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# Innovation in isolation: diffusion of local foods purchasing and online shopping methods during the pandemic

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**Introduction:** The COVID-19 pandemic caused mainstream food supply chain disruptions, increased food security concerns, and impacted agri-food production and distribution systems. Short food supply chains provided consumers with an alternative method to acquire food outside conventional food supply chains. In this paper, innovation was seen as a solution to external challenges or problems in global food supply chains during a pandemic crisis. The solution was analyzed in the context of the United States and changes in the consumers' behavior and purchasing patterns in the direction of more accepting short supply chains, which led to the successful overcoming of crisis or adaptation of consumers to crisis circumstances.

**Methods:** The Diffusion of Innovations was selected as the theoretical framework. Data were collected from 1,002 American adults from July 13 to August 18, 2021, through an online survey.

**Results and discussion:** Results showed that consumers with higher educational attainment and financial status, from non-rural areas, and with more conservative viewpoints had higher innovation adoption levels, and they were more likely to embrace short food supply chains as an alternative during disruptions to conventional supply chains. Recommendations provide strategies to increase the use of short supply chains during the crisis to better meet the needs of consumers in the food system and improve marketing and communication efforts. Marketing and communication initiatives should engage these food innovators as opinion leaders to increase the adoption of short food supply chains to stabilize food supply in preparation for future crises.

## KEYWORDS

consumer behavior, diffusion of innovations, food supply chain, local foods, marketing, short food supply chain, sustainable development

## 1 Introduction

The COVID-19 pandemic caused significant disruptions to global supply chains and impacted agri-food production and distribution systems (Altieri and Nicholls, 2020; Court et al., 2023), highlighting the vulnerabilities of long and complex food supply systems. In response, there has been a growing interest in shorter supply chains (DuPuis et al., 2022), which are seen as being more resilient and adaptable. The pandemic is a clear example of a crisis that forced businesses to innovate (DiGiacomo et al., 2023). This paper examines how

people explored the adoption of shorter supply chains as an innovative response to crisis to improve their livelihood.

Impacts of the pandemic and inflation on the food retailing sector caused an 11% sharp increase in food prices from 2021 to 2022 (U.S. Government Accountability Office, 2023). The Consumer Price Index for food at home also surged, climbing by 3.5 percent annually in 2020 and 2021—substantially above the historical average (McLaughlin et al., 2022). This crisis caused a reduction in the food purchasing power of consumers and decreased farmers' income (Gortázar and de la Fuente, 2020; Lioutas and Charatsari, 2021; Peterson et al., 2023). Moreover, driven by uncertainty and fear, the early pandemic panic-buying created an unprecedented surge in demand (Weersink et al., 2020). After the national emergency declaration in March 2020, the food retailing sector experienced an increase in food retail sales, leading to an approximate 10% rise over two years (McLaughlin et al., 2022). This surge led to empty retail shelves, particularly in larger cities heavily reliant on air or truck shipments from distances exceeding 600 miles. This scarcity of goods further intensified concerns about potential food shortages and insecurity (Altieri and Nicholls, 2020; Barrett, 2020; Oncini, 2021).

In addition, the closure of numerous restaurants, stores, and educational institutions caused a significant shift in the demand within the food supply chain (Richards and Rickard, 2020). This sudden alteration in consumption patterns and disruption of distribution channels resulted in the wastage of substantial quantities of food and serious changes in food prices (Weersink et al., 2020; Lioutas and Charatsari, 2021). The disappearance of end markets further compounded these challenges, creating a ripple effect throughout the entire food system.

In response to shocks faced by food supply chains, innovations and adaptations aimed at achieving sustainability and resilience have been proposed to address these shocks faced by food supply chains (Berry, 2023). The idea of encouraging consumers to choose local food during the pandemic was presented across media. This recommendation stemmed from supporting local food systems, which have been known to alleviate some of the challenges conventional supply chains face (Sneed and Fairhurst, 2017). Local food definitions vary by country and individual perception. In the United States, according to the Farm Bill, it is defined as food transported less than 400 miles (about 643.7 kilometers) from production and/or sold in the state where it is produced (U.S. Government Publishing Office, 2023). This definition emphasizes the importance of proximity in the production and distribution of local food consumption.

Short food supply chains are crucial for enhancing the resilience and sustainability of our food economy, particularly in a time of crisis when longer, complex supply chains are disrupted. The agility of shorter supply chains has been proven by adapting quickly to disruptions, such as those caused by the COVID-19 pandemic (Michel-Villarreal, 2023). By providing alternative methods for food acquisition, including farmers' markets, farm direct sales, and consumer cooperatives, short food supply chains help mitigate food shortages and promote a stable supply in the context of the United States (Butu et al., 2020; Lioutas and Charatsari, 2021). For instance, a local farmer grows organic tomatoes and sells them directly to consumers at a farmers' market without the process of wholesalers, distributors, and retailers. It is worth mentioning that in the United States, short food supply chains have not traditionally been integral to food purchasing habits, as they are in regions like Southeast Europe, where they are a customary

part of the food system (Kneafsey et al., 2013). Although the advantage of short food supply chains ensuring a lower carbon footprint remains not always supported in literature (Pacirotti and Torregiani, 2021; Stein and Santini, 2022), it helps reduce food damage and waste due to long-distance transportation in line with the values of more sustainable food production (Schmutz et al., 2018). Besides, it has been apparent that the systems offer economic, social, and ethical benefits, particularly during disruptions. Specifically, these include enhancing the economic benefits for the local community involved in the supply chain (Stein and Santini, 2022; Jia et al., 2023) and fostering high levels of trust and transparency in the supply chains among stakeholders (Aguar et al., 2018; Pacirotti and Torregiani, 2021; Stein and Santini, 2022). This level of transparency and closer connections has been critical during uncertainty, such as the pandemic (Cappelli and Cini, 2020). These advantages collectively contribute to making the choice of consuming local food an innovative life value during the pandemic.

Moreover, evolving consumer preferences led to a significant surge in the adoption of online pre-ordering systems for food acquisition (Lioutas and Charatsari, 2021; Alaimo et al., 2022). COVID-19 hastened the shift toward online shopping across all market channels (Edmondson et al., 2021; Berry, 2023). The growth in e-commerce platforms has revolutionized how consumers interact with food markets and profoundly impacted their inclination to invest in local food through short food supply chains (Barska and Wojciechowska-Solis, 2020). These situations could gradually become the norm, potentially strengthening local food systems and promoting sustainability and resilience in food sourcing (Pacirotti and Torregiani, 2021; Jia et al., 2023). An in-depth comprehension of how people engage with short food supply chains is needed to tailor these systems to effectively meet consumer demands and enhance the support of developments in future food disruptions.

This study aimed to identify the characteristics of consumers regarding their innovation adoption and food acquisition behaviors during the COVID-19 pandemic, particularly in relation to short food supply chains. The fears associated with the pandemic can impact consumers' choice of food access channels (Gavilan et al., 2021; Mehrolia et al., 2021). In the post-COVID-19 period, an upswing in interest in the "local food movement" has been anticipated, driven by concerns for food security and a heightened desire to support local businesses within food supply chains (Hobbs, 2020). This study addressed the gap in understanding how consumers engage with short food supply chains during crises, highlighting the need for innovative approaches to enhance local production and distribution systems. Focusing on adopting short food supply chains, this research provided insights into how these systems can mitigate risks during uncertain times and contributed to long-lasting economic and social benefits (Cappelli and Cini, 2020). These findings are necessary for developing strategies to strengthen food resilience and sustainability, ensuring that local food systems are better equipped to handle future disruptions.

## 2 Theoretical framework and literature review

### 2.1 Diffusion of innovation (DOI) theory

Innovation helps restore normalcy to people's lives, especially during crises like the COVID-19 pandemic, reducing the damage

caused by economic or human health shocks (Carlsson-Szlezak et al., 2020). According to Rogers (2003), innovation diffusion is how a new idea spreads and is adopted by people in a community over time. The Diffusion of Innovations (DoI) theory provides a framework to explain why some innovations become popular while others do not, including the process, elements (e.g., innovation, communication channel, time, and social system), and rate of innovation adoption. In the DoI theory, innovation can be an idea, practice, or object recognized as novel by an individual or other unit of adoption. Five qualities of the innovation that affect its adoption rate and likelihood are proposed: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability (Rogers, 2003). Potential adopters' perceptions of these characteristics affect acceptance and use of the innovation.

