers to invest in practices that improve soil health). It is important to note that for the sake of simplicity this figure only includes the *direct* connections between risk sharing methods and aspects of farm viability.

	Aspect of Farm Viability Supported						
	Economic			**Social & Institutional**		**Ecological**	
Risk & Reward Sharing Method	Flexibility in Supply Chain	Financial Stability	Availability of Key Physical Resources	Farmer Knowledge	Availability of Risk-Management Mechanisms	Soil Health	Yield Resiliency
Cooperatives	X		X	X			
Custom Contracts	X	X			X		
On-Farm Value Addition		X					
Direct-to-Consumer Marketing	X	X					
Enhancing Credit Access		X	X				
Flexible Product Specifications	X	X					
Sustainability Marketing & ID Preservation		X					
Digital Trading Platforms		X		X			
Product Diversification					X	X	X
Ecosystem Service Markets and Carbon Credits		X			X	X	X

Figure 4: Aspects of farm viability directly supported by various risk and reward sharing methods.

Selection of Risk & Reward Sharing Methods

Cooperatives

Risk & reward sharing mechanisms: *Resource sharing, Price Premiums, Price stability*

Farmers have used cooperatives to share risk for hundreds of years, and active marketing, supply and service cooperatives still exist for a variety of agricultural products. Marketing cooperatives aggregate multiple farms' products and market them collectively, allowing farmers to gain market power by interacting with the market as a single entity. This benefit is especially important given that buyers are generally very large compared to a single farm. Better negotiating power relative to the buyer therefore improves farmers' potential to negotiate higher prices or favorable risk sharing provisions in a contract.

In some cases, the cooperatives also process the product, with cooperative members collectively investing in processing infrastructure that adds value to the product. Cooperatives can also enhance access to capital and financial stability for farmers by collecting and managing investments. Usually, the fixed cost of processing infrastructure would be too great for any single farmer, so the creation of a cooperative enables farmers to process the product on their own and receive the associated premium themselves, rather than selling to a processor for a lower price.

Cooperatives rely on the existence of a group of producers with similar products and similar production costs. Additionally, cooperatives that physically pool and process products require a certain density of members within a geographic area to keep transportation costs down and remain financially viable. As long as organic farming is a small share of the market and medium and large-scale organic farms are geographically isolated, building successful marketing cooperatives for grains, pulses and oilseeds will be challenging. In this way, cooperatives may become more practical as the organic sector matures, and organic farm density increases.

Another complication of this model is that it relies on all members' products meeting a uniform specification. As previously discussed, this assumption poses a challenge for organic products, whose physical characteristics vary more widely than conventional crops. However, a small cooperative or partnership could serve a customer that did not require uniform specifications, such as a local artisan bakery or brewery that might prize this variation and use it to differentiate their product.

Custom Contracts

Risk & reward sharing mechanisms: *Price stability, Financial liquidity*

Traditional producer/buyer contracts are called marketing, or forward, contracts. Usually agreed upon before planting, the contract locks in a price per harvested bushel between a farm and buyer. Alternatively, without a contract, growers can sell their product at the time of harvest on the open market and receive the current, or spot, price. For both growers and buyers, marketing contracts protect against price volatility risk, enable better planning, and increase access to credit. For specialty or smaller market grains, marketing contracts may be the only way to guarantee the crop will have a buyer at the time of harvest, and that the buyer will have access to product when they need it. Note that the main downside of marketing contracts is simply a different perspective on their upside: they lock in a price, preventing farmers or buyers from realizing a better price if the market moves in their favor.

Farms and buyers can create custom contracts as well, that stipulate the length of the contract (e.g., beyond the standard one-harvest time frame), special payment timing and pricing mechanisms, and more. Thoughtful contracts can reduce risk and increase rewards for both parties, capitalize on different comparative advantages, and create better, more stable relationships. It should be noted that while custom contracts can offer great opportunities, the power dynamic between large buyers and relatively smaller farms will often shape the terms of the contract in favor of the buyer.

On-Farm Value Addition

Risk & reward sharing mechanisms: *Price premiums*

Value-added production refers to processing a raw agricultural commodity into another product that either itself can be used by consumers or can be incorporated into a product used by consumers. This processed product is sold at a higher price than the raw commodity. Adding value to a commodity through processing is a strategy often promoted by cooperative extension services and federal policy to enhance farm income and catalyze rural development. A major advantage of this approach is that it eliminates the processor as an intermediary between the farmer and the consumer.

In the right situation, on-farm processing can help a group of farmers share market risk among themselves and with their customers. However, value-added production requires substantial investment in equipment and other infrastructure. While value-added production can help manage market risk, investment in the equipment required to deploy this strategy can itself be a source of risk.

Investing in value-added processing capacity in partnership with other farmers can help reduce the risk of this strategy and increase access to capital through pooling resources. However, partnerships like this are only feasible if similar operations with similar products are located within a reasonable distance. This is a great example of how increasing organic farm viability can create a positive feedback loop, increasing the number of organic farms, which provides further opportunities for synergies and risk sharing within a certain area.

Careful consideration of the market for the value-added product is necessary before making an investment in value-added production. If the cost associated with producing a value-added good exceeds the price premium the farmer is able to receive, value-added production does not improve risk sharing or farm viability. While value-added production is often associated with direct-to-consumer marketing, value-added products can also be sold as ingredients to commercial customers. In this type of arrangement, a group of farms may collectively mill grain into flour and sell it to small commercial customers like artisanal bakeries, or even large commercial customers like food conglomerates.

Direct-to-Consumer Marketing

Risk & reward sharing mechanisms: *Price premiums, Revenue stability*

Direct-to-consumer marketing can benefit farmers by removing intermediaries from the supply chain, which allows all or most of the retail price paid by a consumer to reach the farmer and allows consumers to know their farmer.

Direct-to-consumer marketing is traditionally a more common business model for small and medium-scale organic farmers growing perishable produce. Historically, in order for a direct-to-consumer model to work, the farm must be located within a reasonable distance of a relatively densely populated area where there is demand for it. This is not the case for many grain, pulse and oilseed farms located hours away from viable markets. Additionally, unlike produce, many staple crops require processing before they can be used by an

average consumer. Despite these challenges, with modifications, farmers growing less perishable commodity or staple crops could utilize this model. Particularly as online food sales grow, farms are increasingly able to directly and efficiently reach distant customers.

