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GROWING LOCAL FOOD SYSTEMS: INFORMATION TECHNOLOGY USE AND IMPACTS IN GEOGRAPHICALLY-EMBEDDED MARKETS

Research-in-Progress

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Abstract

Over recent decades, reliance on global food systems involving highly distributed supply chains has increased. However, as awareness of environmental, social, and health consequences of these arrangements has developed, so has interest in local food systems (LFSs) in which consumers are served by nearby producers and intermediaries. Yet, in spite of the purported benefits of LFSs, there are challenges which limit their impact. There is an opportunity for IS scholars to contribute by examining how technology is and could be used in geographically-embedded markets like LFSs. We draw on prior studies of IT use and impacts in markets to generate exploratory propositions regarding ways that IT might be used to in LFSs. The results have the potential to build a bridge between IS research and the study and development of LFSs and, thus, create opportunities for IS scholars to contribute directly to the economic health and quality of life of communities.

Keywords: IT impacts, Local food Systems, IT and Sustainability, Geographically-Embedded Markets, Food

Introduction and Local Food System Background

A food system is a set of interconnected activities by which food is managed and moved from creation to consumption (Gillespie et al. 2007). These systems include not only the commercial activities associated with buying and selling food and food production, but also non-commercial activities, such as the acquisition, preparation, and consumption of food and the social activities of the various participants in which the commercial and productive aspects of foodmaking are embedded (Heldke 1992; Hinrichs 2007). Underlying a functioning food system is a complex infrastructure that enables, or constrains, these activities. This infrastructure includes a) materials, technologies, and facilities, both natural and man-made, b) organizations and institutions, c) individual knowledge and skills, and d) social relationships and networks (Gillespie et al. 2007). Together these components provide the environment in which food system activities are situated.

Over the past several decades, global food systems have been used increasingly to meet the food needs of consumers and communities. The United States, for example, is both the world's largest agricultural importer and exporter (Jerardo 2004), with agricultural imports of $79.3 billion and exports of $115.5 billion in 2008 (U.S. Department of Agriculture 2009). However, the agricultural imports overall have been increasing, and the portion of the American diet composed of imported food is steadily increasing. Between the early 1980s and 2002, the portion of the

American diet accounted for by imported food rose from 9 to 13 percent (Jerardo 2004). Over the last four years, U.S. agricultural imports have increased by more than $23.5 billion, from $57.5 billion in 2005 to a forecasted $81 billion in 2009, while exports are expected to grow $36 billion during the same period, from $62.5 to $98.5 with a forecasted decrease from 2008 to 2009 (U.S. Department of Agriculture 2009). Agricultural economists and other economic researchers predict the U.S. may become a net importer of agricultural goods by the end of the decade (Jerardo 2004). These trends are part of a larger globalization movement that has included greater use of highly-distributed operations and global supply chains to provide a variety of goods and services. Specifically, in the area of food systems, the rise of commercial agriculture reflects the high and specialized production of food in advantageous locations. The resulting impact on the global food supply chain has been more food being transported longer distances to reach consumers.

During this same time period, other issues have arisen that cause some authors and commentators to be concerned with the negative consequences of globally distributed food systems. There is an awareness of the environmental impact of transporting food due to high, rapidly changing fuel costs. The average distance that food travels between its production and consumption is known as food-miles (Weber and Matthews 2008) and is used as a proxy to indicate the amount of energy or resources used to move the food, although different modes of transportation use quite different amounts of energy. Several reports indicate that food-miles, which vary widely depending upon food type, are increasing overall. For example, the Leopold Center for Sustainable Agriculture reports that food-miles for fresh produce arriving by truck to the Chicago Terminal Market from the continental U.S. increased 22 percent between 1981 and 1998, rising from 1,245 miles to 1,518 miles (Pirog and Larson 2007). Food imported into the U.S. from overseas typically travels thousands of miles more than these domestic distances.