Time is another central element when discussing innovation adoption. People go through six stages to decide whether to adopt an innovation, including being aware of the innovations (knowledge stage), proactively seeking the information (persuasion stage), deciding to accept or reject the innovations (decision stage), and figuring out how the innovation works (implementation stage), confirming to use (confirmation stage), and ultimately adopting innovation (adoption stage). Furthermore, Rogers (2003) purported that people can be divided into five categories based on the relative speed of adoption, assuming that the speed at which people accept innovation follows a normal distribution. The categories range from those most likely to adopt innovation quickly to those who may never embrace innovation as innovators (2.5%), early adopters (13.5%), early majority (34%), late majority (34%), and laggards (16%). According to the definition by Valente (1996), early adopters are individuals who adopt a particular concept, technology, or practice more than one standard deviation earlier than the average adoption time. The early or late majorities are individuals whose adoption time falls within one standard deviation earlier or later than the average. Lastly, laggards adopt later than one standard deviation from the mean.

The DoI theory is one of the most commonly used theories for understanding innovation adoption and implementation. Research found some differences in basic demographic variables among people in different rates of innovation adoption groups (Avery et al., 2010; Gulati and Williams, 2013; Clarke et al., 2016; DiGiacomo et al., 2023). More specifically, people who are younger, more educated, and have higher social status or income are more likely to adopt innovations faster (Rogers, 2003). Previous studies did not consider the relationships between people's innovation adoption and non-sociodemographic differences like political beliefs or residency when focusing on food-related topics as an innovation. Based on the DoI theory, innovative information can be more effectively promoted and communicated if it accounts for measurable individual differences. In particular, it would be more conducive to planning future communication or education strategies for late majorities or laggards.

Many studies have used the DoI theory in the context of food supply chains. For instance, Qader et al. (2023) emphasized that perceived compatibility, relative advantage, and religious beliefs positively influence the adoption of halal meat supply chains, while perceived complexity has a negative impact. Similarly, Yi et al. (2022) identified key factors influencing the adoption of traceability practices, including low awareness of the importance of food recalls, perceived relative advantages, and cultural compatibility issues. These studies

demonstrate the feasibility of using the DoI theory to analyze food supply chains. However, most research focuses on producers' adoption of new technologies or concepts in food production rather than consumer perspectives. To our knowledge, no studies have applied the DoI theory as a framework to investigate consumers' values and purchasing behaviors toward local food and short food supply chains during the pandemic. Thus, this research seeks to bridge this gap in the existing literature, assessing the applicability of the DoI theory in this context.

In this study, consumers' initiative to purchase local food through short food supply chains for the first time during the COVID-19 pandemic was considered the innovation in the food acquisition process. Such food supply chain shifts were notable in the United States during the pandemic (DuPuis et al., 2022), when these shorter, more localized supply chains helped alleviate food shortages and promote a stable supply (Butu et al., 2020; Lioutas and Charatsari, 2021), thereby reducing food insecurity. Furthermore, short food supply chains reduced the workload of mainstream food channels (Richards and Rickard, 2020) and solved problems in food distribution and price volatility (Butu et al., 2020; Lioutas and Charatsari, 2021). This study also considered the adoption of, at the time, less traditional logistics like online ordering for food purchases as a response to the health risks associated with more traditional logistics, like in-store purchases, as part of the food acquisition innovation.

## 2.2 Consumers' values and concerns toward local food

A substantial body of research has delved into consumers' preferences and values concerning local food within the United States (Costanigro et al., 2011; Godette et al., 2015; Abrams and Soukup, 2017). While studies have scrutinized individuals' personal attributes about their food choices (Rossi et al., 2017), the prevailing wisdom in the realm of food marketing and ideology advocates was for a focus on consumers' values and perceptions (Costanigro et al., 2011; Grebitus and Dumortier, 2016; Abrams and Soukup, 2017; Reich et al., 2018; Mehroli et al., 2021). It has been observed that consumers tend to gauge the worth of local foods based on a multifaceted spectrum of factors, including but not limited to quality attributes like taste and freshness (Spiller and Belogolova, 2017), sustainable and/or organic production practices (Abrams and Soukup, 2017; Ellison et al., 2017), the reduction of transportation distance from farm to table (McIlvain-Newsdad et al., 2004), and the prevailing perception that local food is inherently healthier (Robinson and Smith, 2003; Haws et al., 2017). Marketing messages about local foods may more likely resonate with consumers if they believe these values are socially desirable (Costanigro et al., 2011) and align with their personal beliefs (Rossi et al., 2017). Besides, research has identified causal connections in food preferences, from concerns to attitudes and specific behaviors (Kang et al., 2015; Dang and Tran, 2020).

The surge of interest in local food and short food supply chains underscores the importance of a community-centric and decentralized approach to food production and distribution (Barska and Wojciechowska-Solis, 2020; Lioutas and Charatsari, 2021). Consumers' values for local food are positive, as are their willingness to pay higher prices (Hempel and Hamm, 2016; Printezis et al., 2019). This shift in attitudes, if translated into behavioral changes, could

address immediate challenges in the food supply chain and lay the foundation for a more stable and sustainable food system, especially during times of crisis. Furthermore, it underscores prioritizing food security as a core value during crises, ensuring immediate relief and enduring resilience in a community-driven food network (Hobbs, 2020). It also includes endeavors to reduce food waste and promote the consumption of healthier, more sustainably produced food (Schmutz et al., 2018).

Using a national online panel of people, who identified as the main grocery shoppers for their household, two research objectives were pursued to help design educational plans and marketing strategies for people in different innovation adoption groups based on the Diffusion of Innovations framework (Rogers, 2003). The research objectives were:

RO1: Describe the characteristics of people in different innovation adoption groups, regarding how they might increase the use of short food supply chains in response to food supply disruptions.

RO2: Determine if perceptions of short food supply chains are associated with changes in the use of non-conventional channels (farmers' markets and directly from farmers) or methods (online food ordering) in response to food supply disruptions.

## 3 Methods

### 3.1 Data collection

We conducted this quantitative study from July 13 to August 18, 2021, collecting data from 1,002 adults (18 years or older) in the United States through an online survey administered by Qualtrics. Our sample was stratified to reflect the 2020 U.S. Census population in terms of race, ethnicity, geographic region, age, and income. Qualtrics employs advanced measures like internet protocol (IP) address checks and digital fingerprinting technology to prevent duplicate responses and ensure the validity of the data (Qualtrics, 2019). To acknowledge the valuable time and input of participants, we provided compensation, which encouraged full engagement with all survey questions. To maintain the integrity of our analysis, we excluded any participants who did not complete the entire survey.

Non-probability sampling was used in this study due to its advantages in accessibility, cost-effectiveness, and higher response rates compared to traditional survey methods (Creswell and Creswell, 2018; Lamm and Lamm, 2019). This approach allows for exploring a broader range of perspectives within the population, which is particularly advantageous in studies focusing on societal behaviors and opinions (Lamm and Lamm, 2019). Though it does not provide a fully representative sample, it was considered suitable for making population estimates in this context, especially given limited resources and time constraints (Baker et al., 2013).

### 3.2 Instrument development

This instrument was part of a larger study designed by the researchers with several constructs developed using the DoI theory from Rogers (2003). Three sections of the questionnaire were used to

fulfill the objectives of this study: (1) innovation adoption rate, (2) food acquisitions, and (3) food safety concerns. A panel of experts from the University of Minnesota, University of Florida, Kansas State University, University of California-Irvine, and the University of Wisconsin-Madison reviewed the instrument for face and content validity. Their expertise helped refine the questions to ensure comprehension and pertinence to the research objectives. A pilot test ( $n=50$ ) was conducted to identify any issues with the survey design, such as unclear questions, and to estimate the reliability of the constructs. It also used reliability to determine if items should be dropped or potentially added.

The operational definition of short food supply chains in our instrument refers to a distribution system in which the number of intermediaries between the producer and the consumer is minimized, often involving direct sales or limited levels of middlemen. This supply chain could help reduce the distance food travels from farm to table, thereby enhancing transparency, system stabilization, and connection between producers and consumers during the pandemic (Aguiar et al., 2018; Cappelli and Cini, 2020; Paciarotti and Torregiani, 2021).

