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Navigating organic farming challenges with farmer-led entrepreneurial innovations in the U.S. Mid-South

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Abstract

Agricultural production is fraught with risks and uncertainties. However, unlike conventional agriculture, where producers have a variety of options to mitigate risks around diseases, pests, and poor-quality soils, organic farmers face limitations on the use of synthetic chemicals and fertilizers. These challenges have contributed to the low adoption of certified organic production particularly in the Lower Midwest and Mid-South of the U.S. as compared to other parts of the country, such as the Upper Midwest and Northeast.

Recently, there has been growing interest in entrepreneurship and innovations happening in the agricultural sector, but our literature review revealed that there is limited research on entrepre-

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neurship and innovations among certified organic farmers, particularly in the Mid-South region, including the states of Arkansas, Kentucky, Missouri, Oklahoma, and Tennessee. In this paper, we employed a hybrid thematic analysis, integrating both deductive and inductive approaches, to examine the entrepreneurial innovations used by certified organic farmers to address regional-specific challenges affecting their operations. We used Schumpeter's perspective on innovations to categorize farmer innovations. Our findings reveal that farmers have demonstrated remarkable proactivity and innovativeness in tackling regional production challenges. They have done so by diversifying their products and services, improving production processes, creating new marketing strategies, and reinventing their farming. Through these approaches, farmers have created fresh opportunities for their enterprises. However, despite significant individual farmer innovations, there are system challenges for these producers. Our findings suggest an entrepreneurial ecosystems approach might be necessary to support producers' entrepreneurial innovations, which could involve developing supportive policies and community support networks in these regions. Additional research is needed to gain a deeper understanding of the reinventions and transformations occurring among organic producers, including their experiences pushing them away from certified organic production.

Keywords
entrepreneurship in agriculture, entrepreneurial organic farming ecosystems, farmer innovations, innovation in agriculture, organic farming innovation

Introduction

Organic farming has gained broad acceptance as a sustainable food production model (Gamage et al., 2023; Meemken & Qaim, 2018) and plays a critical role in maintaining soil health, ecological diversity, and environmental quality (Merrigan et al., 2022; Šrůtek & Urban, 2008). Many organic farming practices contribute to its efficacy. For example, employing cultural techniques such as mulching and crop rotation help control pests and weeds while minimizing adverse effects on the environment, and providing beneficial soil organisms and habitat for pollinators (Magkos et al., 2006; Wiggins et al., 2020). Advocates for organic farming believe that producing and consuming food without the use of synthetic fertilizers and chemicals can lead to healthier individuals, society, and the environment (Kroma, 2006; Uddin & Bari, 2019), thus contributing to sustainable livelihoods.

Due to their perceived nutritional and health benefits, the demand for organic products has been growing exponentially (Peng, 2019; U.S. Department of Agriculture Economic Research Service [USDA ERS], 2024). For instance, the expenditure on organic products increased almost ninefold from US$7.8 billion in 2000 (Dimitri & Greene, 2002) to over US$67 billion in 2022 (USDA, 2023). This increase in demand has played a crucial role in shaping policies to promote organic farming, including the development of regulations specifying what constitutes organically produced foods (Magkos et al., 2006; Šrůtek & Urban, 2008). The presence of an organic certification label renders credibility to the organic products and fosters trust between producers and consumers (Simons, 2023; Uddin & Bari, 2019).

The U.S. passed the Organic Food Production Act in 1992, establishing the National Organic Standards Board and a framework for USDA-certified organic production, with certification rules finalized in 2002 (Greene & Kremen, 2003; Simons, 2023). Incentives were put in place to encourage the adoption of Certified Organic Production (COP). However, despite the codification of COP and the provision of incentives, the adoption rate of COP is lower in the Lower Midwest and Mid-South of the U.S. as compared to other parts of the country, such as the Upper Midwest or Northeast (Bagi, 2013; Greene et al., 2017; Marasteanu & Jaenicke, 2018).

Several factors impede the transition to organic farming. These include the cost associated with transitioning and obtaining certification, market uncertainties, and production risks associated with organic farming, including weeds, pests, diseases, inadequate supply of organic inputs, low soil fertility, and inadequate storage facilities (Kirchmann et al., 2016; Srivastava et al., 2022). Other risk factors affecting organic production include extreme

weather and climate variability, particularly because climate change appears to influence the emergence of certain pest, weed, and disease pressures (Azadi et al., 2011; Wiggins et al., 2020). Unlike conventional agriculture, where producers might have a variety of options to deal with risks such as pests and weeds (Mukembo et al., 2023), organic farmers must be proactive and entrepreneurial in their operations by employing more preemptive strategies (Canwat & Onakuse, 2022). As a result, there has been an increased interest among stakeholders in understanding the innovative strategies that farmers use to adapt to the challenges encountered, especially in organic production (Kahan, 2013; Terziev, 2016). However, based on our review of the literature on entrepreneurship and innovation in organic production, we found limited research in this area especially in the U.S. Most of the studies we encountered were conducted outside of the U.S., particularly in Europe and Asia (Magnaye, 2017; Terziev, 2016).