Organic commodity farmers could gain power in the supply chain by partnering directly with local and regional businesses that utilize organic commodities in their products. These may be bakeries, breweries or even a manufacturer of high-end pasta or packaged foods. Generally, matching the scale of the farm selling the product to the scale of the business buying the product sets the transaction up for more equitable and effective risk sharing. Unlike large multinational food manufacturers, these smaller businesses are more likely to view the natural variation present in products from organic farms as adding value to their unique product, rather than a deficiency that is incompatible with a standardized manufacturing process and product.

However, processing capacity outside of the traditional, industrialized supply chain must be available in order for an arrangement like this to work. To fulfill this need, farms could form marketing cooperatives to collectively invest in processing infrastructure, or a collection of would-be buyers of the organic product could partner with the farm itself to invest in this infrastructure.

Sustainability Marketing and Identity Preservation

Risk & reward sharing mechanisms: *Price premiums*

When food companies make unusual efforts to partner with a specific farm with specific practices, part of the value proposition is the ability to build the company's brand and reputation by association with the farm's environmentally virtuous image and story. Companies are keen on featuring sustainable farms in advertising and packaging. This effect is magnified when a company can credibly say that a product from a certain farm or collection of farms was used in the exact product in a customer's hands. This is known as identity preservation. While identity preservation may increase the amount a company is willing to pay for a product, it also increases administration, processing, and transportation costs because the product must be kept separate from similar commodities and tracked throughout its journey from farm to processor to manufacturing facility.

Whereas a certification may capture one feature of a farm, identity preservation programs may enable farms to capitalize on their full set of practices because marketing can be tailored to the individual farm(s). Advertising a farm's specific practices allows customers to recognize and pay a premium for them, enabling the product to become the antithesis of a commodity. Yet featuring a farm in marketing material or participating in an identity preserved sourcing partnership requires additional administrative work on behalf of the farmer as well. The great power imbalance between the farmer and the food company also places the farmer in a poor position for negotiating additional compensation that reflects these additional costs.

While direct sourcing and identity preservation agreements with large food companies can increase price premiums for high quality growing practices, food companies must be willing to pay a significant premium for the product and adjust their operations to accommodate the smaller scale of product produced by medium-sized organic farms.

Enhancing Credit Access

Risk & reward sharing mechanisms: *Financial liquidity*

We have established that farm viability extends beyond financial viability. At the same time, farms cannot survive, much less expand, without access to financial resources. Conventional farmers may receive this financing through commercial banks or the Farm Credit System. Even though certified organic farms have existed for over two decades, some farmers still encounter skepticism from traditional lenders when seeking financing. This response is particularly common in areas where organic farming is relatively uncommon. Fundamentally, this barrier exists because lenders' financial models heavily weight the short-term production risk of organic agriculture, while discounting its long-term benefits.

Access to capital for purchasing farmland is often a prerequisite for implementing conservation practices. Much like other types of real asset ownership, owning land provides the security and long-term view that encourages farmers to take up conservation practices for which they may only see benefits in ten years. If a farmer is renting land and unsure of whether they will still be farming that piece of land in ten years, these practices become unattractive because they have substantial upfront costs and delayed benefits. Because of the three-year commitment required to transition land to organic, would-be organic farmers may be similarly reluctant to undertake the substantial investment of transitioning a farm to organic without the certainty of long-term ownership. As more producers rent land, access to operating capital also becomes more challenging because historically, agricultural operating financing was secured by owned farmland. In some cases, long-term leases are an effective middle ground, in that they allow a farmer to start producing without up-front capital to purchase land, but they do not solve many of the aforementioned long-term planning issues.

Organic farming is unique and a small portion of the market, often misunderstood by conventional agricultural institutions. Establishing financial networks specifically designed to serve organic agriculture may help overcome barriers organic farmers currently face to accessing credit. These institutions could leverage their familiarity with organic farms' unique opportunities and challenges to establish terms that meet organic farmers' unique needs. Similarly, these financial services companies could leverage impact-oriented investors' interest in making a positive environmental impact to establish credit agreements that distribute risk away from the farmer and toward the investor.

Flexible Product Specifications

Risk & reward sharing mechanisms: *Price stability*

As mentioned above, narrow specifications in contracts increase production risk: if the product does not meet the specification, then the buyer is not obligated to purchase it. The farmer must then sell into an alternative, lower value market, such as feed, forgoing substantial potential revenue. To the extent that buyers can still use the out-of-spec product, buyers can lessen the damage of narrow specs by creating price penalties rather than outright rejecting the product. Industry-wide solutions include creating more numerous and better connected secondary markets for products, adding more smaller players to the supply chain that can accommodate more product variability, and establishing new online marketplaces to connect farmers and buyers.

Digital Trading Platforms

Risk & reward sharing mechanisms: *Revenue stability*

Digital trading platforms match buyers and sellers online, offering farmers alternative pathways to sell their products. These platforms typically allow bid negotiations and the option to organize delivery. They often

also test samples for quality to allow buyers to review uniformly graded offers. In addition, services such as identity preservation, market analytics, and advisory through specialists that help with hedging strategies to manage risk, are offered through the platforms. By matching buyers with sellers and streamlining the negotiation process, digital platforms increase efficiency. At the same time, they support farmers by providing market insights, thereby recreating some of the informal networks that typically exist among smaller farmer communities. While new digital trading platforms like the Indigo Marketplace[35] and the Mercaris Trading Platform[36] do not necessarily solve the fundamental issues of commodity crop supply chains and can re-create existing problems, they can decrease dependence on traditional buyers, serve as additional sales channels, and thereby somewhat decrease the power gap between producers and buyers.