Other concerns besides the environmental cost of transporting food include tainted food (Morris and Buller 2003), such as the recent cases of contaminated spinach, tomatoes, peanut butter, and milk products. A recent survey of U.S. adults found that while 85 percent perceive a local or regional food source to be safe, only 12 percent had the same confidence in the global food chain (Pirog and Larson 2007). In a later study, 74 percent of U.S. consumers saw local or regional food systems as very safe, while 56 percent rated the national food system as very safe, while only 15 percent gave the same rating to the global food system (Pirog and Rasmussen 2008). Consumer demand for more varieties of fresh food, and the perception that local food is fresher, tastes better, and is more nutritious (Pirog and Larson 2007), is also attracting interest among researchers. Even in advanced economies, small scale farmers, smaller stores, and independent retailers often suffer in the conventional food system supply chain because they are unable to compete in price terms successfully against larger corporations. Support of these entities in rural communities may strengthen the sustainability of local economies. In addition, movement away from local sources of food may harm the social ties built in a community between food producers and consumers.

Because of these concerns, local food systems (LFSs) have emerged as an alternative to the conventional global supply chain. Local food systems refer to the supply chain through which producers are able to market and distribute food to communities and consumers located within their region. Direct marketing through producer-owned retail outlets, farmers' markets, and cooperative arrangements such community supported agriculture arrangements (CSAs) are some ways in which local food systems function. In addition to producers and consumers, independent wholesalers, retailers, restaurants, and institutions such as schools, hotels, hospitals, and other care organizations play active roles in LFSs. Together these organizational and institutional structures comprise a LFS.

Advocates and scholars interested in community-embedded commerce, which includes LFSs, have noted many economic and social benefits. Communities that have successful networks of interrelated small businesses have seen higher levels of civic welfare than those with predominately corporate enterprises (Hart 1992; Lyson et al. 2001; Robinson et al. 2002; Tolbert et al. 2002; Tolbert et al. 1998). Initiatives to buy local food seek to increase the economic, social, and political welfare and sustainability of a community (Allen and Hinrichs 2007). Vermont has estimated that a "Buy Local" campaign generates approximately $100 million of economic impact by keeping local dollars in the community (Timmons et al. 2008). Successful local food systems can also both educate consumers about food and influence farmers to produce more varieties of food (Brown and Miller 2008). Finally, as LFSs develop there is potential for reduction of transportation costs and greater local control over food quality and safety. These are just a few of the factors which lead to greater attention being given to the benefits of strong, sustainable local food systems.

Yet there are still challenges and limitations to local food systems and local food efforts. Despite growth in local food markets and increasing popular interest in local food, the proportion of food purchased from local producers remains low (Hinrichs and Barnham 2007). Consumers are often unaware of the differences in greenhouse

emissions from different food transportation options, may not be aware of the modes of transportation used for the products they purchase, or are not willing to pay a higher cost for locally produced food (Pirog and Larson 2007). Sometimes consumers attempting to use local food sources exhibit "supermarket withdrawal" due to unfamiliarity with local produce (Ostrom 2007). Finally, consumers may be unaware of local food options or may have difficulty locating sources and/or products. Conversely, producers often encounter significant transaction and learning costs associated with selling to a local market (Ostrom 2007), and organizational buyers find that identifying and working with local producers can introduce logistical and business challenges all of which can result in locally produced food costing more in spite of the reduced supply chain. Thus, while there is significant potential benefit associated with LFSs, without addressing the fundamental challenges this potential is likely to be unrealized (Hinrichs and Barnham 2007).

IS researchers and practitioners have long argued for the role of information technology (IT) in global supply chains and the impact that it has by increasing the efficiency and effectiveness of such supply chains (e.g. Ghose, Telang, and Krishnan, 2005; Forman, Ghose, and Wiesenfeld, 2008). However, the role of IT in local business communities, and specifically in local food systems, is less clear. Is IT primarily useful in global supply chains and hence a threat or hindrance to the maintenance of local food systems? Or is IT a more complex factor in these discussions, potentially also playing a significant positive role in the functioning of local food systems?