In this paper, we explore entrepreneurial innovations employed by certified organic producers to address regional-specific challenges in the Mid-South, including states such as Arkansas, Kentucky, Missouri, Oklahoma, and Tennessee, which are considered organic "cold spots." Cold spots are clusters of counties in the U.S. that positively correlate on low values of organic farming, as opposed to hot spots, those positively correlated with high values, based on analysis of the USDA national database of organic operations (Marasteanu & Jaenicke, 2016). While they also found some overlap between hot and cold spots of conventional agriculture and organic farming, each of these spots was mostly distinct. Our own research has identified several issues faced by producers in this region, such as poorer quality soils, a hotter and more humid growing season, and less accessible markets. Building on these identified challenges, we analyze and identify farmer-led entrepreneurial innovations being used to address these challenges, including product innovation, service innovation, process innovation, marketing and overall re-invention (Canwat & Onakuse, 2022; Kahn, 2018; Rogers, 2003; Schumpeter, 1934/2008). These innovations are contributing to the continued adoption of organic farming in this "cold spot."

Theoretical and Conceptual Framework

This study incorporates Schumpeter's theory of innovation (Drucker, 1995; Schumpeter, 1934/2008). Though several definitions of an innovation exist (Carayannis et al., 2015; Drucker, 1995; Kahn, 2018; Kuratko et al., 2018), we adopted Everrett Rogers' definition of an innovation for this study. Rogers (2003) described "an innovation as an idea, practice, or project that is perceived as new by an individual or other unit of adoption" (p. 13). Although organic farming was essentially the de facto production method until the 20th century, it could be perceived as a novel practice today given that most agricultural production in North America has relied on synthetic pesticides and fertilizers for the last 70 years. According to Schumpeter, innovation is critical factor for the growth, survival, and profitability of businesses (Schumpeter,1934/2008). It is through innovation that agricultural producers and businesses can gain a competitive edge and achieve higher levels of productivity with limited resources. According to Schumpeter, innovations can happen in different ways, including introduction of new products and services, new processes of production, market expansion, new supply channels for raw materials as well as new organizational structure (Canwat & Onakuse, 2022; Schumpeter, 1934/2008). To this end, Kahn (2018) stated that innovation "should be thought of as both an outcome and a process" (p. 454).

For entrepreneurship and innovation to succeed, the environment—that is, the entrepreneurial ecosystem in which they take place—must be conducive and resilient to nurture these interventions (Bischoff & Volkmann, 2018; Roundy et al., 2017). An entrepreneurial ecosystem metaphorically refers to an interdependent network of agencies, individuals, institutions, and community resources that collectively work together to create and support an environment where entrepreneurs and entrepreneurship can flourish (Isenberg, 2010; Stam & Van de Ven, 2019). As a result, we integrated a conceptual framework encompassing the six domains of entrepreneurial ecosystem espoused by Isenberg (2010) to understand how the environment in which these certified organic producers thrive helps to bring their innovations to fruition. According to Isenberg, entrepreneurship is a team

sport and cannot thrive without adequate human capital, finance, markets, favorable policies, favorable culture, and support for entrepreneurs (Isenberg, 2010, 2014; Stephens et al., 2022). Having a vibrant entrepreneurial ecosystem can serve as a catalyst for innovation and entrepreneurship within a community and promotes resilience against external shocks (Roundy et al., 2017).

Methodology

We used a semi-structured protocol to interview farmers in the region we broadly call the Mid-South, including the southern half of Missouri, western Kentucky and Tennessee, northern Arkansas, and eastern Oklahoma. We asked three overreaching questions to farmers: (a) what inspired you to enter into certified organic production, (b) what challenges you have encountered as an organic producer, and (c) what strategies have you used to navigate these challenges. Probes included asking about specific soil, pest and weed pressures, and management strategies, as well as perceived opportunities for organic farming in the region.

We selected producers from the list of organic operations available in the USDA Organic Integrity Database[1] and used spatial mapping to locate organic operations and addresses in our targeted areas. All targeted farms were mailed an introductory letter, with a complimentary organic report, and were asked for an interview, which clearly mentioned a participation incentive of a gift certificate to a local farm store. We then followed up with producers using any phone numbers listed in the database. After this initial recruitment, we used snowball sampling to gain more interviews, asking the initial participants to recommend other organic farmers who might agree to participate. We also requested referrals from input suppliers, organic certifiers, and other agricultural professionals. Because we were interested in organic production as a whole, rather than a particular sector such as grains or dairy, we solicited interviews from all types of farm operations utilizing many different market channels.