Product Diversification

Risk & reward sharing mechanisms: *Revenue stability, Yield resilience, Soil health*

Diversifying the crops produced on a farm is, in theory, a relatively straight-forward approach to reducing both production risk and market risk. Investing resources in different crops instead of concentrating them on a single one decreases the variance of the overall return.[37] Diversification can mitigate the potential impact from production risk, when weather conditions or disease negatively affect the yield of one crop but not another one. It can also reduce the impact of price fluctuations. When one crop might achieve a lower price one year, a second crop might get a higher price, evening out overall income. Diversifying input is another aspect of this risk mitigation strategy. Using a variety of seeds diversifies the gene pool present on the farm and allows it to cope with adverse shocks and adapt to changing climatic conditions.

Organic farms are more likely than conventional farms to use crop rotation practices and grow a diverse array of crops. However, crops that are included in the rotation cycle with the goal of increasing soil fertility or suppressing weeds are often of lower market value. The development of adequate markets will therefore reward and encourage the additional effort from managing a larger number of crop types. In addition to diversifying the number of different crops grown, including other farming activities such as livestock raising or seed propagation adds even more diversity to a farm's potential revenue streams.

While a diverse set of crops and practices is common in organic agriculture, multiple products increase on-farm complexity, can add management and labor requirements, and increase the number of processing partners farmers must manage. Whether diversification of products is an advisable risk mitigation strategy for a farm therefore depends on the availability of resources to manage those products, the presence of a market for each of them, and the ability to insure a diverse set of crops.

Ecosystem Services and Carbon Credits

Risk & reward sharing mechanisms: *Revenue stability, Soil health, Financial liquidity*

Ecosystem services and carbon credit markets offer a way to internalize previously externalized benefits associated with farming practices that either sequester carbon and/or measurably support certain environmental characteristics. Buyers pay farms who have sequestered carbon or provided an ecosystem service (such as improved water quality, decreased erosion, or increased wildlife habitat), giving the buyer official ownership over the positive action. For carbon credits, this can enable companies, governments, or

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[35] Indigo Ag, 2021
[36] Mercaris, 2021
[37] OECD, 2009

individuals to offset their emissions. One prevalent program akin to ecosystem services is the USDA's Conservation Reserve Program (CRP), in which the USDA pays farmland owners to remove environmentally sensitive land from agricultural production.[38] Carbon and ecosystem credits may be either practice-driven, such as planting cover crops, or result-driven, such as a measured increase in soil carbon.

Despite the promise of ecosystem services and carbon markets, there are some issues. First, only a fraction of the value that farms create will be able to be clearly labeled and measured, and thereby enter a marketplace. Relative to ecosystem services, carbon has an advantage in that it is singular, measurable, and already has some established markets. Second, markets that are practice-dependent and rigid may hinder or exclude complex farms' operations that are integral to holistic environmental stewardship. Lastly, these new markets may create perverse incentives or reward farms in unfair or backwards ways. For example, markets that measure soil carbon changes may reward farms that have already depleted their soil and now can be paid to replenish it, while punishing farms that have already been building soil for many years and may not be able to increase their already high soil carbon content as much or as quickly. Moreover, the responsibilities and risk of engaging in these novel financing mechanisms fall on the farmers directly.

[38] USDA Farm Service Agency, n.d.

Risk & Reward Sharing Methods in Action

Pipeline Foods

Methods included in example: *Custom contracts (secondary method: Credit access)*

Pipeline Foods aims to connect farmers more directly with the large companies who incorporate their products into consumer goods. They streamline the organic supply chain by contracting directly with farmers and providing transportation and processing services for organic commodities, which they sell to food and feed manufacturers.

Pipeline helps address organic farmers' credit challenges by establishing "guaranteed offtake" agreements with farmers. In these arrangements, Pipeline Foods agrees to purchase the production from a certain number of acres at a specific time in the future. This agreement lasts between two and ten years and does not include a price. The price is set at the time of sale, rather than in the contract. Even though the offtake agreement does not include a price, these agreements are often sufficient to reassure lenders of a farmer's creditworthiness. In this way, the offtake agreements facilitate credit access for organic farmers. Expanding and innovating around this type of risk sharing via long-term contract mechanisms may help improve credit access across a wider range of organic farms.

Iroquois Valley

Methods included in example: *Credit access*

Iroquois Valley Farmland Real Estate Investment Trust is a farmland finance company focused on increasing access to capital for certified organic farms, with the ultimate goal of expanding the number of acres of certified organic agricultural land in the United States. Iroquois Valley offers long-term leases and mortgages to organic farmers with previous farming experience. In most cases, if a farmer successfully leases land for several years, they will be offered the opportunity to purchase it.

While Iroquois Valley has benefitted from a surge in interest in ESG (Environment, Social, and Corporate Governance) investing and demand to invest in the company's product is strong, returns have fallen substantially short of market averages in recent years. Improving returns depends on appreciating farmland, and, importantly, farmers themselves turning a profit. Farmers are more likely to be successful if they can employ effective risk sharing mechanisms. Put another way, improved risk sharing for organic farmers supports their financial success, which supports their investors' financial success, which attracts further investment, which catalyzes expansion of organic farmland. In this way, improving risk sharing for organic farmers can create a positive feedback loop and help expand organically managed farmland.

With approximately 50 farms currently receiving credit, Iroquois Valley is a small player in the world of organic agriculture. However, demand for its services is strong among both farmers and investors. Expanding alternative impact-oriented finance models like that of Iroquois Valley may be a key step in providing organic farmers access to the credit they need to become established and grow. While improving returns may be part of what is needed to enable this expansion, even if returns remain modest, investors may become increasingly interested in alternative agricultural finance models like that of Iroquois Valley as impact-oriented investment grows and investors search for novel methods of portfolio diversification.

Vilicus Farms

Methods included in example: *Custom contracts, Product diversification*

Vilicus Farms is piloting custom contracts with its buyers to address issues such as seasonal cash flow strains, long-term planning needs, financial instability, and business and marketing administration costs. One particularly novel contract with HB Specialty Foods addresses each of these issues via multiple features.