This research-in-progress describes a developing research program focused on bridging this gap: developing and testing theoretically-based models of the potential role and impact of IT in local food systems. We begin with a review of relevant information systems literature, specifically considering general studies of IT use and impact in markets and communities and more specific studies of IT use and impacts on geographically-embedded business clusters. We then outline a set of exploratory propositions regarding the use and impact of IT in local food systems that are guiding our early stage empirical work. This is followed by a description of the methods and context of the exploratory study and an overview of the type of findings that we anticipate presenting at ICIS in December 2009. We then conclude with a short discussion of the likely audiences for this work and some of its potential implications for IS research and practice.

Theoretical Background: IT and Markets

IT affects markets, distribution channels, and supply chains in several ways. IT has had a major impact in the areas of reducing inventory, creating efficiency in transportation, and managing facilities. In a market, IT can serve as an intermediary between buyers and sellers. The benefits derived from the use of IT as an intermediary include the reduction of costs and increased efficiency, also referred to as a “friction-free” market (Bakos 1997; Bakos 1998). In supply chains, IT provides higher quality information faster.

Benefits can be derived by both buyers and sellers in the market. Buyers benefit by having lower search costs, increased access to product information, and increased product selection. Using IT, buyers can easily obtain the prices from multiple suppliers, lowering the costs to obtain information (Ghose et al. 2007). Empirical studies support theories which suggest that compared to brick-and-mortar retailers, the Internet can deliver lower search costs and influence buying decisions (Brynjolfsson and Smith 2000). Further, lower search costs increase buyer price sensitivity (Lynch and Ariely 2000; Shankar et al. 2003). Access to additional product information is made possible by both the sellers providing additional information and other buyers contributing their opinions and referrals (Ghose et al. 2005). The buyers' opinions often come in the form of product feedback or reviews (Chevalier and Mayzlin 2006; Forman et al. 2008). Lastly, lower search costs combined with other factors (e.g. endless low cost virtual shelfspace) facilitate the creation of markets for niche products, or products that are not in high demand in a confined region. As a result, sellers are able to offer high-demand products alongside niche products, creating greater product selection for buyers (Brynjolfsson et al. 2003).

From the seller's perspective, the use of IT as an intermediary expands the scope of competition from local to national and international markets, allowing more prospective buyers to reach and engage the seller. IT facilitates this expansion by reducing costs, such as production costs, transaction and distribution costs, binding cost, and menu cost (Bakos 1998). IT can also increase access to substantial information about prospective buyers and ease the negotiation process between sellers and buyers (Bakos 1998). However, Bakos (1998) states, "The dynamics of friction-free [IT-driven] markets are not attractive for sellers that had previously depended on geography or customer ignorance to insulate them from the low-cost sellers in the market" (p. 41). Due to the nature of online

channels, companies often shift strategies when engaging such competitors, such as their pricing strategy (Dewan et al. 2000), communication strategy, and market segmentation (Zettelmeyer 2000).

Previous studies compared IT-driven channels and traditional channels, exploring the relationship between the two. When comparing product selection across these two channels, it was found that buyers have access to different products in each channel due to the product nature and location of brick-and-mortar stores (Chu et al. 2008). Additionally, IT-driven channels and traditional channels interact in that characteristics of the traditional channel (e.g. retail pricing strategy, location) influence online purchases (Forman et al. 2008; Goolsbee 2001). The IT-driven channels possess several features that are different from traditional channels, including channel flexibility, network externalities, and low switching costs (Chen and Hitt 2002; Viswanathan 2005). As an added benefit for sellers, the reciprocal relationship between customer loyalty and satisfaction is stronger in IT-driven channels (Shankar et al. 2003).