The first section, innovation adoption rate, was designed to measure the extent to which individuals are quick to try new practices, particularly using short food supply chains and online grocery shopping during the pandemic. Statements were related to local food and the four qualities of the DoI theory (relative advantage, compatibility, complexity, and observability) that may influence the speed and likelihood of adopting short food supply chains in response to crisis (Rogers, 2003). Examples of the statements are "Local/regional foods are overall better for me" (relative advantage), "Local/regional food is compatible with the needs of my family" (compatibility), "Switching to local/regional foods is an easy thing for me to do" (complexity), and "I have observed the process of someone acquiring local/regional foods" (observability). All statements used a 5-point *Likert scale* ranging from 1 = strongly disagree to 5 = strongly agree. Eight items, two questions on each of the four qualities, were included in the scale, and each respondent got an innovation adoption score ranging from 8 to 40 points ( $\alpha=0.83$ ,  $M=27.34$ ,  $SD=5.62$ ). People with more positive values toward local food receive higher points, which means they hold an open attitude toward changing food acquisition channels and have higher innovation adoption rates in this study. Assigning higher scores to positive values toward local food allows the researchers to correlate these attitudes with a greater likelihood of adopting new food acquisition practices.

The data were used further to divide the sample into five levels of different "innovation adopter groups" with the combined index including all of the DoI attributes. Based on Rogers (2003) and Valente (1996), respondents' innovation adoption scores in this study between the average and above/below one standard deviation can be early (28–32 points) and later majority (22–27 points). Those with scores higher than a standard deviation above the average (33–38 points) were early adopters and higher than two standard deviations (> 38 points) were innovators. Lastly, people scoring lower than a standard deviation below the average (< 22 points) were defined as laggards.

The second section about food acquisitions aimed to identify changes in how respondents acquired food, focusing on new purchasing methods that emerged during the pandemic. The questionnaire included questions about how people obtained food during the pandemic, focusing on both the outlets (e.g., supermarket, farmers' market, convenience store) and logistics (e.g., in-store/eat-in,

online orders for at-home delivery). Specifically, the study focused on outlets related to short food supply chains, such as “farmers’ market (e.g., farm stands and community-supported agriculture (CSA))” and “direct from farmers and/or food makers.” These outlet items were re-coded to represent participants who purchased from these channels for the first time during the pandemic (coded as 1) and those who did not (coded as 0). Regarding logistics, the study analyzed methods for obtaining food during the pandemic that minimized public health risks, which included options like “online order for at-home delivery,” “online ordering for bundled at-home delivery (e.g., DoorDash, Instacart),” and “online order for in-store or curbside pickup.” These logistics were also re-coded to identify participants who utilized these safer methods for the first time during the pandemic = 1 and those who did not = 0. These were matrix-style questions where participants could select different logistics for each outlet that applied to them during the pandemic.

The last section of the questionnaire focused on participants’ concerns about food safety issues. Specifically, two questions were asked to assess their level of concern during the pandemic. The first question inquired about their level of concern regarding “where food comes from,” while the second question explored their concerns regarding the “safety of food we consume (from COVID-19).” Participants were asked to rate their level of attention to food safety issues during the pandemic compared to non-pandemic periods, using a three-point scale where 1 indicated “more attention,” 0 represented “the same amount of attention,” and –1 indicated “less attention than before.” Previous studies have suggested that people’s values can influence their food selections, and therefore, this study sought to control for participants’ concerns.

We also collected and controlled for participants’ demographic variables, which included age, household income, and highest educational level. Additionally, participants were asked to indicate their political preferences, which were categorized into five options, ranging from very liberal (coded as 1) to very conservative (coded as 5). Participants’ place of residence was coded into five categories: “a farm in a rural area,” “rural area, not a farm,” “urban or suburban area outside of the city limits,” “subdivision in a town or city,” and “downtown area in a city or town.” Their geographic region in the United States, such as the Midwest, Northeast, South, and West, was also collected. These demographic variables were included as control variables in the regression models.

### 3.3 Data analysis

SPSS 29 was used for analysis. Descriptive statistics, one-way analysis of variance (ANOVA) with *post hoc* Scheffe analyses, and several regressions were used to answer the research objectives. Descriptive statistics were used to analyze sample characteristics, while ANOVA was used to compare differences in innovation adopter groups between different demographic variables.

To conduct multivariable regression analysis, the categorical data types, such as age and annual family income, were transformed into numerical values represented by their respective median values within each group. For example, household income from \$15,000 to \$24,999 was transformed to \$20,000. For the educational level, those with a 4-year college degree and higher degree were re-coded as 1, and others were 0. Other characteristics were converted using dummy variables.

Regarding political beliefs and place of residence, the reference category for comparison with others is neutral to simplify interpretation and highlight differences. To elaborate, moderate political beliefs are the basis for comparing with those that hold liberal or conservative political beliefs. This makes it easier to interpret the effect of being more conservative or liberal relative to being moderate. Those living in an urban or suburban area outside of the city limits were compared with those who live in rural and city areas, allowing for a clearer understanding of how location makes an influence. For the geographic region variable, since the majority of participants (41.4%) reside in the South, it was designated as the reference category for comparison with other regions. Regarding the level of innovation adoption, the laggards were selected as the base category for comparison, as it facilitates a clear interpretation of the study’s findings by contrasting the other groups against this reference group.

Before conducting regression analyses, we checked for and ensured that the data met the necessary statistical assumptions for linear models. This included testing for linearity, multicollinearity, and independence of errors.

## 4 Results

### 4.1 The characteristics of people in different innovation adopter groups

The 1,002 respondents were classified into five different levels of innovation adopter groups, as depicted by Rogers (2003) and shown in Figure 1. The demographic variables of the respondents in different groups are shown in Table 1. For some respondents who chose not to disclose their political beliefs and residency, missing values were replaced with the average values in the analysis.

Comparing demographic data across the innovation adopter groups yielded some significant differences in age, income, educational level, and political belief. Table 2 shows the ANOVA results. The *post hoc* results indicated no significant differences for age between different innovation adopter groups,  $F(4, 997) = 2.57, p = 0.04$ , partial  $\eta^2 = 0.01$ . However, certain trends were observed. For instance, respondents with slower adoption rates tended to be older in age. In addition, early adopters tended to have a higher household income,  $F(4, 997) = 5.63, p < 0.001$ , partial  $\eta^2 = 0.02$ , and a higher educational level,  $F(4, 997) = 4.81, p < 0.001$ , partial  $\eta^2 = 0.03$ , than the late majority and laggards. Moreover, respondents who held liberal political beliefs typically had a slower speed of innovation adoption than those with conservative beliefs,  $F(4, 997) = 4.03, p = 0.003$ , partial  $\eta^2 = 0.02$ . On the other hand, participants’ place of residence and geographic region showed no significant differences across the various innovation groups.

### 4.2 Changes in food acquisition practices during the pandemic

To scrutinize the disparities in food acquisition channels, distinguishing between short food supply chain sources and non-short food supply chain sources, this study specifically defined short food supply chain sources as either farmers’ markets or direct purchases from farmers. These two local food outlets emphasize the proximity of food production and acquisition. Figure 2 presents the percentages

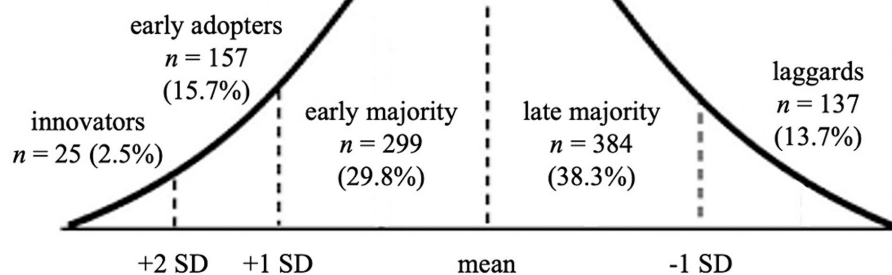


FIGURE 1

DoI distribution curve of respondents regarding the adopting short food supply chains during the pandemic. The percentages of each group are based on Rogers (2003) and Valente (1996). On the scale of innovation adoption of local food during the pandemic in this study, participants who scored 38 to 40 = "innovators"; 33 to 38 = "early adopters"; 28 to 32 = "early majority"; 22 to 27 = "late majority"; and below 22 = "laggards".

of respondents, categorized by innovation adopter groups, who indicated their use of these specific food acquisition channels.