Our recruitment approach yielded 40 interviews with a combined total of 48 participants (several interviews were conducted with two operators present). Data was collected from the summer of 2021 through the spring of 2023. Interviews, conducted in person or virtually, lasted 30 to 60 minutes. Interviews were recorded and transcribed. The study and methods were approved by the Institutional Review Board (IRB) at the researchers' university.

Description of Participants

Our sample included 19 organic operations from Missouri, 13 from Oklahoma, five from Arkansas, two from Tennessee, and one from Kentucky. Thirty-two of these interviews were conducted with single operators (including 23 men and nine women), while eight interviews were conducted with two operators present (including 10 men and six women).[2] Participants included 15 grain producers, 14 diversified vegetable and/or flower farmers, seven poultry producers, one livestock operator, and three agricultural suppliers/handlers. Of these, 17 producers were engaged in direct market channels, and 23 sold through organic commodity markets. While the region has more certified grain and egg producers than other types, many of these producers are reaching larger organic commodity markets. Data saturation was reached relatively quickly where the descriptions of operations, challenges, and opportunities varied little between interviews. By data saturation, we refer to a point during data collection where no new information emerges from the participants, and additional interviews do not yield any further insights. On the other hand, direct-market participants were less similar, which required more interviews. Participants were categorized into five age groups and had various certifications (see details in Table 1). The modal age group of participants was 30 to 40 years.

[1] https://organic.ams.usda.gov/integrity/Home

[2] Of the eight interviews conducted jointly, one was with father-son partners and another with male business partners; the other six were conducted with spouses who operated the farm jointly. In addition, seven of the farmers we interviewed also ran businesses as input suppliers, seed cleaners, grain or egg marketers, and/or feed millers.

Data Analysis

We employed a hybrid thematic analysis (Fereday & Muir-Cochrane, 2006), which combines both deductive and inductive thematic analysis (Braun & Clarke, 2012, 2018; Fereday & Muir-Cochrane, 2006, Proudfoot, 2022) to develop codes and identify patterns grouped into themes and subthemes. Unlike deductive thematic analysis, which starts with predefined codes or theories from literature reviews (Proudfoot, 2022) or answering a specific question (Maguire & Delahunt, 2017), inductive thematic analysis involves an objective approach where themes emerge from the data without preconceived notions or theories through open coding (Braun & Clarke, 2018, 2019; Maguire & Delahunt, 2017). Because deductive thematic analysis involves preconceived notions from the literature or the researchers' theoretical perspective, integrating it with inductive thematic analysis can help mitigate bias (Joffe, 2012) and improves rigor during data analysis (Proudfoot, 2022).

Further, because of the objective approach, thematic analysis can be descriptive, exploratory, and interpretive enabling the researchers to examine and analyze participants' shared experiences to derive meaning (Braun & Clarke, 2006, 2012; Nowell et al., 2017). The overarching goal of thematic analysis is to recognize and organize data into meaningful themes for interpretation (Maguire & Delahunt, 2017; Proudfoot, 2022). We utilized a six-step thematic analysis framework proposed by Braun and Clarke (2006, 2018) during data analysis. First, all the researchers immersed themselves into the data by reading the transcripts multiple times to familiarize themselves with the data set to get the bigger picture (Braun & Clarke, 2006). This was followed by preliminary team discussions to develop codes, comparison of codes for agreement, with modifications as needed. Once agreement was reached, each team member continued coding independently using Nvivo software (version 14). . Next, we deliberated and developed themes based on the codes. Following that, we proceeded to review, designate, and refine the themes based on the

Table 1. Summary of Participants' Operations and Characteristics

		States				
Profile Attribute	**Operation Categories**	**MO**	**OK**	**TN/KY**	**AR**	**Total**
Market Channel	Direct	1	9	2	5	17
	Organic commodities	18	4	1	0	23
Produce	Crop/grain	7	3	1	0	11
	Crop/grain/dairy	3	0	0	0	3
	Diversified livestock/poultry	5	1	0	1	7
	Livestock only	0	1	0	0	1
	Feed miller/seed cleaner	3	1	0	0	4
	Vegetables/flowers/herbs/micro-green	1	7	2	4	14
Certification Status	USDA certified organic	14	9	2	3	28
	Certified Naturally Grown	0	0	0	2	2
	Multiple certifications	0	2	0	0	2
	USDA certification surrendered	5	2	1	0	8
Interviewee(s)' Sex	Male	19	9	2	3	33
	Female	4	7	1	3	15
Age	20–30	0	2	0	1	3
	30–40	8	9	2	4	23
	40–50	3	0	0	0	3
	50–60	8	1	1	1	11
	60+	4	4	0	0	8

meanings derived from the codes, and we retained those we deemed significant. Finally, we developed the comprehensive report of the findings which we share in this paper (Braun & Clarke, 2008, 2012). Although Braun and Clarke's (2008) six-step framework is often depicted as a linear process, we embraced an iterative approach involving personal reflections (Fereday & Muir-Cochrane, 2006), allowing for a comprehensive, in-depth exploration and analysis of the data.