To reduce Vilicus' seasonal cash flow burden, HB Specialty Foods pays for seed and inoculant up-front. These costs are netted out of the final price of the harvested crop. To address long-term planning, the contract is on a 3-year basis (rather than the typical single year) and includes multiple crops in the growing rotation. This allows Vilicus to better plan their multi-year growing rotation, and ensure that their diversified crops have a market at harvest. A long-term contract also creates more stable relationships and reduces administrative costs because each time a contract is renegotiated it takes time and adds uncertainty. Another novel clause enables and compensates for administrative burden: Since HB Specialty Foods will be advertising using Vilicus' pictures and content, Vilicus must be compensated if it provides above normal labor to help with marketing.

The contract has three clauses that address financial instability in the face of climate and yield instability. Two of them are relatively common. The first is an "Act of God" clause, meaning Vilicus is not responsible if an unpredictable and unpreventable act of nature, such as a flood, ruins the crop. The second clause stipulates an acreage rather than a bushel basis, meaning that the contracted sale is based on all the output from a given number of acres, rather than a predetermined number of bushels. The third clause is as uncommon as it is significant: the contracted price is yield-dependent. If the yield is particularly good (above a specific threshold), then HB Specialty Foods pays a lower price per bushel, while if the yield is particularly bad (below a specific threshold), they pay a higher price. This mechanism stabilizes aggregate revenues for Vilicus and costs for HB Specialty Foods without insurance or any third parties.

General Mills and Annie's

Methods included in example: *Sustainability marketing and identity preservation*

Consumer facing brands are confronting increasing cultural pressure and mounting consumer expectations around environmental sustainability. Even the largest food companies are eager to demonstrate a commitment to sustainability and highlight sustainability efforts in their marketing. Major manufacturers of processed food represent a huge potential market for organic commodities.

General Mills' experience sourcing organic grain for its Annie's Macaroni and Cheese illustrates both large food manufacturers' potential to support organic farm viability and the challenges associated with large food companies becoming more involved in markets for organic commodities. After launching and ultimately ending an attempt to source and identity preserve organic grain from smaller and mid-size organic farms, General Mills sought a larger, more concentrated domestic source of organic grain that matched its own scale. Unable to find such a farm, General Mills committed to a deal in which it would support transitioning a 34,000-acre conventional South Dakota grain farm to organic in exchange for the right to purchase the organic grain it produced for its Annie's Macaroni and Cheese.

This example illustrates both the strong desire large food companies have to source domestic organic grain and the apparent difficulty they face in tailoring their systems to accommodate direct sourcing and identity preservation agreements with smaller farms. Many food companies expect to source organic products in exactly the same manner as their conventional ingredients. This approach is problematic because the

structure of the organic grain market is different from the conventional grain market and organic farms differ from conventional farms in important ways.

Paradoxically, many large companies do not directly do business with existing organic commodity farms because these farms are not large enough or cannot guarantee delivery of supply of product within a certain specification. Yet, by not adapting to the unique circumstances of these organic farms in order to do business with them, large food companies are missing a valuable opportunity to invest in the organic sector in a way that would ultimately grow domestic supply of organic commodities and enable the sector to eventually better meet large food manufacturers' needs.

Meadowlark Organics

Methods included in example: *On-farm value addition, Direct-to-consumer marketing*

Meadowlark Organics is an organic farm in southern Wisconsin that focuses on selling value-added staple grain and legume products directly to consumers and local small businesses. Having constructed their own grain mill, they primarily focus on selling wheat flour, but also grow and sell other food-grade grains and legumes that are part of a complex crop rotation. Meadowlark's flour is marketed to local small businesses such as bakeries and craft breweries and distilleries, as well as directly to consumers throughout the country via their online store.

While investing in the processing and marketing infrastructure required to produce and distribute value-added products involves added risk, moving processing and sales within Meadowlark's control reduces market risk by allowing them more control over the method and timing of marketing their product. It also allows Meadowlark to retain all of the added value within their own business. Additionally, by selling the product outside the industrialized food system, Meadowlark is able to use their products' natural variation as an asset, rather than experiencing it as a liability in large contracts with narrow specifications. Serious bakers and cooks view the flours' natural variation as a sign of quality and character, further enhancing the products' value.

Regionalwert AG

Methods included in example: *Cooperatives, Enhancing credit access*

The Regionalwert AG, which translates to "regional value" in English, is a citizen shareholder corporation based in Germany. It offers regional shares and participation rights to citizens and invests this capital in land, buildings and processing facilities along a regional organic value chain.[39] The organization connects producers and consumers, and creates a regional solidarity economy that supports farmers and allows shareholders to shape the direction of rural development and know where their food comes from. It also finances farm succession outside the family by enabling farmers to find successors and providing farmers that plan to start or expand their own operations with access to land. As discussed in the credit access section of this report, access to farmland can be a significant barrier for farmers. While leasing farmland can provide farmers with the necessary acreage to operate, this model can disincentivize long-term conservation

[39] Hiß, 2014

practices because the investment in these practices might not be returned within the time frame of a lease or because the land owner is opposed to the proposed practices.

Investments made through the Regionalwert AG are linked to environmental protection and social standards based on the organization's statutes. In addition to economic returns, social and ecological returns on investments are assessed and reported annually. Citizens therefore share some of the risks that farmers take on and simultaneously increase the socio-ecological value of the region by supporting local food production, soil fertility, the preservation of biodiversity, and thriving farm communities. The Regionalwert AG consists of a regional network of enterprises along the value-added chain, thereby fostering collaborations between different enterprises. Having started with one network in southern Germany, there are now a total of seven individual corporations that have raised over 10 million euros from approximately 3,000 shareholders throughout Germany. By identifying regional communities as investors, regional food sovereignty and farm viability can be enhanced on the basis of a social contract between producers and consumers.[40]

This approach presents a successful example of how to directly engage citizens in risk and reward sharing, because they take on some capital risk while the services provided by the farm are shared with society. However, the focus on regional added value and close links to citizen investors makes its application more feasible in areas with a high density of smaller farms.