The linear regression results are presented in Table 3. The explanatory variables used in the regression model accounted for approximately 25.8 and 29.7% of the variance in the respondents' choices of acquiring food from farmers' markets and direct sources, respectively. The results indicated a significant positive association between respondents who demonstrated a higher readiness to adopt innovative food acquisition practices as measured by the DoI innovation adopter groups and their self-reported use of local food outlets during the pandemic. Moreover, the regression analysis identified other factors influencing the first-time use of local food outlets during the pandemic. It was observed that accounting for their innovation tendencies, people with younger ages ( $\beta = -0.40$ ,  $p < 0.001$ ), higher household incomes ( $\beta = 0.11$ ,  $p < 0.001$ ), and those who identified themselves as more conservative in political beliefs ( $\beta = 0.07$ ,  $p = 0.04$ ) were more likely to acquire food from farmers' markets for the first time during the pandemic, while those with younger ages ( $\beta = -0.45$ ,  $p < 0.001$ ), higher household incomes ( $\beta = 0.11$ ,  $p < 0.001$ ) and educational levels ( $\beta = 0.08$ ,  $p = 0.01$ ), and identified themselves as more conservative in political beliefs ( $\beta = 0.08$ ,  $p = 0.01$ ) were more likely to acquire food directly from farmers. Additionally, participants who expressed higher levels of concern regarding the origin of their food during the COVID-19 pandemic also exhibited a stronger inclination toward acquiring food for the first time from farmers' markets ( $\beta = 0.06$ ,  $p = 0.04$ ). On the contrary, it is worth highlighting that people who expressed heightened concern about the safety of food (from COVID-19) during the pandemic, compared to before it, were associated with less tendency to purchase food through these local food outlets, all else equal.

Moreover, the COVID-19 pandemic significantly impacted food purchasing logistics, leading to a notable surge in online food ordering as a prominent method of acquiring food. As online ordering represents an innovative approach compared to traditional in-store purchases, it became crucial to assess whether respondents who used local food outlets also adopted online ordering methods. Next, the study considered two specific online ordering methods for acquiring food from local food outlets: "online ordering for at-home delivery" and "online ordering for in-store or curbside pickup." Figure 3 presents

the distribution of respondents, categorized by their innovation adopter groups, who reported using online ordering methods from local food outlets, like farmers' markets or direct purchases from farmers.

The subsequent multivariate regression analysis revealed a significant positive correlation between early adopters and the preference for purchasing food at local food outlets through online ordering for at-home delivery (Table 4). Several demographic variables were also identified as influential factors impacting this behavior. Participants with younger ages ( $\beta = -0.30$ ,  $p < 0.001$ ) and higher educational levels ( $\beta = 0.13$ ,  $p < 0.001$ ) displayed a stronger inclination toward acquiring food at local food outlets through online ordering for at-home delivery. Additionally, individuals residing in the northeastern region of the United States ( $\beta = 0.08$ ,  $p = 0.01$ ) were more likely to exhibit this behavior.

However, the findings indicated no significant association when examining the relationship between respondent innovation adopter groups and acquiring food at local food outlets through online ordering for in-store or curbside pickup. Similar to online ordering for at-home delivery, people of younger ages ( $\beta = -0.35$ ,  $p < 0.001$ ) and higher educational levels ( $\beta = 0.07$ ,  $p = 0.04$ ) were more likely to purchase food at local food outlets through these logistics during the pandemic, in addition to those earning higher household incomes ( $\beta = 0.15$ ,  $p < 0.001$ ).

## 5 Discussion

This study represents the pioneering effort in applying the DoI theory to investigate peoples' perceptions of short food supply chains in acquiring food during the pandemic. The importance of this research was to identify characteristics of people that prefer to use these shorter, more localized food supply outlets to acquire food. Such understanding could guide strategies for policymakers, marketers, and agricultural educators to increase the adoption of these innovations among specific innovation adopter groups and promote the use of short food supply chains in ways that are tailored to those with varying perceptions. In this study, respondents exhibiting a more favorable disposition toward local food were classified as those with higher

TABLE 1 Frequency and percentage of samples' demographic variables in each innovation group.

	Innovators	Early adopters	Early majority	Late majority	Laggards
<b>Age</b>					
18–24	0(0.0%)	12(7.6%)	24(8.0%)	53(13.8%)	23(16.8%)
25–34	2(8.0%)	53(33.8%)	69(23.1%)	88(22.9%)	21(15.3%)
35–44	8(32.0%)	32(20.4%)	62(20.7%)	62(16.1%)	20(14.6%)
45–54	3(12.0%)	20(12.7%)	35(11.7%)	43(11.2%)	17(12.4%)
55–64	7(28.0%)	17(10.8%)	35(11.7%)	51(13.3%)	16(11.7%)
over 65	5(20.0%)	23(14.6%)	74(24.7%)	87(22.7%)	40(29.2%)
<b>Household income</b>					
Less than \$10,000	0(0.0%)	10(6.4%)	12(4.0%)	30(7.8%)	6(4.4%)
\$10,000 to \$14,999	1(4.0%)	5(3.2%)	10(3.3%)	20(5.2%)	9(6.6%)
\$15,000 to \$24,999	3(12.0%)	13(8.3%)	21(7.0%)	33(8.6%)	16(11.7%)
\$25,000 to \$34,999	2(8.0%)	7(4.5%)	32(10.7%)	35(9.1%)	15(10.9%)
\$35,000 to \$49,999	1(4.0%)	10(6.4%)	43(14.4%)	51(13.3%)	22(16.1%)
\$50,000 to \$74,999	10(40.0%)	17(10.8%)	43(14.4%)	85(22.1%)	23(16.8%)
\$75,000 to \$99,999	3(12.0%)	28(17.8%)	41(13.7%)	50(13.0%)	15(10.9%)
\$100,000 to \$149,999	3(12.0%)	37(23.6%)	56(18.7%)	45(11.7%)	17(12.4%)
\$150,000 to \$199,999	2(8.0%)	24(15.3%)	25(8.4%)	17(4.4%)	6(4.4%)
\$200,000 or more	0(2.0%)	6(3.8%)	16(5.4%)	18(4.7%)	8(5.8%)
<b>Educational level</b>					
Less than 12th grade	1(4.0%)	2(1.3%)	6(2.0%)	13(3.4%)	5(3.6%)
High school graduate	4(16.0%)	30(19.1%)	49(16.4%)	100(26.0%)	25(18.2%)
Some college, no degree	4(16.0%)	20(12.7%)	67(22.4%)	74(19.3%)	36(26.3%)
2-year college degree	4(16.0%)	16(10.2%)	33(11.0%)	51(13.3%)	12(8.8%)
4-year college degree	7(28.0%)	55(35.0%)	88(29.4%)	96(25.0%)	38(27.2%)
Graduate or professional degree	5(20.0%)	34(21.7%)	56(18.7%)	50(13.0%)	21(15.3%)
<b>Political beliefs</b>					
Very liberal	2(8.0%)	50(31.8%)	39(13.0%)	35(9.1%)	17(12.4%)
Liberal	5(20.0%)	25(15.9%)	67(22.4%)	86(22.4%)	27(19.7%)
Moderate	8(32.0%)	41(26.1%)	91(30.4%)	147(38.3%)	44(32.1%)
Conservative	3(12.0%)	16(10.2%)	63(21.1%)	63(16.4%)	26(19.0%)
Very conservative	7(28.0%)	23(14.6%)	29(9.7%)	36(9.4%)	21(15.3%)
<b>Residence</b>					
A farm in a rural area	2(8.0%)	6(3.8%)	11(3.7%)	17(4.4%)	5(3.6%)
Rural area, not a farm	5(20.0%)	22(14.0%)	51(17.1%)	63(16.4%)	31(22.6%)
Urban or suburban area outside of the city limits	12(48.0%)	89(56.7%)	154(51.5%)	186(48.4%)	61(44.5%)
Subdivision in a town or city	4(16.0%)	31(19.7%)	54(18.1%)	86(22.4%)	27(19.7%)
Downtown area	5(8.0%)	9(5.7%)	28(9.4%)	29(7.6%)	11(8.0%)
<b>Geographic region</b>					
Midwest	7(28.0%)	33(21.0%)	59(19.7%)	79(20.6%)	26(19.0%)
Northeast	3(12.0%)	36(22.9%)	56(18.7%)	46(12.0%)	21(15.3%)
South	10(40.0%)	50(31.8%)	125(41.8%)	175(45.6%)	55(40.1%)
West	5(20.0%)	38(24.2%)	59(19.7%)	84(21.9%)	35(25.5%)

TABLE 2 ANOVA tests between adoption innovation groups with different demographic variables.