Reflexivity Statement

Qualitative research requires continuous interrogation of the ideas and experiences that the researchers bring to the study. Author Mukembo has a background in agricultural education, extension, and entrepreneurship. He worked as an extension business development specialist with a land-grant university in the U.S. His research interests are in entrepreneurship and innovations happening in the agricultural sector. Author Srivastava has a background in environmental planning and rural sociology, particularly around natural resource use with interests in sustainable development. She has worked in areas of urban and regional planning, natural resource management and rural development. Author Hendrickson has a long research and extension career focused on alternative food networks and sustainable agriculture. She has taught sustainable farming, organic production, and marketing courses at the undergraduate level. She grew up on a Midwestern commercial crop and livestock farm and maintains strong linkages with several organic and sustainable farming organizations. The unique backgrounds of the research team provided rich interpretations of the data, involving cross-checking and spirited discussions. We acknowledge that our backgrounds might have impacted our own analysis. However, the findings reported here have been rigorously debated and refined.

As part of a bigger study, part of our other ongoing research focused on challenges experienced by organic producers, and we identified seven themes related to these challenges. In this paper, we use these seven challenges as a foundation to explore farmer-innovations used to overcome barriers in organic farming. In reporting our findings, we describe our themes and provide participant quotes to substantiate and reflect the participants' voices in the process (Lester, 1999) to increase the likelihood of our research resonating with the readers and the chances of transferability of the findings (Tracy, 2010).

Findings

Challenges Experienced by Participants

In Table 2, we present a summary of challenges both spurring innovations and constraining their operations (see Srivastava et al., 2022). We share seven themes emerging from the data, percentage of operations that mentioned factors associated with the theme, as well as some quotes that captured the theme.

Entrepreneurial and Farmer-Led Innovations Addressing the Challenges Encountered

Out of necessity and proactiveness, the producers we interviewed were driven to innovate and be entrepreneurial (Alsos et al., 2011; Bigliardi & Filippelli, 2022). They developed strategies to overcome challenges and remain competitive. Factors influencing these farmer-led innovations include market availability and accessibility, government policies and incentives, personal values, climate changes, technological advancements, population shifts, lack of resources, competition, disease, and social factors. We categorize and present these farmer-led entrepreneurial innovations based on Schumpeterian perspective: product, service, process, and market innovation (Canwat & Onakuse, 2022; Schumpeter,1934/2008), as well as Rogers' (2003) reinvention approach.

Figure 1 presents a summary of the percentage distribution of innovation categories identified among the participants. This is followed by a detailed description of the various types of innovations identified.

Theme #1: Product Innovation

A majority, seven of 10 (70%), of producers diversified their operations by developing new or improved products to overcome marketing and production challenges. This included adding value to existing products, as well as introducing new or modified farm machinery and tools to aid their

Table 2. Challenges Experienced by Participants

Theme description	% of Participants Attributed to the Theme	Select Participant quote(s) supporting the theme
Challenges spurring innovation		
Biophysical and climatic factors included weeds, pests, insects, poor soils, predators, and weather conditions. Often it was the interaction of weather with other factors that were difficult for farmers.	87.5%	*We get a shower every couple of weeks, and you start over. That's every time you get rain, you get a new crop of weeds coming on. Usually, a different species comes on, depending on the temperature and the time of year.* (M01) *Fertility, especially nitrogen for corn. I put most of my crops out in June. That way I can kill the first flushes of weed before planting. Also, it's good for my corn so it's later pollinating than the neighbors. But late harvesting can be a challenge.* (M0 18) *The squash bugs are so bad . . . they ate all of the gourds, then they went to our cucumbers, ate all of the cucumbers, then they went to all of our cantaloupe. And then they went to our watermelon, they just took everything. And you can't pick that many bugs off. You'd have to have like, eight people in the garden full-time.* (OK5). *Raccoons, skunks, possums . . . [are] a huge problem. I would say my assumption would be I lost up to 10% of my flock to chickenhawks.* (M03).
Market access, competition, and lack of trust for organic products. Several farmers received pushback from a few consumers who do not believe that some of the products sold as "organic" are credible. Dairy farmers were cut off from organic markets.	80.0%	*The people that are organic skeptic, think this is just a marketing scheme, it's just a stamp or badge you try to get so you can charge more for your product and they're like hey, it's like we don't want to join the racket or whatever we'll just do way you know, we'll do something reliable and not join that marketing racket of organic certified organic and there might be some legitimate perspective there.* (OK6)
High cost of production, especially input prices and machinery that make organic products expensive for consumers.	72.5%	*Any pesticide that you want to purchase for organic farming is typically three to four times more expensive.* (M02) *We had a company build a machine that goes over the top of the beans, and it electrocutes them, a weed shocker. And I'd like to have one of those, but . . . they want US$80,000. We need [*a bigger tractor*], and by the time you get the tractor and the weed whacker, you're gonna have a quarter million [dollar] cost and I don't have enough acres to justify that.* (M011) *If we had a local butcher that can handle high volume . . . not like a backyard mom and pop shop – [one] that had like an actual facility that would break open the chicken market in Oklahoma. But right now, nobody has to time because you got to go to Kansas, drop it off, you got to go back and pick it up . . .. So that product gets really expensive, really fast.* (OK8)
Challenges in obtaining and keeping organic certification due to several factors, such as a shortage of local organic certifiers, the time it takes to be certified, paperwork for certification, and high costs associated with acquiring and renewing the organic certification, often ranging from US$750 to US$1200 annually.	72.5%	*lit's a tough road because it takes three years to certify your ground. And that's one of the big barriers that keeps people from going in, so it's hard to get in. It's expensive.* (OK13) *I remember [the application] being really long, like maybe 16 pages, and wanted to know, kind of basically every input that I use as far as for pest control or fertility, and, you know, farm map, and sales and harvest records, and then send that off.* (OK10)