However, implicit in these discussions is the assumption that IT is primarily a means to operate outside a local market and hence that IT is not directly altering the nature of business *within* geographically-embedded markets. While there are some studies of IT in small businesses and geographically-embedded business clusters (Steinfield 2004; Steinfield and Scupola-Hugger 2006), much of this work has also focused on how IT enables local or small businesses to connect to global markets - not to address the issues associated with doing business within their region. Yet even in cases where the focus is on building connections to the global marketplace, an increasing number of commentators and scholars are concluding that communities which have strong networks consisting of diverse local organizations that serve the local and regional markets are both better for the community and more able to participate in global commerce (Lyson et al. 2001; Robinson et al. 2002).

The premise of our work is that, while IT may have significant impacts on the cost of creating and maintaining globally distributed supply chains, the same fundamental arguments can be read as also predicting that the use of IT will also impact the development and management of locally situated supply systems. To examine and develop this premise, we draw from the general IS literature on IT use and impacts on inter-organizational relationships, supply chains/networks, communities, and markets to develop propositions to describe how IT can contribute to the functioning of LFSs.

Consequences of IT Use in Local Food Systems

Prior studies of IT in markets and research on the nature of food systems and the infrastructure which supports them (Gillespie et al. 2007) suggest that IT can affect local food systems by:

- Facilitating many types of search
- Supporting innovation (product, production, and process) and the transfer of innovation
- Reducing production and distribution costs
- Facilitating the execution of transactions
- Increasing the legitimacy of participation in these systems among consumers and producers
- Enabling social activities (e.g. identification, relationship building and maintenance, impression management, trust formation) between individuals

While it is common for IS researchers to focus on either business-to-business (B2B) or business-to-consumer (B2C) markets in discussion of these types of issues, within local food systems roles and channels are often more flexible. Consumers, restaurant buyers, and food processors often purchase through the same channels and encounter the same problems and systems. For this research the exploratory propositions developed to guide this early stage research are, wherever possible, framed with respect to the general roles of buyer and seller instead of consumer and supplier.

IT and Search in Local Food Systems

The activities of search and discovery play a prominent part in anecdotal descriptions of participation in local food systems. The challenges of finding small producers (at all), finding suppliers of particular products, discovering new types of food, identifying appropriate ways of preparing or storing food, and doing all of this at prices that are viable given a budget are significant (e.g. Smith and Mackinnon 2007). These problems impose costs (i.e. search costs), in terms of time, attention, and money, on those interested in participating in local food systems. Generally

when search costs are low, parties are more likely to search for desirable transactions (i.e. those with appropriate product characteristics, best price, etc.) (Bakos 1997), and if search costs are high, they will be more likely to accept less than ideal outcomes of transactions, or in the extreme, choose not to engage in transactions at all. While the impact of search costs on participation in a LFS may be compensated for by other aspects of the process, including additional knowledge about the product and producers, social and relational capital, and desirable experiences, it remains true that high search costs can reduce the number and quality of transactions, and hence the viability, of a LFS.

In general terms it has been argued that IT can significantly reduce search costs (Bakos 1991; Bakos 1997). Database and search technologies enable lower cost retrieval of information about products, and enable buyers to develop larger sets of alternatives (Punj and Moore 2009). Widely available web-based multimedia technologies allow for low cost communication of product and vendor descriptions. Social computing technologies, including discussion forums, reviewing and evaluation systems, and other collective intelligence technologies, support aggregation of individual experiences with particular products and vendors. All of these technologies help buyers identify products and providers who might be of interest, evaluate them, and select one or more while paying relatively low costs. Taken together, many of the technologies now available have significant potential to lower search costs.

While many of the arguments made in the current literature about search focus on the potential of IT to lower search costs in location-independent online markets, such as the market for music or books where distribution costs are low and the products are not perishable, they also suggest, at least in principle, that there will be ways that IT can be applied in LFSs to reduce the search costs associated with LFS transactions. This leads to our first exploratory proposition:

Proposition 1: IT contributes to the functioning of local food systems by facilitating buyer search for suppliers, products, and marketplaces.