Consumers (I)	Consumers (J)	Household income		Education level		Political belief	
		MD (I - J)	SD	MD (I - J)	SD	MD (I - J)	SD
Innovators (n = 25)	Early adopters	-0.002	0.23	0.15	0.15	0.02	0.13
	Early majority	-0.56	0.24	-0.21	0.15	0.08	0.13
	Late majority	-0.90*	0.27	-0.39	0.17	0.46	0.15
	Laggards	-0.37	0.51	-0.23	0.32	-0.23	0.28
Early adopters (n = 157)	Innovators	0.002	0.23	-0.15	0.15	-0.02	0.13
	Early majority	-0.56*	0.18	-0.36*	0.11	0.06	0.10
	Late majority	-0.90*	0.22	-0.54*	0.14	0.44*	0.12
	Laggards	-0.37	0.48	-0.39	0.31	-0.24	0.27
Early majority (n = 299)	Innovators	0.56	0.24	0.21	0.15	-0.08	0.13
	Early adopters	0.56*	0.18	0.36*	0.11	-0.06	0.10
	Late majority	-0.34	0.23	-0.18	0.15	0.38	0.13
	Laggards	0.19	0.49	-0.02	0.31	-0.30	0.27
Late majority (n = 384)	Innovators	0.90*	0.27	0.39	0.17	-0.46	0.15
	Early adopters	0.90*	0.22	0.54*	0.14	-0.44*	0.12
	Early majority	0.34	0.23	0.18	0.15	-0.38	0.13
	Laggards	0.53	0.51	0.16	0.32	-0.68	0.28
Laggards (n = 137)	Innovators	0.37	0.51	0.23	0.32	0.23	0.28
	Early adopters	0.37	0.48	0.39	0.31	0.24	0.27
	Early majority	-0.19	0.49	0.02	0.31	0.30	0.27
	Late majority	-0.53	0.51	-0.16	0.32	0.68	0.28
F		5.63		4.82		4.03	
p-value		< 0.001**		< 0.001**		0.003*	
Eta-squared		0.02		0.02		0.02	

\*p < 0.05, \*\*p < 0.001.

innovation adoption rates. The significance of the study lies in the potential advantages garnered from acquiring local food through short food supply chains, which not only ensures a stable and uninterrupted food supply during disruptions but also aligns with sustainable practices (Schmutz et al., 2018; Lioutas and Charatsari, 2021).

The findings showed that consumers categorized as innovators or early adopters in the context of short food supply chains tended to be younger. This correlation aligns with the DoI theory and earlier studies (Gulati and Williams, 2013; DiGiacomo et al., 2023), suggesting that younger individuals are typically more open to adopting new technologies or practices due to their greater acceptance of change and innovation. We inferred that younger people tend to be more flexible and adventurous (Rogers, 2003), making them more willing to try new ways of obtaining food. Additionally, innovators or early adopters exhibit higher educational attainment and financial status than other stages of innovation adoption (Rogers, 2003; Barska and Wojciechowska-Solis, 2020). These demographic indicators effectively delineate the characteristics of people inclined to embrace innovative practices, particularly in times of uncertainty. Understanding these characteristics can help marketers and policymakers design strategies tailored to the needs and behaviors of these population segments, enhancing the

effectiveness of new values and practices about food acquisition options.

Furthermore, in contrast to previous research that may not have extensively explored political beliefs, our study found an intriguing insight: consumers with a higher rate of adoption of short food supply chains during the pandemic generally held conservative political beliefs. While Rogers (2003) posited that groups embracing innovations tend to be more receptive to new phenomena, our findings provided a nuanced view. This variance might be because, given our categorization of people into distinct adoption innovation groups based on their values of acquiring local food during COVID-19, it became evident that respondents' inclinations toward local food are likely influenced by an amalgamation of factors that transcend more than political beliefs. This aligned with prior research outcomes, reinforcing that a person's perception and value cause a more significant impact on their choice to opt for online ordering through local food outlets during the pandemic, surpassing the impact of demographic variables (Gavilan et al., 2021; Mehrolia et al., 2021). Such an idea was further confirmed in our next objective.

Through RO2, this study determined a relationship exists between perceptions of short food supply chains and adoption of non-traditional channels and methods of purchasing during the COVID-19 pandemic. Specifically, respondents with a propensity for



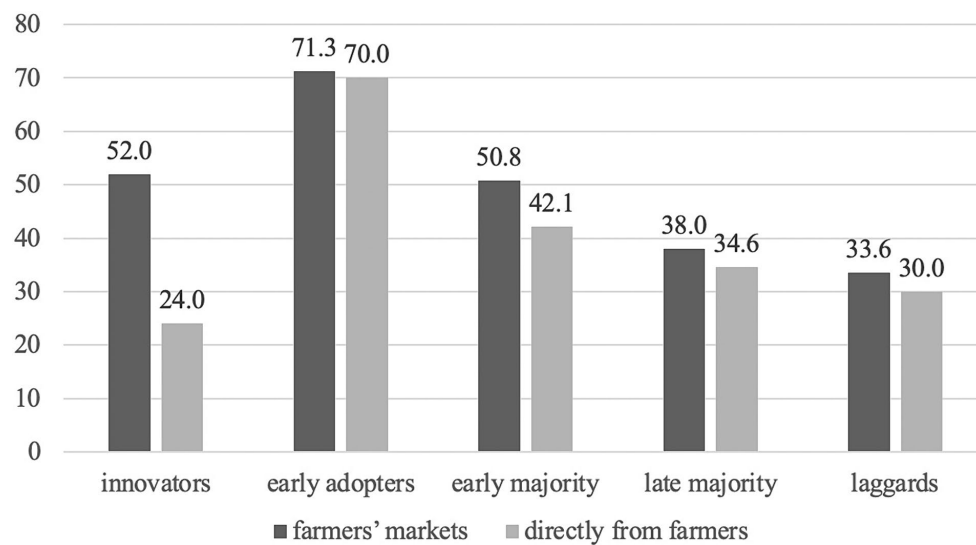


FIGURE 2  
Percentages of respondents, by innovation adopter group, who purchased food through local food outlets during the pandemic (%).

adoption of local food supply chains were more willing to obtain food through farmers' markets or direct purchases from farmers for the first time during the pandemic. Additionally, those with less positive perceptions of short supply chains were also willing to adopt during times of disrupted traditional supply chains. Our results echoed not only the previous literature proposed about peoples' value toward local food purchasing (Hempel and Hamm, 2016; Printezis et al., 2019) and their sustainability in economic and social development (Aguiar et al., 2018; Paciarotti and Torregiani, 2021; Stein and Santini, 2022; Jia et al., 2023), but also the advantages of short food supply chains, as it can provide a more stable channel during some external impacts (Schmutz et al., 2018; Butu et al., 2020; Lioutas and Charatsari, 2021).

In addition, despite not discovering a significant relationship between respondents' adoption levels and purchasing local food through online ordering for in-store or curbside pickup, we identified a positive significant relationship between early adopters and their inclination to purchase food at local food outlets through online ordering for at-home delivery for the first time during the pandemic. With the increase in the usage rate and convenience of the internet, more and more people will select to acquire their food online, which is considered an emerging trend (Richards and Rickard, 2020). Furthermore, obtaining food through an online platform during COVID-19 effectively reduced peoples' chance of contact with others, thus reducing the risk of contracting illness; under this special situation, increasingly more people were willing to obtain local food through this online method (Gavilan et al., 2021; Mehrolija et al., 2021).

However, our investigation into online ordering patterns discovered a compelling trend that deviates from conventional expectations. Contrary to the assumption that innovators, typically at the forefront of embracing novel concepts, would be the primary proponents of innovation adoption in this context (Rogers, 2003), our regression models presented a different narrative. Figure 3 shows this phenomenon more clearly: Short food supply chain innovators did not always obtain local food online during the pandemic. This study inferred that the unique context of the pandemic might have reshaped

the landscape of innovation adoption in this context. To be more specific, the innovation adopters during this period might not align perfectly with the conventional innovator category that existed prior to the pandemic. Instead, the circumstances surrounding the pandemic could have induced a distinct set of actors to embrace innovation- individuals who were driven to adapt due to the unprecedented challenges posed by the crisis. Our inference may be supported by Edmondson et al. (2021), who stated that the pandemic induced food insecurity in a substantial portion of the population that had previously experienced financial stability or only minor risks. This resulted in a surge of new users adopting innovative methods for food acquisition, including alterations in online food shopping practices.

This study also observed a relationship between respondents' levels of concern regarding where their food comes from and food safety issues, and their purchasing behavior through innovative channels and logistics. Previous studies have outlined the positive impact of an increasing emphasis on food safety concerns on peoples' preferences and choices (Kang et al., 2015; Dang and Tran, 2020). However, the finding suggested that consumers who are more mindful of the origin tend to embrace and adopt innovative ways of accessing local food sources, while in our study, people's concerns about their food safety showed the opposite results. We inferred that the reason could be that instead of seeking to use innovative food outlets, these respondents may rely more on conventional outlets, which they perceive as safer or more regulated. For instance, larger grocery stores with robust safety certifications could be preferred by this group because such options are perceived to have stricter safety controls and oversight. This may imply that consumers do not comprehensively understand local food, leading to differences in their concerns about food safety during the pandemic. This insight opened up a promising avenue for future studies within the context of the DoI theory, allowing researchers to delve deeper into the relationship between food awareness and the adoption of innovative food acquisition practices.