continued

Challenges constraining operations		
Lack of access to informational resources and appropriate training. Some producers pointed out that they were having trouble accessing educational information at the local extension and USDA offices since some employees were not well-versed with policies around organic production.	65.0%	*There's not a lot of support in the [local] USDA [office].. . . we may be the only organic farm in our county, actually. And so, every time we have to do something through the USDA, it's something new they've never done, and there's just no support there. They don't know.* (OK4) *I did not get any support from the government. All the information and awareness was through attending the various conferences and workshops. The transition was through self-learning process. Experimented, made mistakes, and learned from it.* (OK9)
Damages from drift or overspray. Some organic producers faced the loss of crops and sometimes certification due to spray drift, such as dicamba,[a] from farming neighbors, forcing them to either scale back on their operations or exit the organic farming business.	35.0%	*My neighbors did not care one bit that I was organic ever, not one of them. In the year that the dicamba drift was so bad… there were probably 1000 cases of drift across Missouri… And everybody just kept their mouth shut and combined the beans and went on with life.* (MO1) *The main problem is brush, spraying pastures in the spring with 2,4-D, or other volatile compounds that tomatoes are very sensitive to and fruit trees. It's been a problem historically.* (OK6)
Perceived unfavorable policies that disadvantage small organic farmers and/or beginning farmers. Some producers were not aware of federal or state programs available for them. Others experienced inconsistencies with which guidelines were applied when dealing with USDA's Farm Services Agency (FSA):	12.5%	*But as far as something geared towards organics, I don't know that there are programs that I'm aware of that the USDA offers strictly for organics.* (MO11) *They [FSA] will say, well, there is a set of guidelines. But the regulatory agency doesn't necessarily follow the same guidelines. It's conflicting. So, we need a standard set for the U.S. that everybody can follow.* (OK3) *I asked for a microloan for my startup expenses from the USDA, and they still told me no; I was so mad at them . . . they refused to work with me at all. And so, I turned around I called my credit union, and I had the US$30,000 loan in 30 minutes.* (OK8)

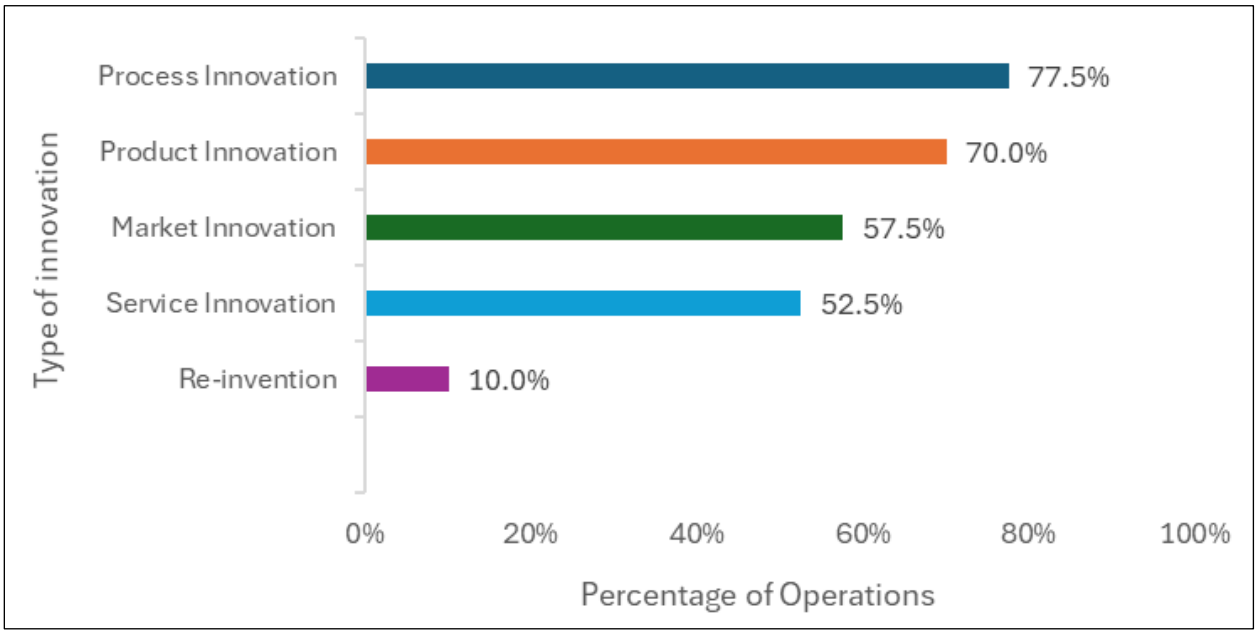
[a] Note that dicamba became a significant problem for farmers in the Mississippi Delta region that includes parts of Missouri, Arkansas, Tennessee, and Kentucky in the late 2010s (see Gullickson, 2020; Unglesbee, 2018).