Demeter Producer Groups in Germany

Methods included in example: *Cooperative, On-farm value addition*

Producer groups of biodynamic farmers serve as a link between individual farmers and processors. In Germany, they typically consist of 25 to 40 Demeter-certified farms.[41] In addition to providing a platform for knowledge exchange and solidarity, they give farmers advantages in negotiations about prices and contracts. From a processor view, they are beneficial because processors don't have to communicate with dozens of individual farmers but rather have contracts with a smaller number of producer communities. The legal form of these groups is predominantly companies with limited liability which insures them against cases of, for example, contaminated products from one farmer that contaminate the entire batch. Demeter producer groups organize regular meetings to talk about cost reviews, challenges, quality requirements, pricing and agronomic theories. These meetings usually include farmers, mills and bakeries and often entail on-farm visits. These visits allow farmers to show processors the specific conditions on the farms each year and raise awareness about farmers' concerns. Many producer groups also enter long-term contracts with stable pricing policies, and many have decades-long relationships with the processors that buy their products.

While producer groups also exist among farmers that are not biodynamic, multi-year contracts and close cooperation is much easier for Demeter-certified producers compared to conventional ones because consumers are willing to pay a consistent price premium for certified products and because there is only limited competition. However, entering a producer group that emphasizes close cooperation and solidarity, which can be particularly tested in times of crises, requires the willingness to transition into a different value system with actors that have distinct philosophical goals that often go beyond purely financial interests.

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[40] Regionalwert AG, n.d.

[41] Demeter, n.d.

The Demeter association plays an important role in facilitating the relationship between producers and actors along the supply chain. In addition to agronomic consultations, the federal Demeter association in Germany groups requests from processors and buyers and forwards them to regional Demeter advising centers. These regional centers then contact producer groups and individual producers with this information, allowing farmers to plan their seeding and sales accordingly.

Strong growth in consumer demand for Demeter products, while desirable, has influenced production to become more market-based. Farms are increasingly selling to the highest bidder, undermining long-term partnerships and leading to the dissolution of mutual agreements and associative cooperation.

Policy and Economic Changes to Support Risk & Reward Sharing and Organic Farm Viability

Policy Changes to Enhance Farm Viability

While policy is not the focus of this report, it is important to note that many of the challenges mid-size organic commodity farms face could be substantially reduced through changes in federal agricultural and environmental policy. In fact, major shifts in federal policy would likely address the challenges more quickly and perhaps more comprehensively than the risk sharing solutions proposed above. While such solutions hold promise, fundamental, substantial changes to crop insurance, antitrust or agricultural conservation policies are difficult to predict in the long term and will take time.

There already exists an abundance of proposals for changes to federal policy that would provide helpful tools to organic and conservation-minded farmers. There is little need to reinvent that work. However, because of the immense power of federal policy in shaping the current system in which many organic farmers struggle, and due to the potential impact of changing these policies, some of the most impactful potential changes are discussed briefly below. In many cases, these changes could interact synergistically with the methods we propose above, reinforcing their benefits and doubly enhancing farm viability.

Crop Insurance Reforms

The current federal crop insurance system reduces production and market risk for farmers that participate in it. At the same time, the significant subsidy of premiums reduces incentives for conventional farmers to implement innovative management practices that reduce production risk.

Additionally, the current crop insurance system, which is mostly structured around policies that insure a single crop, can pose logistical and administrative challenges for organic farms, which tend to be more diversified than conventional operations. While the USDA has developed alternative forms of crop insurance designed to better suit diversified, smaller organic operations (most notably the Whole-Farm Revenue Protection insurance plan), these growers' participation in federal crop insurance remains limited compared to conventional growers.[42] Reformed insurance mechanisms should not only provide equal resources to organic farms, but they should also support and incentivize diversity within existing organic and conventional farms.

[42] Morris, Belasco, & Schahczenski, 2019

Much has been written about the implications of the current crop insurance system on agricultural conservation and the structure of the U.S. food system. That is not the focus of our analysis, so we will not explore these issues and alternative proposals in detail. However, it is important to acknowledge that with significant reforms, federally subsidized crop insurance has potential to substantially enhance organic farm viability by meaningfully mitigating the risks organic farmers face.

Antitrust

In recent decades, the American agricultural sector has consolidated on both the buyer and supplier side. Many farmers are squeezed between large, powerful companies from two directions. Suppliers can charge a high price for seeds and inputs due to a lack of competition. In 2015, the four largest companies in the U.S. seed and input sector supplied 82% of the corn and 76% of the soy seed used by American farmers.[43] Meanwhile, farmers also confront a limited set of outlets to sell their product. These anti-competitive forces are most acute in conventional agriculture, and they have contributed to a steadily increasing average farm size in the United States. The rise of large-scale farming has in turn encouraged further commoditization and industrialization of the food system, making it more difficult for farms that do not fit this mold to survive.

Nonprofits, academics and policy experts are increasingly raising awareness about the ways that consolidation in the agricultural sector is harming farmers, and there is a growing movement to address this challenge. Multiple bills have been introduced in recent sessions of Congress designed to slow or halt mergers in agribusiness, but there has been no major federal regulatory or legislative response.

While antitrust issues are not the focus of our work, it is important to acknowledge and understand the market context in which famers currently operate. Increasing competition among both input suppliers and product buyers has the potential to improve farmers' position and power in the supply chain, which would also enhance overall farm viability.

Expanding Federal Agricultural Conservation Programs

The USDA administers multiple popular agricultural conservation programs utilized by organic and conventional farmers alike. However, enrollment in both programs is limited, and demand routinely exceeds program capacity. Increasing funding for federal agricultural conservation programs to make them available to all eligible operations would reduce both production and market risk for participating farms.

Many of the practices promoted in the USDA's largest conservation programs, the Environmental Quality Incentives Program (EQIP) and the Conservation Stewardship Program (CSP) promote soil health. Enhanced soil health improves resilience to weather extremes, resulting in more stable yields over time and reduced production risk. Programs like these also address market risk by providing a source of income for the farmer regardless of yield. Because these programs are based on the implementation of specific practices rather than the ecological outcome of these practices, farmers can count on them as a reliable source of income. Currently the magnitude of this income is relatively modest, yet demand for funding from these programs is high and continues to outstrip supply. If funding for federal agricultural conservation programs were increased to match demand, it could substantially enhance farm viability, particularly for organic operations.