TABLE 3 Linear regression results for the first-time use of local food outlets during the pandemic.

Variables	B	SE	t	p
<b>From farmers' markets</b>				
Late majority	0.03	0.04	0.71	0.48
Early majority	0.14	0.05	3.42	< 0.001**
Early adopters	0.22	0.05	5.65	< 0.001**
Innovators	0.07	0.10	2.40	0.02*
Concern about food origin	0.06	0.03	2.07	0.04*
Concern about food safety	-0.07	0.03	-2.45	0.01*
Age	-0.40	0.001	-13.65	< 0.001**
Household income	0.11	0	3.72	< 0.001**
Education level	0.05	0.03	1.50	0.13
Liberal political belief	0.03	0.03	0.83	0.41
Conservative political belief	0.07	0.04	2.08	0.04*
Live in rural areas	0.02	0.04	0.76	0.45
Live in urban areas	-0.003	0.03	-0.10	0.92
Midwest region	-0.03	0.04	-0.85	0.40
Northeast region	0.02	0.04	0.61	0.55
West region	0.02	0.04	0.61	0.54
Adjusted R <sup>2</sup>	0.26			
F statistic	22.72**			
n = 1,002				
<b>Directly from farmers</b>				
Late majority	0.04	0.04	0.91	0.37
Early majority	0.10	0.04	2.49	0.01
Early adopters	0.20	0.05	5.14	< 0.001**
Innovators	-0.001	0.09	-0.03	0.98
Concern about food origin	0.05	0.03	1.71	0.09
Concern about food safety	-0.09	0.02	-3.20	0.001*
Age	-0.45	0.001	-15.65	< 0.001**
Household income	0.11	0	3.79	< 0.001**
Education level	0.08	0.03	2.75	0.01*
Liberal political belief	0.04	0.03	1.20	0.23
Conservative political belief	0.08	0.03	2.61	0.01*
Live in rural areas	0.01	0.04	0.49	0.62
Live in urban areas	-0.03	0.03	-0.99	0.32
Midwest region	-0.03	0.04	-1.03	0.30
Northeast region	0.04	0.04	1.41	0.16
West region	0.01	0.04	0.42	0.67
Adjusted R <sup>2</sup>	0.30			
F statistic	27.46**			
n = 1,002				

\*p < 0.05, \*\*p < 0.001; For the dummy variables, those with moderate political beliefs and who lived in an urban or suburban area outside the city limits were the base category for comparison in different political beliefs and residency. Also, the South region was designated as the reference category for comparison with other regions, and the laggards were selected as the base category for comparison in different innovation adoption groups.

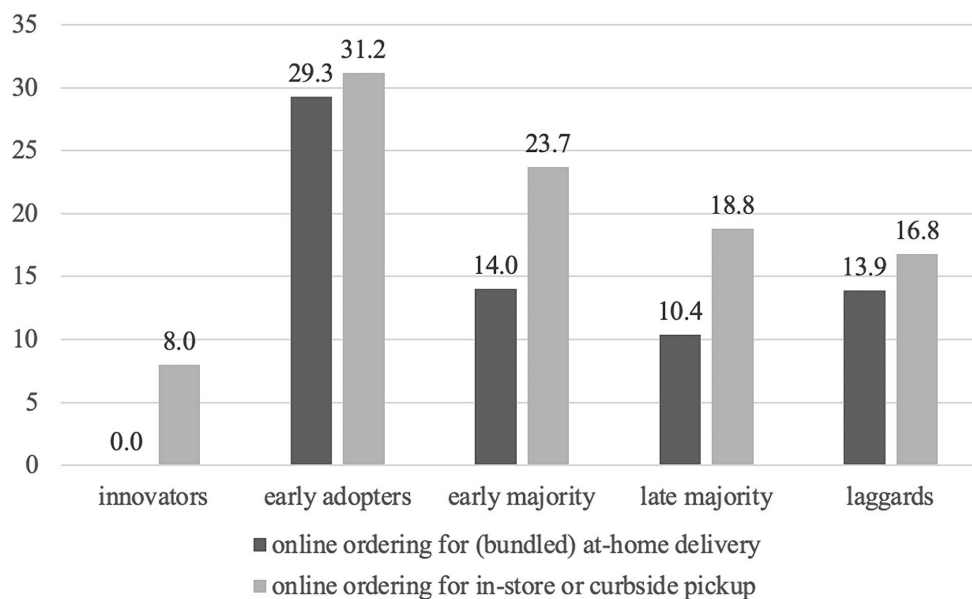


FIGURE 3

Percentages of respondents, by innovation adopter groups, who purchased from local food outlets using online ordering methods during the pandemic (%).

## 6 Conclusions and implications

During the COVID-19 pandemic, short food supply chains proved more resilient and adaptable, ensuring stable food supplies when traditional chains were disrupted. In non-crisis times, short food supply chains promote transparency and strengthen community ties. The pandemic accelerated their adoption, with lasting benefits likely to persist, encouraging more sustainable and resilient food-sourcing practices even after the crisis.

This exploratory study applied the DoI theory to understand peoples' preferences for short food supply chains during the COVID-19 pandemic. The behavioral measurements were specific to (1) people who said they purchased food through local outlets (such as farmers markets or direct from farmers) for the first time since March 2020, i.e., during the pandemic; and (2) they purchased food through local food outlets using online logistics for the first time during the pandemic. Our research showed the key characteristics of people who favor these channels for acquiring food, laying the groundwork for strategies that enhance the adoption of innovations and support the development of more sustainable and stable food supply chains. We found that individuals identified as innovators or early adopters of short food supply chains were generally younger, with higher educational levels and financial well-being, which are crucial factors in their willingness to engage with new outlets and logistics of food acquisition.

This research can help to better understand the characteristics of the people with lower adoption rates regarding purchasing local food during times of uncertainty, such as those older, with lower household income and educational level, and with more liberal political belief, and help identify holdups for lower innovation adopter groups related to new technologies. Additionally, this study can help communicators design strategies for consumers within specific demographic groups, thus reducing information gaps caused by differences in age or

residence. For instance, messaging that emphasizes the safety, convenience, and community benefits of local food could be tailored to address the concerns of older adults or those with lower incomes.

It is important to encourage innovation adoption across all segments of society for overall societal development and resiliency during future crises that involve supply chain disruptions. Strategies might include community-based programs and partnerships with local organizations to provide resources and support for adopting these innovative practices. With those with lower innovation adoption rates, it is important to start adopting innovative food acquisition methods and channels, if only for use in a crisis, which can popularize ideas more effectively and contribute to the overall resiliency of society post-crisis. Some practical strategies might include community-based programs and partnerships with local organizations to provide resources and support for adopting these innovative practices. For example, workshops and local events could be organized to demonstrate the benefits and ease of using short food supply chains, particularly targeting those with lower innovation adoption rates. Providing incentives, such as discounts or subsidies for first-time users, could also encourage adoption.

In exceptional circumstances like a pandemic, our findings challenged the applicability of traditional categories of innovators. This suggested that broader consideration should be given to segments, such as the early majority, who may exhibit a higher propensity for adopting innovative practices like online food shopping. Furthermore, offering people detailed information about food safety, including the origin of the food, has proven to be a potent motivator for choosing local food. This insight provided valuable guidance for communicators in devising effective communication strategies. By emphasizing these factors, a more comprehensive approach to innovation adoption in the realm of food acquisition can be pursued, potentially leading to more widespread and sustainable practices.

TABLE 4 Linear regression results for the acquisition of food at local food outlets through online logistics.