farm operations. Diversifying their products helped to mitigate market slowdowns and to spread risks to minimize losses. We noted that a lot of vertical integration was happening among the organic producers, where some farmers are exploring adding value to existing products and moving down the value chain. For example, one farmer extracted and sold soybean oil from their crop, which fetched better prices than selling the raw products, while another made juices and smoothies from her fruits and vegetables. Further, another farmer shifted from selling pork at US$3 per pound (453 grams) to processing it into hot dogs, which sold for US$40 per pound. This change allowed for a more profitable and manageable business, moving from producing 40 cows and 250 pigs per year to just 15 pigs per year, while earning more revenue:

> *I took the pig to the butcher had it turned into sausages. Grind the whole thing into jalapeno and cheese sausage and smoked sausage. And I went to the Dallas farmers market and set up a little grill . . .. They're sausages on a hot dog bun. And I turned on my grill, and I served sausages all day. I also had all my frozen meat. I sold maybe one pound of bacon and one whole chicken to 100 Hot dogs. . . I was selling them for US$10 each [US$40 per pound of hot dogs] . . . I slowly transitioned from restaurants into hot food myself, which allowed me to scale down significantly.* (OK8)

By adding value and creating a variety of products, producers were able to expand their product offerings and earned more money than they would have made if they sold primary products.

Figure 1. Percentage Distribution of Innovations Among the Organic Operations



Another farmer had a challenge of finding the right equipment for their soil type and could not afford to buy new equipment. As a result, he scavenged old parts and ingeniously rebuilt equipment for better weed control:

> I was searching hedgerows and dragging stuff [old equipment] up and rebuilding it, and a lot of it I pieced together from nothing basically or built from pieces and parts of this and that. . .. It took me a long time to build up my equipment . . . if I could have gone to town and bought new equipment to do what I was doing, it would have been too expensive. (MO1)

Theme #2: Process Innovation

Unlike conventional farmers, organic producers have limited options to deal with risks and uncertainties during the production process. As a result, 77.5% of the organic farmers we interviewed were more proactive in their production process, employing more preventative strategies to mitigate the challenges they were likely to encounter during production, including pests and diseases, drought, and weeds. Among the improvements made in their production processes were mulching, irrigating, and setting up shades, greenhouses, and high tunnels. To combat fungal problems and weeds in their vegetables, some farmers used high tunnels to control the amount of moisture, especially in the tomatoes. Too much moisture and warmth can create a favorable microclimate for the growth of fungal and other disease-causing organisms. Others have used row covers to control pests such as squash bugs in their vegetables.

Several producers used chicken and animal manure to help maintain soil fertility, improve soil health, and promote soil regeneration. For example, producer MO2 said:

> *But mostly, we've been keeping animals on the farm for the purpose of them regenerating the soil returning energy and nutrients back into the soil. So, we use poultry, as much for its manure, the bedding, and all of that that comes with the animals' lifestyles, we return that into the soil, and we sell eggs as much as possible, but we're as interested in the nutrients the poultry manure provides us . . . we've got some small livestock on the soil where we tried to use them to graze the land and not use machinery whenever possible, and just continuously add back to the soil with various organic inputs that are a part of the process and we tried to be as self-contained as possible.* (MO2)

Theme #3: Market Innovation

Nearly three-fifths (57.5%) of the operations interviewed expanded their market outreach, transitioning from farmers markets to more diverse channels. These included restaurants, food markets, food trucks, community supported agriculture (CSA) operations, schools, online sales through websites with delivery options, on-site picking, and innovative outlets such as conferences and sporting events.

Others have ventured into other product lines to boost their incomes, such as raising and selling dogs and puppies alongside organic offerings. Other producers have focused on product differentiation to retain and attract new customers and expand their networks. For example, some producers concentrated on building their brand, trust, and friendships with customers leading to repeat customers.