IT makes what others are doing more visible. IT provides tools for actively describing and observing what is being done. Together these capabilities facilitate innovation by providing examples which can serve as the "raw materials" of attempts to innovate. IT provides an infrastructure for asking and answering questions. IT provides the opportunity to act as a "legitimate peripheral participant" in a community of innovators, even across/outside organizational and community boundaries. IT allows for the creation of communities of practice which are locally situated and those that are not geographically bounded – this combination of local and "global" facilitates achieving the critical mass needed to support ongoing innovation, while still providing the support for local adaptation of the innovations, which is critical if they are to strengthen individuals, organizations, and structures that comprise a given LFS.

The ability of IT to facilitate innovation is particularly critical for LFSs at this point because they are rarely the dominant mode of food production and consumption in a community. Hence, the very act of participating in a LFS, no matter what the role, is often an "innovation." Furthermore, because participation is not a simple decision (i.e. it requires numerous adaptations no matter what role), choosing to participate in a LFS is a matter of choosing to engage, at some level, in an ongoing process of innovation and change. To the degree that IT can reduce the costs of this innovation (particularly practice innovation), it facilitates participation in the LFS by a wider range of parties and contributes to the ongoing functioning and growth of the system as a whole. Thus we propose that:

Proposition 2: IT contributes to the functioning local food systems by facilitating innovation (product, production, and process) and the transfer of innovation.

Inventory systems, production planning systems, and GPS technologies are a few of the ways that IT can be applied in the production and distribution of food on a local level to reduce the costs of production and distribution. Reducing the costs, or at least altering the cost structure, facilitates the functioning of LFSs by increasing the range of products that can be offered and making the locally produced offerings more price competitive.

Proposition 3: IT contributes to the functioning of local food systems by reducing production and distribution costs (e.g. better planning, less waste).

IT facilitates the accounting and financial aspects of market transactions, rather than the use of hierarchies of single suppliers with a supply chain (Malone et al. 1987). Thus IT enables transactions between supply chain partners and reduces the coordination costs of these transactions without increasing risk (Clemons et al. 1993). For example, by making credit card transactions available on a small scale (i.e. with a smaller significant upfront investment in

equipment or capabilities), IT reduces the coordination costs of LFS transactions and increases the number and variety of the transactions that are possible. Online order placement, systems for supporting standing orders, and communication technologies applied to facilitate resolution of order handling problems also reduce the costs of distribution and, hence, enable a larger universe of possible transactions.

Proposition 4: IT contributes to the functioning local food systems by facilitating the execution of transactions (e.g. fund transfers, recording exchanges, resolving problems in transactions).

By increasing the visibility of other parties who are participating in local food systems, IT may increase the legitimacy of participating in LFS as a consumer, producer, or intermediary. This in turn affects the willingness of individuals and firms to participate (and continue participation) and their confidence in their decisions and actions. Creating opportunities for parties to interact and share experiences has been shown to not only strengthen the community (McAlexander et al. 2002), but to also engender greater community engagement (Algesheimer et al. 2005).

Proposition 5: IT contributes to the functioning local food systems by increasing the legitimacy of participation in these systems among both consumers and producers.

The value of social networking and social activities in the creation of social capital in both business and the community can be very beneficial (Coleman 1988; Nahapiet and Ghoshal 1998). The formation and mobilization of social relationships is a key part of efforts to develop and maintain local food systems (Hinrichs 2000; Hinrichs 2007). Thus food production, distribution, and consumption are socially-embedded activities. This suggests that information technologies that serve to help involved parties discover potential "partners," initiate interaction, and maintain these connections, particularly weak ties, will have the potential to contribute to the growth and strengthening of local food systems. As a local food system grows and matures, new social relationships may emerge, such as links to non-agricultural partners like tourism, education, or health entities (Hinrichs 2007). Thus we propose that:

Proposition 6: IT contributes to the functioning of local food systems by enabling social activities (e.g. identification, relationship building and maintenance, impression management, trust formation) between individuals.