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[43] Maisashvili, Bryant & Richardson, 2016

True Cost Accounting

As the discourse above shows, a holistic approach to farm viability includes ecological and social values in addition to the financial success of a farm. Farmers are currently neither compensated sufficiently for the additional benefits and services they create for society, nor penalized for the damage they cause to the environment. While the majority of methods and examples introduced in this report focus on sharing risks and rewards related to the primary agricultural output farms are producing, it is important to note that farmers accept additional effort and costs to create natural and socioeconomic assets. However, these values are currently assumed to be zero in financial assessments.

True cost accounting aims to evaluate the ecological, social, knowledge-based and regional-economic values and risks that farmers assume by defining, gathering, and assigning them a monetary value and including them in financial accounting sheets.

Efforts to measure the additional value created by farms exist on multiple levels. The Sustainable Food Trust is developing a common framework for categorizing, quantifying and monetizing food systems externalities.[44] Quarta Vista has created a methodology to evaluate benefits and services created by farms not in absolute terms but through the expenditures that farms spent to create the additional non-financial capital. [45,46] By analyzing over 100 performance metrics on, for example, agrobiodiversity, economic sovereignty or specialist knowledge, they enable farms to include non-monetary benefits on balance sheets in financial accounting. Setting forth the monetary value in this way does not only acknowledge the farmers' work and creates information for on-farm operational development, it also establishes the baseline for potential financial compensation. However, a willingness to pay through price premiums or the expansion of public payments to include true cost assessments would be needed to compensate farmers for the services enjoyed by society.

[44] Sustainable Food Trust, 2016
[45] QuartaVista, 2021
[46] Bildmayer, n.d.

Conclusion

Risk and Viability

While improving risk and reward sharing across the organic agricultural supply chain is the explicit focus of this work, the overarching goal of the risk and reward sharing methods described in this report is to improve organic and sustainable farm viability.

A farm cannot easily remain viable if it must consistently accept the bulk of the risk that exists in a supply chain. For example, by writing a contract that states that the buyer will only accept a product if it fits a certain narrow specification, the buyer takes on very little risk, while the farmer who grows the product takes on the entirety of the risk associated with growing that product. If the product does not comply with specifications, then the farmer loses potential income from that sale that does not occur, while the buyer can simply purchase product from another source. This unexpected loss of income after many resources have already been invested in the crop clearly undermines farm viability. By redistributing risk away from the farmer and through the supply chain, we improve farm viability.

Most of the risk-sharing methods described in this paper are already being deployed in some form within the agricultural system. However, by deploying them more widely or deploying them in novel combinations, particularly as the number of organic farms grows, risk may be distributed back up the supply chain more effectively than it is currently. The collection of methods we have identified is by no means exhaustive. Promising areas for further work on risk sharing and viability are outlined later in this section.

Key Themes

The highlighted risk and reward approaches that we outline in this paper fall into a few thematic categories. An overarching goal of nearly all of the approaches is to enable farms to gain leverage and power relative to other members of the supply chain. Within that goal, and related to it are a few other themes.

One of the key themes of our paper is to demonstrate options for more directly connecting producers and consumers. These direct connections have three major benefits. First, this enables consumer demand for organic food to translate more directly to increased domestic organic farming. Second, this directs a greater portion of the consumer dollar to the farm. Lastly, this helps farms shield themselves from market volatility (and yield volatility in the case of community-supported agricultural systems). While identity preservation and direct-to-consumer marketing are two ways to help decommodify crops, and encourage a more direct consumer-farmer connection, our concentrated and industrialized infrastructure isn't built to accommodate these efficiently. Regional, distributed infrastructure, and less industrialized processing will be key to enable these marketing methods for sustainably grown grains, pulses and oilseeds.

Similarly, relationships between producers and actors along the supply chain have been deteriorating with an increasingly commodified agricultural system. Maintaining long-standing partnerships creates trust and enables farmers to share equipment and ask each other for help in times of crisis. Processors are also more willing to make concessions such as advance payments when they know farmers personally and have successfully worked with them in the past. The scale at which organic grain, pulse, and oilseed agriculture operates often hinders personal relationships. Facilitating community building through approaches such as producer groups and cooperatives would allow for more informal assistance in mutually absorbing risk. To shift from purely private objectives to community objectives, actors along the supply chain have to recognize that their interests are mutually supporting.

Another key theme is how supply chains can empower complex farm systems that use nature as a partner, not an enemy. Looser specifications, cooperatives, and custom contracts are three such methods. The nascent

field of payments for carbon credits and ecosystem services, on the other hand, may support complexity, or may fall prey to the ailments that have befallen the crop insurance industry. Namely, if transaction costs are high, and models are rigid, it is very possible that the markets will mainly support large-scale monocultures, leaving out and disincentivizing complex and diversified farms—the very farms that are most ecologically responsible.

Finally, farmers' time and resources are limited. In the current system, the burden of proposing and implementing these solutions usually falls on farmers. Given farmers' financial and time limitations, many farmers are unlikely to have the capacity to implement these solutions without collaboration and assistance from others in the supply chain. Notably, the decision to accept more risk ultimately rests with all members of the supply chain. If risk is to become more equitably distributed along the supply chain within a reasonable time frame, processors, food manufacturers and even consumers must step up and contribute to these changes.

Risk & Reward Sharing as a Catalyst for Growth in Sustainable Agriculture

While uniqueness can be a competitive advantage in some sectors, in commodity-scale agriculture it is more often a liability. Commodity agriculture functions on the explicit and implicit premise that all farmers are selling identical products produced in an identical manner. The expenses of adopting sustainability practices are usually immediately borne by farms, while the benefits are typically delayed, externalized or insufficiently compensated.

The organic certification system recognizes this incentive problem and attempts to provide a premium to compensate farmers for their efforts. Consumer demand for organic and sustainably produced food is growing in the U.S., and while not at the same pace, the number of such farms is growing too. Yet risks and rewards are still fundamentally shared inequitably in the commodity-scale supply chain, and this undermines farm viability. The current supply chain is a limiting factor, but it could become a supportive force by adapting to and rewarding sustainable farming practices. Deploying tools that share risks and rewards and support farm viability is one key way that supply chains can meaningfully support organic farming and benefit from this growing consumer demand.