Additionally, because they resided in a low-income community with price constraints, one producer decided to appeal to other community members by accepting other forms of payment, including Supplemental Nutrition Assistance Program (SNAP) and Electronic Benefit Transfer (EBT):

> *Our major issue is price, and we live in a lower income part of [city]. So, our answer to that problem has been to start accepting SNAP and EBT and we even do a program called Double Up Food Bucks in May through October, which is when people can come and use their SNAP card and get 50% off. So that's kind of been our solution to where we can still offer vegetables at a competitive price like Walmart. (*AR2)

Faced with reduced traffic at their weekly farmers market, others switched to an online platform, ensuring constant availability of their products to their customers.

Theme #4: Service Innovation

To broaden their market and tap into new customer segments, more than half (52.5%) of the producers have introduced additional services options to complement their existing physical products. One of the main service farmers have used to draw people to their farms has been through agrotourism, including a U-pick operation that offers educational tours, as well as on-farm stays. Some farmers mentioned introducing culinary education where they educate consumers how to prepare the crops and vegetables harvested from the farm using unique recipes. Other services offered by producers include teaching people such as master gardeners about organic farming for a fee, as well as providing delivery options for online shoppers. To this end, one producer who transitioned to delivering their produce during the COVID-19 pandemic shared:

> *One of the things that's most innovative about our farm to the region is we found out that delivering to people's doors was the best way to get customers. And since we were going year-round, we didn't have to worry about the farmers markets closing.* (KY1)

Theme #5: Re-invention

Ten percent of the operations found it expensive to keep their organic certification and had challenges finding certifiers. As a result, these producers have re-invented their operations by venturing into adjacent products, including adopting alternative certifications such as certified regenerative products and naturally grown certifications.[3] For example, this Arkansas farmer said,

> *I've heard there's like a waiting list for Arkansas farms to be inspected, so Certified Naturally Grown it's just kind of another option. We follow all the same rules of certified organic, but we're able to be peer inspected. So other organic or other Certified Naturally Grown farms within our state can actually inspect us.*

[3] We were specifically interested in the dearth of organic farmers in northern Arkansas and the cluster of organic-adjacent certifications such as Certified Naturally Grown (CNG), so we included some interviews with this type of producer. Some argue that CNG is essentially a participatory guarantee system (May, 2019) which some producers, particularly in the international context, have adopted because of the costs of U.S., European Union or Japanese organic certification. It is important to note that CNG is NOT organic according to U.S. organic rules.

> *It costs about US$250 per year instead of thousands of dollars per year. I wish the state of Arkansas had an organic certification agency, I think that's something we really need and all of our farmers would benefit.* (AR2)

Also, because of the challenges associated with keeping the records needed for organic certifications and renewal, some producers re-invented the way they keep records from paperwork copies to a digital platform to reduce the burden and improve efficiency. For example, KY1 developed software to reduce the administrative burden and ensure compliance:

> *We were so unhappy with the certification process that I developed a software . . . to pursue USDA organic certification. It is a tremendous administrative burden. To the point that we estimate what we do, it's almost a full-time position just to keep up with everything that USDA has asked for compliance.* (KY1)

Conclusions

In this paper, we have highlighted the regional-specific challenges encountered by certified organic producers and explored the farmer-led entrepreneurial innovations contributing to adopting organic farming in the U.S. Mid-South states of Arkansas, Kentucky, Missouri, Oklahoma, and Tennessee. Based on the themes that emerged from the data analysis, we identified seven major thematic challenges that certified organic farmers face in the "cold spot" of the Mid-South region. These thematic challenges included biophysical and climatic factors, the high cost of production pushing the price of organic products beyond the reach of local consumers, perceived unfavorable policies that do not favor small organic farmers and beginning farmers, challenges in getting organic certification, lack of access to informational resources and appropriate training, and drift and spray challenges. As a result of these challenges, these producers were pushed to innovate to address them. These entrepreneurial innovations came in five thematic areas, with a majority of participants being engaged in process innovation (77.5%), followed by product innovation (70%), market innovation (57.5%), service innovation (52.5%), and re-invention of their farming approaches (10%) to tackle these challenges. Four of these innovations (process innovation, product innovation, market innovation, and service innovation) align with the perspectives of innovation espoused by Schumpeter, while the fifth innovation (re-invention) is derived from Rogers (2003) regarding what can happen to an innovation during the adoption process. However, some of their entrepreneurial innovations have been hampered by system-level constraints. Enhancing entrepreneurial ecosystems that can support these innovative farmers is necessary in this region, and likely in other areas of the country with organic cold spots.