Variables	B	SE	t	p
<b>Through online ordering for at-home delivery</b>				
Late majority	-0.06	0.04	0.71	0.22
Early majority	-0.02	0.05	3.42	0.62
Early adopters	0.09	0.05	5.65	0.03*
Innovators	-0.06	0.10	2.40	0.08
Concern about food origin	0.08	0.03	2.07	0.02*
Concern about food safety	-0.06	0.03	-2.45	0.05
Age	-0.30	0.001	-13.65	< 0.001**
Household income	0.06	0	3.72	0.08
Education level	0.13	0.03	1.50	< 0.001**
Liberal political belief	0.05	0.03	0.83	0.12
Conservative political belief	0.02	0.04	2.08	0.62
Live in rural areas	0.01	0.04	0.76	0.67
Live in urban areas	-0.03	0.03	-0.10	0.35
Midwest region	0.03	0.04	-0.85	0.38
Northeast region	0.08	0.04	0.61	0.01*
West region	0.05	0.04	0.61	0.16
Adjusted R <sup>2</sup>	0.16			
F statistic	13.25**			
n = 1,002				
<b>Through online ordering for in-store or curbside pickup</b>				
Late majority	0.01	0.04	0.23	0.82
Early majority	0.05	0.04	1.21	0.23
Early adopters	0.06	0.05	1.51	0.13
Innovators	-0.02	0.08	-0.62	0.54
Concern about food origin	0.04	0.02	1.28	0.20
Concern about food safety	-0.05	0.02	-1.47	0.14
Age	-0.35	0.001	-11.52	< 0.001**
Household income	0.15	0	4.78	< 0.001**
Education level	0.07	0.03	2.10	0.04*
Liberal political belief	0.06	0.03	1.72	0.09
Conservative political belief	0.04	0.03	1.31	0.19
Live in rural areas	-0.03	0.03	-0.81	0.42
Live in urban areas	0.002	0.03	0.07	0.94
Midwest region	-0.06	0.03	-1.82	0.07
Northeast region	0.03	0.04	0.85	0.39
West region	-0.004	0.03	-0.12	0.91
Adjusted R <sup>2</sup>	0.20			
F statistic	16.35**			
n = 1,002				

\*p < 0.05, \*\*p < 0.001; For the dummy variables, those with moderate political beliefs and who lived in an urban or suburban area outside the city limits were the base category for comparison in different political beliefs and residency. Also, the South region was designated as the reference category for comparison with other regions, and the laggards were selected as the base category for comparison in different innovation adoption groups.

Additionally, agricultural communicators can craft better marketing messages for local food in future health crises based on this research. Our findings recommend adding food safety to

value-based local food marketing during a crisis, which has proven effective in previous work in marketing of local foods based on other values (Costanigro et al., 2011; Grebitus and Dumortier, 2016;

Abrams and Soukup, 2017; Reich et al., 2018). The value proposition of local foods as a safer choice during a health crisis resonated with respondents in this study who had a propensity for innovation. Communicators can use these innovators and early adaptors as opinion leaders, as recommended in the DoI literature (Rogers, 2003), to distribute messages and amplify market promotion efforts related to local foods.

## 7 Limitations

This study shared a common limitation with online survey approach, as it relied on non-probability sampling for its convenience. However, research has shown that non-probability sampling can yield comparable results under certain conditions, while a probability sample is often considered preferable in research (Baker et al., 2013). It should also be emphasized that this study focused on assessing consumer values related to the food acquisition behaviors of local food and short food supply chains. While efforts were made to control for demographic variables and concerns about food safety, it is worth acknowledging that additional factors like internet usage patterns, product attributes, or different situational factors may also influence discrepancies between values and behaviors. This presented an avenue for future research exploration.

In addition, future research could consider investigating these topics outside the context of a pandemic to understand how short food supply chains and local food preferences evolve during non-crisis times. This can help determine the lasting impacts of the pandemic on consumer behavior and the broader food system.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## References

- Abrams, K. M., and Soukup, C. (2017). Matching local food messages to consumer motivators: an experiment comparing the effects of differently framed messages. *J. Appl. Comm.* 101:3. doi: 10.4148/1051-0834.1297
- Aguiar, L. D. C., DelGrossi, M. E., and Thomé, K. M. (2018). Short food supply chain: characteristics of a family farm. *Ciência Rural*. 48:e20170775. doi: 10.1590/0103-8478cr20170775
- Alaimo, L. S., Fiore, M., and Galati, A. (2022). Measuring consumers' level of satisfaction for online food shopping during COVID-19 in Italy using POSETs. *Soc. Econ. Plan. Sci.* 82:101064. doi: 10.1016/j.seps.2021.101064
- Altieri, M. A., and Nicholls, C. I. (2020). Agroecology and the reconstruction of a post-COVID-19 agriculture. *J. Peasant Stud.* 47, 881–898. doi: 10.1080/03066150.2020.1782891
- Avery, E., Lariscy, R., Amador, E., Ickowitz, T., Primm, C., and Taylor, A. (2010). Diffusion of social media among public relations practitioners in health departments across various community population sizes. *J. Public Relat. Res.* 22, 336–358. doi: 10.1080/10627261003614427
- Baker, R., Brick, J. M., Bates, N. A., Battaglia, M., Couper, M. P., Dever, J. A., et al. (2013). Summary report of the AAPOR task force on non-probability sampling. *J. Surv. Stat. Methodol.* 1, 90–143. doi: 10.1093/jssam/smt008
- Barrett, C. B. (2020). Actions now can curb food systems fallout from COVID-19. *Nat. Food*. 1, 319–320. doi: 10.1038/s43016-020-0085-y
- Barska, A., and Wojciechowska-Solis, J. (2020). E-consumers and local food products: a perspective for developing online shopping for local goods in Poland. *Sustain. For.* 12:4958. doi: 10.3390/su12124958
- Berry, E. M. (2023). Editorial: COVID-19: food system frailties and opportunities. *Front. sustain. food syst.* 7:1245384. doi: 10.3389/fsufs.2023.1245384

## Author contributions

CY: Conceptualization, Formal analysis, Methodology, Visualization, Writing – original draft. LB: Conceptualization, Data curation, Funding acquisition, Methodology, Supervision, Writing – review & editing. AM: Data curation, Visualization, Writing – review & editing. HP: Conceptualization, Funding acquisition, Supervision, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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- Butu, A., Brumă, I. S., Tanasă, L., Rodino, S., Dinu Vasiliu, C., Doboş, S., et al. (2020). The impact of COVID-19 crisis upon the consumer buying behavior of fresh vegetables directly from local producers. Case study: the quarantined area of Suceava County, Romania. *IJERPH* 17:5485. doi: 10.3390/ijerph17155485

- Cappelli, A., and Cini, E. (2020). Will the COVID-19 pandemic make us reconsider the relevance of short food supply chains and local productions? *Trends Food Sci. Technol.* 99, 566–567. doi: 10.1016/j.tifs.2020.03.041

- Carlsson-Szlezak, P., Reeves, M., and Swartz, P. (2020). Understanding the economic shock of coronavirus. Available at: <https://hbr.org/2020/03/understanding-the-economic-shock-of-coronavirus> (Accessed January 26, 2024).

- Clarke, T. B., Murphy, J., and Adler, J. (2016). Celebrity chef adoption and implementation of social media, particularly Pinterest: a diffusion of innovations approach. *Int. J. Hosp. Manag.* 57, 84–92. doi: 10.1016/j.ijhm.2016.06.004

- Costanigro, M., McFadden, D. T., Kroll, S., and Nurse, G. (2011). An in-store valuation of local and organic apples: the role of social desirability. *J. Agribus.* 27, 465–477. doi: 10.1002/agr.20281

- Court, C., Outerbridge, D., Baker, L., Birou, L., Campbell, C., DiGiacomo, G., et al. (2023). Pandemic produce: impacts of COVID-19 on Florida's fruit and vegetable industries. *JAFIO* 21, 69–88. doi: 10.1515/jafio-2022-0025

- Creswell, J. W., and Creswell, J. D. (2018). *Research design. 5th Edn.* Cham: SAGE Publications.

- Dang, H. D., and Tran, G. T. (2020). Explaining consumers' intention for traceable pork regarding animal disease: the role of food safety concern, risk perception, trust, and habit. *Int. J. Food Sci.* 2020:8831356. doi: 10.1155/2020/8831356