As the number of farms employing sustainable practices increases, synergies are likely to emerge among these producers, both tangible and intangible. Additionally, as organic farm networks grow, so too will the surrounding systems that interact with it, thereby lessening the infrastructure, cultural, and economic barriers to adoption. In short, successfully deploying tools to share risk and support farm viability can create a positive feedback loop by making the system work better for other sustainability-oriented farms, further facilitating their proliferation and success.

Future Research

We hope that this paper provides a menu of options for farms and supply chain members to deploy to reduce risks, enhance rewards, and improve overall farm viability. While easier said than done, we believe that for most parties, certain elements of this paper are highly actionable. For farmers, this paper outlines ideas such as joining or creating cooperatives, adding on-farm processing, and seeking out buyers who have more flexible specifications. For supply chain members, this paper outlines ideas such as loosening specifications, helping farms connect with ecosystem service and carbon markets, and leveraging comparative advantages to create contracts that are beneficial for farms and either help or only marginally cost the buyer.

In addition to presenting practical ideas to be implemented immediately, this paper also aims to serve as a starting point for future research. Although this paper highlights opportunities to support both organic farms and their supply chain partners, it emphasizes the farm perspective. We recommend future research examine what organic supply chain members need in order to work with farms in a way that supports their viability, and what opportunities exist to mitigate key supply chain risks. We also recommend future research examine risk and resource sharing in natural systems and their applicability to the agricultural supply chain. Such themes might include mutualism and interdependence, along with circularity across farms through resource sharing, and within the farm through reducing off-farm inputs. Lastly, we recommend that future research identify tools used in other industries that increase the power and security of small producers high up in the supply chain, and the applicability of these tools to the agricultural supply chain.

As consumer demand for sustainable and organic agriculture grows, we caution that policies and private enterprises must be mindful to avoid duplicating the current conventional agriculture system through falling prey to the same traps. Organic markets and the growing soft (cultural, intellectual, and political) and physical infrastructure serving organic agriculture should intentionally support small and medium-scale farms, diverse growing operations, and ecologically and socially beneficial farms. For example, as ecosystem service and carbon credit markets grow, they must be designed to welcome small and medium sized, organic, and diversified farms. Such access will depend on keeping the costs of entry low, and carbon measurements and models that are flexible enough to accommodate many crops and growing systems.

As tech and big data rapidly advance, the farm and supply chain interaction will change too, affecting many of the methods of risk and reward sharing we have outlined. To name a few of the more certain examples: improved data storage and communication will likely improve traceability, which will in turn ease identity preservation; cheaper data collection, storage, and communication will expand carbon and ecosystem service markets; and expanded online purchasing will enable more geographically distant direct-to-consumer relationships. Impact investors, members of the supply chain, and farmers will need to discern and lean into new opportunities to enhance farm viability.

Risk management is directly tied to the viability of diverse and sustainable farms. While cultural momentum continues to build around supporting organic and sustainable agriculture, this goodwill and interest must be translated into concrete risk sharing improvements throughout the supply chain if organic agriculture is to expand and continue to provide ecological and economic benefit to society. In this way, members across the supply chain, from consumers to food manufacturers to commodity buyers, have the potential to facilitate the success and expansion of domestic organic agriculture by adopting innovative risk-sharing tools. We hope that the ideas in this report provide inspiration and tools for these supply chain actors to begin to make these changes.

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REFERENCES

Baldwin, T. (2018). *In Major Victory For American Consumers And Organic Farmers, Baldwin's Legislation To Combat Fraudulent Organic Imports Heads To The President's Desk*. Tammy Baldwin Press Release. Retrieved from https://www.baldwin.senate.gov/press-releases/major-victory-for-organic-farmers-in-farm-bill

Basche, A. D., and Edelson, O.F. (2017). Improving Water Resilience with More Perennially Based Agriculture. *Agroecology and Sustainable Food Systems 41*(7). 799–824. https://doi.org/10.1080/21683565.2017.1330795.

Berentsen, P. B. M., & van Asseldonk, M. A. P. M. (2016). An empirical analysis of risk in conventional and organic arable farming in The Netherlands. *European Journal of Agronomy*, *79*, 100–106. https://doi.org/10.1016/j.eja.2016.06.002

Bildmayer, R. (n.d.). *Navigation system for value orientated companies: QuartaVista*. Retrieved from https://www.quartavista.de/en-gb

Bloom, J. (2010). Place, Price, and Associative Economic Practice. *RSF Social Finance.* Retrieved from https://rsfsocialfinance.org/2010/02/16/place-price-associative/

Bowles, T. M., Mooshammer, M., Socolar, Y., Calderón, F., Cavigelli, M.A., Culman, S.W., Deen, W. et al. (2020). Long-Term Evidence Shows That Crop-Rotation Diversification Increases Agricultural Resilience to Adverse Growing Conditions in North America. *One Earth 2*(3). 284–93. https://doi.org/10.1016/j.oneear.2020.02.007.

Brown, J.P., Goetz, S.J., and Fleming, D.A. (2012). *Multifunctional Agriculture and Farm Viability in the United States.* Agricultural & Applied Economics Association's 2012 AAEA Annual Meeting, Seattle, Washington, August 12-14, 2012.

Chhabra, E. (2017). Biodynamic farming is on the rise – but how effective is this alternative agricultural practice? *The Guardian.* Retrieved from https://www.theguardian.com/sustainable-business/2017/mar/05/biodynamic-farming-agriculture-organic-food-production-environment

Christensen, Li., & Limbach, L. (2019). Finding Common Ground: Defining Agricultural Viability and Streamlining Multi-organization Data Collection. Journal of Agriculture, Food Systems, and Community Development, 1–16. https://doi.org/10.5304/jafscd.2019.08C.005

Demeter. (n.d.). *Biodynamisches: Wofür wir stehen.* Retrieved from https://www.demeter.de/biodynamisches

Escalante, C., et al. (2014). *Organic Farms' Credit Access and Farm Lenders' Assessment of Organic Farms' Credit Risks.* Final Report for Sustainable Agriculture Research and Education Grant LS11-240. Retrieved from https://projects.sare.org/project-reports/ls11-240/

Federal Register. (2020). *National Organic Program; Strengthening Organic Enforcement: A Proposed Rule by the Agricultural Marketing Service*. Retrieved from https://www.federalregister.gov/documents/2020/08/05/2020-14581/national-organic-program-strengthening-organic-enforcement

Frawley, J.P. and Commins, P. (1996). *The Changing Structure of Irish Farming: Trends and Prospects*. Rural Economy Research Series No. 1. Dublin: Teagasc.