Land-grant extension and other education by nonprofit organizations can play a critical role in enhancing entrepreneurial ecosystem development by connecting producers and other members of the value chain to resources and education. While some farmers in our sample had negative experiences with extension educators, many extension educators have experience with facilitating peer-to-peer networks and significant educational outreach to consumers and families that can be mobilized to help these entrepreneurs develop. Cooperative Extension, state agencies and community-based organizations currently have a significant and unique opportunity to work with the resources provided through policies such as USDA's Transition to Organic Partnership Program (TOPP) to develop entrepreneurial ecosystems that can support organic farmers and farming systems into the future. Additional research is needed to explore and gain a deeper understanding of the reinventions and transformations occurring among organic producers in organic cold spots, including the experiences of those who decided to exit the production of organic products.

Implications for Practice, Policies and Research

This section explores strategies to develop a robust organic farming entrepreneurial ecosystem in the Mid-South region. It examines key elements including human capital, market access, policies, financing, and community support. These recommendations aim to create a self-sustaining environment for organic producers to innovate and thrive.

Organic Farming Entrepreneurial Ecosystem Development

While we are seeing important innovations happening at the individual farmer level, there are clearly challenges at a systems level for these producers. These findings suggest we may need to apply an entrepreneurial ecosystems approach (Isenberg, 2010, 2014; Stephens et al., 2022), which would entail examining the supportive policies and community support networks (Bischoff & Volkmann, 2018) surrounding organic in the region. The six elements of the entrepreneurial ecosystems as espoused by Isenberg (2010, 2014) may help these cold-spot areas of the Mid-South to establish a self-sustaining organic entrepreneurial ecosystem to assist certified organic producers in scaling up their innovations and to aid others who might be experiencing related challenges. For example:

Building human capital through training and collaborations: Land-grant universities in cold-spot areas of the Mid-South are uniquely positioned to build human capital by collaborating with innovative producers to conduct on-farm research to co-create new knowledge that can be shared with other organic producers. Through their extension programs, new training programs could be developed to help farmers find the best approaches to organic farming while connecting them to resources (such as existing guides on how to acquire, maintain, and renew one's organic certification). Extension services in the region have been successful in the past building human capital by facilitating peer-to-peer learning networks for rotational grazers as well as holding grazing schools.

Market access and expansion: Many organic producers we interviewed were embracing vertical integration by developing and marketing value-added products that can command premium prices and provide access to better markets. Institutions such as nonprofits and universities in the regions can develop training focused on entrepreneurial marketing, equipping organic producers with the skills to identify, evaluate, and pursue new market opportunities that align with their organic farming operations. Additionally, state governments could help build market access through existing marketing programs.

Policies: Our data show that some organic farmers feel unsupported by federal and state agencies even though scholars have shown that small-scale organic producers can play a vital role in alleviating poverty, increasing household incomes, and addressing food insecurity at the county level (Marasteanu & Jaenicke, 2018; Peng, 2019). Recently announced policies such as the Transition to Organic Partnership Program (TOPP) that will invest up to US$100 million in helping spur organic production, including providing mentoring and technical assistance, signal that the policy arena may be changing (USDA Agricultural Marketing Service [USDA AMS], 2023). The program's emphasis on working with existing organizations in different regions, and its focus on mentorship could potentially build a supportive environment for a sustainable entrepreneurial organic farming ecosystem.

Access to financing: Many of the farmers we interviewed use cost-share programs to help offset the costs associated with certification, including providing conservation measures on their farms. However, this funding is sometimes difficult to obtain due to shifts in the management of the program at federal or state levels; in addition, at least one farmer indicated they could not access the favorable financing available for beginning or organic farmers through USDA. This finding suggests that robust training for state and federal personnel on the possibilities of organic agriculture and how to support it could begin to build the supportive environment necessary for organic entrepreneurs to flourish.

Community support: Many Missouri organic farmers we interviewed were located in close-knit religious communities. This allowed them to build on peer-to-peer networks for advice and support in improving production practices, but also in developing new businesses to support the nascent organic industry. However, there are no comparable networks for consumers who are interested in supporting organic consumption. Some organic farmers in the region would like to see more consumer

education about what the organic label does and does not mean and how it is regulated. In addition, celebrating organic production as one form of sustainable food production at local festivals, or at university- or state-supported conferences could begin to show community support for these agripreneurs.

In this study, we noted that some producers are reimagining or reinventing the organic production model and venturing into adjacent products, such as certified regenerative products, certified naturally grown, or grass-fed and pasture-raised products, which can serve as substitutes for organic products to consumers. Therefore, exploring and gaining a deeper understanding of the reinventions and transformations occurring among organic producers, including their experiences pushing them away from producing certified organic products, are imperative. Such research may employ a phenomenological approach to explore the lived experiences of organically certified producers who voluntarily relinquish their certifications or were compelled to do so due to external pressures.

Limitations of the Study

Though the findings of this study may be transferable to other organic producers who might be experiencing similar challenges, the authors caution against generalizing the findings beyond the participants who provided the data. According to Tracy (2010), transferability "is achieved when readers feel as though the story of the research overlaps with their own situation, and they intuitively transfer the research to their own action" (p. 845). 

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