- DiGiacomo, G., Baker, L., Yang, C. X., and Peterson, H. (2023). Innovation among businesses across the Agri-food supply chain during COVID-19. *J. Food Distrib. Res.* 54, 8–16. doi: 10.22004/ag.econ.339695
- DuPuis, E. M., Ransom, E., and Worosz, M. R. (2022). Food supply chain shocks and the pivot toward local: lessons from the global pandemic. *Front. Sustain. Food Syst.* 6:836574. doi: 10.3389/fsufs.2022.836574
- Edmondson, H., Gill, M., Jablonski, B. B., Ladd, J., Rossi, J., Schaffstall, S., et al. (2021). US consumer food insights during the COVID-19 pandemic. *Choices* 36, 1–2. doi: 10.22004/ag.econ.316069
- Ellison, B., Brooks, K., and Mieno, T. (2017). Which livestock production claims matter most to consumers? *Agric. Human Values* 34, 819–831. doi: 10.1007/s10460-017-9777-9
- Gavilan, D., Balderas-Cejudo, A., Fernández-Lores, S., and Martínez-Navarro, G. (2021). Innovation in online food delivery: learnings from COVID-19. *Int. J. Gastron Food Sci.* 24:100330. doi: 10.1016/j.ijgfs.2021.100330
- Godette, S. K., Beratan, K., and Nowell, B. (2015). Barriers and facilitators to local food market development: a contingency perspective. *JAFSCD* 5, 79–96. doi: 10.5304/jafscd.2015.053.012
- Gortázar, C., and de la Fuente, J. (2020). COVID-19 is likely to impact animal health. *Prev. Vet. Med.* 180:105030. doi: 10.1016/j.prevetmed.2020.105030
- Grebitus, C., and Dumortier, J. (2016). Effects of values and personality on demand for organic produce. *J. Agribus.* 32, 189–202. doi: 10.1002/agr.21445
- Gulati, G. J., and Williams, C. B. (2013). Social media and campaign 2012: developments and trends for Facebook adoption. *Soc. Sci. Comput. Rev.* 31, 577–588. doi: 10.1177/0894439313489258
- Haws, K. L., Reczek, R. W., and Sample, K. L. (2017). Healthy diets make empty wallets: the healthy = expensive intuition. *J. Consum. Res.* 43, ucw078–ucw1007. doi: 10.1093/jcr/ucw078
- Hempel, C., and Hamm, U. (2016). Local and/or organic: a study on consumer preferences for organic food and food from different origins. *Int. J. Consum. Stud.* 40, 732–741. doi: 10.1111/ijcs.12288
- Hobbs, J. E. (2020). Food supply chains during the COVID-19 pandemic. *Can. J. Agric. Econ.* 68, 171–176. doi: 10.1111/cjag.12237
- Jia, F., Shahzadi, G., Bourlakis, M., and John, A. (2023). Promoting resilient and sustainable food systems: a systematic literature review on short food supply chains. *J. Clean. Prod.* 435:140364. doi: 10.1016/j.jclepro.2023.140364
- Kang, J., Jun, J., and Arendt, S. W. (2015). Understanding customers' healthy food choices at casual dining restaurants: using the value–attitude–behavior model. *Int. J. Hosp. Manag.* 48, 12–21. doi: 10.1016/j.ijhm.2015.04.005
- Kneafsey, M., Venn, L., Schmutz, U., Balázs, B., Trenchard, L., Eyden-Wood, T., et al. (2013). "Short food supply chains and local food systems in the EU" in A state of play of their socio-economic characteristics. eds. F. Santini, Y. Gomez and S. Paloma. (Luxembourg: Publications Office of the European Union.).
- Lamm, A. J., and Lamm, K. W. (2019). Using non-probability sampling methods in agricultural and extension education research. *J. Int. Agric. Ext. Educ.* 26, 52–59. doi: 10.5191/jiaee.2019.26105
- Lioutas, E. D., and Charatsari, C. (2021). Enhancing the ability of agriculture to cope with major crises or disasters: what the experience of COVID-19 teaches us. *Agric. Syst.* 187:103023. doi: 10.1016/j.agsy.2020.103023
- McIlvain-Newsdad, H., Merrett, C. D., and McLaughlin, P. (2004). Direct from farm to table: community supported agriculture in Western Illinois. *Journal of. Cult. Agric.* 26, 149–163. doi: 10.1525/cag.2004.26.1-2.149
- McLaughlin, P. W., Stevens, A., Dong, X., Chelius, C., Marchesi, K., and MacLachlan, M. (2022). COVID-19 working paper National Trends in food retail sales during the COVID-19 pandemic: findings from information resources, Inc. (IRI) retail-based scanner data. Available at: <https://ageconsearch.umn.edu/record/333527> (Accessed April 11, 2024).
- Mehroliya, S., Alagarsamy, S., and Solaikutty, V. M. (2021). Customers response to online food delivery services during COVID-19 outbreak using binary logistic regression. *Int. J. Consum. Stud.* 45, 396–408. doi: 10.1111/ijcs.12630
- Michel-Villarreal, R. (2023). Towards sustainable and resilient short food supply chains: a focus on sustainability practices and resilience capabilities using case study. *Br. Food J.* 125, 1914–1935. doi: 10.1108/BFJ-09-2021-1060
- Oncini, F. (2021). Food support provision in COVID-19 times: a mixed method study based in greater Manchester. *Agric. Human Values* 38, 1201–1213. doi: 10.1007/s10460-021-10212-2
- Paciarotti, C., and Torregiani, F. (2021). The logistics of the short food supply chain: a literature review. *Sustain. Prod. Consum.* 26, 428–442. doi: 10.1016/j.spc.2020.10.002
- Peterson, H. H., DiGiacomo, G., Court, C. D., Miller, M., Oliveira, G., Stevens, A. W., et al. (2023). Impacts of COVID-19 on US Agri-food supply chain businesses: regional survey results. *PLoS One* 18:e0281930. doi: 10.1371/journal.pone.0281930
- Printezis, I., Grebitus, C., and Hirsch, S. (2019). The price is right!? A meta-regression analysis on willingness to pay for local food. *PLoS One* 14:e0215847. doi: 10.1371/journal.pone.0215847
- Qader, G., Shahid, Z. A., Junaid, M., Shaikh, I. M., and Qureshi, M. A. (2023). The role of diffusion of innovation theory towards the adoption of halal meat supply chain. *J. Islam. Mark.* 14, 1211–1228. doi: 10.1108/JIMA-01-2021-0032
- Qualtrics. (2019). ESOMAR 28: 28 questions to help research buyers of online samples. Available at: <https://www.iup.edu/arl/files/qualtrics/esomar.pdf>. (Accessed June 23, 2024).
- Reich, B. J., Beck, J. T., and Price, J. (2018). Food as ideology: measurement and validation of locavorism. *J. Consum. Res.* 45, 849–868. doi: 10.1093/jcr/ucy027
- Richards, T. J., and Rickard, B. (2020). COVID-19 impact on fruit and vegetable markets. *Can. J. Agric. Econ.* 68, 189–194. doi: 10.1111/cjag.12231
- Robinson, R., and Smith, C. (2003). Associations between self-reported health conscious consumerism, body-mass index, and attitudes about sustainably produced foods. *Agric. Human Values.* 20, 177–187. doi: 10.1023/A:1024017610510
- Rogers, E. M. (2003). Diffusion of innovations. 5th Edn. Simon & Schuster: Free Press.
- Rossi, J., Allen, J. E. IV, Woods, T. A., and Davis, A. F. (2017). CSA shareholder food lifestyle behaviors: a comparison across consumer groups. *Agric. Human Values* 34, 855–869. doi: 10.1007/s10460-017-9779-7
- Schmutz, U., Kneafsey, M., Kay, C. S., Doernberg, A., and Zasada, I. (2018). Sustainability impact assessments of different urban short food supply chains: examples from London, UK. *Renew. Agric. Food Syst.* 33, 518–529. doi: 10.1017/S1742170517000564
- Sneed, C. T., and Fairhurst, A. (2017). Different definitions and great expectations: farmers' market consumers and local foods. *J. Ext.* 55:10. doi: 10.34068/joe.55.03.10
- Spiller, S. A., and Belogolova, L. (2017). On consumer beliefs about quality and taste. *J. Consum. Res.* 43, ucw065–ucw991. doi: 10.1093/jcr/ucw065
- Stein, A. J., and Santini, F. (2022). The sustainability of "local" food: a review for policy-makers. *Rev. Agric. Food Environ. Stud.* 103, 77–89. doi: 10.1007/s41130-021-00148-w
- US. Government Accountability Office. (2023). Food prices: Information on trends, factors, and federal roles. Available at: <https://www.gao.gov/products/gao-23-105846> (Accessed April 11, 2024).
- US. Government Publishing Office. (2023). Food and nutrition act of 2008. Available at: <https://www.govinfo.gov/app/details/COMPS-10331> (Accessed January 26, 2024).
- Valente, T. W. (1996). Social network thresholds in the diffusion of innovations. *Soc. Netw.* 18, 69–89. doi: 10.1016/0378-8733(95)00256-1
- Weersink, A., von Massow, M., and McDougall, B. (2020). Economic thoughts on the potential implications of COVID-19 on the Canadian dairy and poultry sectors. *Can. J. Agric. Econ.* 68, 195–200. doi: 10.1111/cjag.12240
- Yi, Y., Bremer, P., Mather, D., and Miroso, M. (2022). Factors affecting the diffusion of traceability practices in an imported fresh produce supply chain in China. *Br. Food J.* 124, 1350–1364. doi: 10.1108/BFJ-03-2021-0227