Graddy-Lovelace, G., & Diamond, A. (2017). From supply management to agricultural subsidies—and back again? The U.S. Farm Bill & agrarian (in)viability. Journal of Rural Studies, 50, 70–83. https://doi.org/10.1016/j.jrurstud.2016.12.007

Hanrahan, K., Hennessy, T., Kinsella, A., Moran, B., and Thorne, F. (2014). *Farm Viability - A Teagasc National Farm Survey Analysis.* National Rural Development Conference 17th September 2014, Teagasc, Ashtown.

Hiß, C. (2014). *Regionalwert AG – Strengthening the regional economy with citizen shareholder support.* Freiburg, Germany: Agronauten.

Hooks, T., Macken-Walsh, Á., McCarthy, O., & Power, C. (2017). Farm-level viability, sustainability and resilience: A focus on cooperative action and values-based supply chains. Studies in Agricultural Economics, 119(3), 123–129. https://doi.org/10.7896/j.1718

Indigo Ag. (2021). *A simple, more profitable way to sell grain*. Retrieved from https://www.indigoag.com/for-growers/indigo-marketplace

James, K., and Storey, R. (2017). *It's Time to Invest in Organic Grain Handling Infrastructure*. The Organic & Non-GMO Report. Retrieved from https://non-gmoreport.com/articles/time-invest-organic-grain-handling-infrastructure/

Karp, R. (2008). Toward an Associative Economy in the Sustainable Food and Farming Movement. *Biodynamics.* Retrieved from http://www.biodynamics.com/pdf/sp08bd/assoc_ec_karp.pdf

Maisashvili, A., Bryant, H., and Richardson, J. (2016). Seed Prices, Proposed Mergers and Acquisitions Among Biotech Firms. *Choices Magazine*.

Mercaris. (2021). *Mercaris Trading Platform.* Retrieved from https://mercaris.com/trading_platform

Milestad, R., & Darnhofer, I. (2003). Building Farm Resilience: The Prospects and Challenges of Organic Farming. *Journal of Sustainable Agriculture*, *22*(3), 81–97. https://doi.org/10.1300/J064v22n03_09

Morris, M., Belasco, E., and Schahczenski. (2019). *Is Organic Farming Risky? Improving Crop Insurance for Organic Farms*. National Center for Appropriate Technology. Retrieved from https://attra.ncat.org/product/is-organic-farming-risky/

National Sustainable Agriculture Coalition. (n.d.). *Sustainable and Organic Research Investments Drive Innovation*. Retrieved from https://sustainableagriculture.net/publications/grassrootsguide/sustainable-organic-research/

O'Donoghue, C., Devisme, S., Ryan, M., Conneely, R., Gillespie, P., & Vrolijk, H. (2016). Farm economic sustainability in the European Union: A pilot study. Studies in Agricultural Economics, 118(3), 163–171. https://doi.org/10.7896/j.1631

OECD. (2009). Managing Risk in Agriculture: A Holistic Approach. Retrieved from https://doi.org/10.1787/9789264075313-en

Organic Trade Association. (2019). *US organic sales break through $50 billion mark in 2018.* Press Release OTA. Retrieved from https://ota.com/news/press-releases/20699.

QuartaVista. (2021). *Navigation system for value orientated companies: QuartaVista.* Retrieved from https://www.quartavista.de/en-gb/project

Reaves, E., Healy, C., and Beach, J. (2019). *US Organic Grain - How to Keep It Growing*. Organic Trade Association.

Regionalwert AG. (n.d.). *Die Regionalwert AG.* Retrieved from https://www.regionalwert-ag.de/detail/unsere-ziele/

Scott, J. (2005). Farm and Community Viability: Report on Interview Results. *GPI Atlantic: Measuring Sustainable Development.*

Spicka, J., Hlavsa, T., Soukupova, K., & Stolbova, M. (2019). Approaches to estimation the farm-level economic viability and sustainability in agriculture: A literature review. Agricultural Economics (Zemědělská Ekonomika), 65(No. 6), 289–297. https://doi.org/10.17221/269/2018-AGRICECON

Sustainable Food Trust. (2016). The true cost of American food. Conference Proceedings: The True Cost of American Food. Retrieved from http://sustainablefoodtrust.org/wp-content/uploads/2013/04/TCAF-report.pdf

USDA Economic Research Service. (2019a). *Organic Production: Documentation*. Retrieved from https://www.ers.usda.gov/data-products/organic-production/documentation/

USDA Economic Research Service. (2019b). *Farming and Farm Income.* Retrieved from https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/farming-and-farm-income/

USDA Economic Research Service. (2020). *Farm Household Income and Characteristics*. Retrieved from https://www.ers.usda.gov/data-products/farm-household-income-and-characteristics/

USDA Farm Service Agency. (2020). FSA Crop Acreage Data Reported to FSA. Retrieved from https://www.fsa.usda.gov/news-room/efoia/electronic-reading-room/frequently-requested-information/crop-acreage-data/index

USDA Farm Service Agency. (n.d.). Conservation Programs. Retrieved from https://www.fsa.usda.gov/programs-and-services/conservation-programs/

USDA National Agricultural Statistics Service. (2019a). *Organic Farming: Results from the 2019 Organic Survey*. Retrieved from https://www.nass.usda.gov/Publications/Highlights/2020/census-organics.pdf

USDA National Agricultural Statistics Service. (2019b). *Quick Stats Database*. Retrieved from https://www.nass.usda.gov/Quick_Stats/index.php.

Vrolijk, H.C.J., de Bont, C.J.A.M., Blokland, P.W., and Soboh, R.A.M.E. (2010). *Farm viability in the European Union: Assessment of the impact of changes in farm payments.* Wangeningen, NL: LEI.