Although these exploratory propositions cannot be seen as a comprehensive description of all aspects of IT use and impact in LFSs, based on initial reviews of the IS research literature, prior studies of IT in food systems, scholarly and popular material about local food systems, and preliminary discussions with LFS participants and advocates, they provide a reasonable overview of the general areas where IT might be used and the likely consequences for LFSs. As such, they are the starting point for our exploratory study which will serve to provide the terminology and motivation for subsequent work that considers more specific propositions and hypotheses.

Methodology

To explore and explain the nature and impact of IT use in local food systems, a multi-phased study involving both interview-based cases and survey data will be conducted. This study is undertaken with the parallel goals of refining theories of IT impacts in geographically-embedded markets and providing practical information about how IT is (and could be) used by producers, intermediaries, and consumers in LFSs. The study will focus on two comparable LFSs located in the mid-Atlantic region of the United States, the Pittsburgh region and the Lehigh Valley.

Table 1: Study Region Demographics (Source: U.S. Census Bureau 2009)

	Allegheny	**Lehigh Valley**
Primary urban center	Pittsburgh	Allentown/Bethlehem/Easton
Urban center population (2006 estimate)	312,819	179,998
Counties	Allegheny	Lehigh, Northampton, & Carbon
County population (2008 estimate)	1,215,103	698,334
Growth rate (2000 – 2008)	-5.2%	9.5%
Size	730 sq miles	1,100 sq miles
Population density	1,755 / sq mile	634 / sq mile

Phase I will consist of a set of interview-based case studies focused on developing a rich description of the structure, functioning, and uses of IT within the LFSs. The purpose of this initial study is to verify and refine the terminology and concepts used to characterize LFSs, refine the exploratory propositions described above by identifying examples of the phenomena that are referenced, and examine the completeness of the areas encompassed by the propositions. Phase I began in March 2009 and will extend until November 2009. To examine the role of IT in supporting the different aspects of LPSs, it is necessary to examine the use of IT and its consequences for the full range of participants in LFS. Thus, we will study IT use among producers, various intermediaries, and consumers in LFSs where variation is both possible and likely. This will allow for empirical examination of the extent, and ultimately of the impact, of IT use throughout the LFS.

Accordingly, this phase involves conducting interview with individuals who have an overarching role in the LFS (e.g. not-for-profit advocates, institutional experts on LFS, and policymakers) and individuals with specific roles in the LFS (e.g. producers, distributor, market-organizers, consumers). The process began with archival searches to identify relevant organizations, individuals, and locations from which individuals in an overarching role or experts could be recruited for interviews. The focus of these interviews includes:

- The structure of the online and offline systems that comprise the target LFS
- Examples of different types of IT use and potential impacts of IT use within the target LFS
- Validation of the applicability and comprehensiveness of proposed categories for describing IT use in LFSs
- Contacts with individuals and firms within the target LFS to support future research

Interviews of this nature have already been conducted with a number of these individuals, and they have served their purpose of providing additional insight and verifying the approach taken by this study. Based on these discussions, we have developed protocols for semi-structured interviews with representative individuals and organizations with specific roles in the LFS (e.g. producers, distributor, market organizers, and consumers). These interviews will focus on:

- The nature, extent, and history of their participation in the LFS
- Expectations regarding outcomes and reasons for participation
- Perspectives on or evaluations of the LFS
- IT use in relation to the LFS

The individuals are being recruited to result in a mix of representatives from small and large organizations and a variety of roles. This will facilitate the examination of differing IT usage patterns among different types of organizations. For larger firms, managers responsible for operations in the LFS will be interviewed with follow-up discussions with IT managers for clarification. For smaller organizations, the head or someone designated as being knowledgeable about business activities, relationships, and choices related to the LFS will be interviewed.

Together these interviews will provide a foundational view of how IT is used in LFS and glimpses of what the impacts of that use might be. It will also provide information about terminology and concepts that are salient to LFS participants that can be used to design empirical instruments such as surveys and more targeted interview protocols. While this will provide a starting point for research into the impact of IT in geographically embedded markets, additional work will be needed to explicitly compare the relative impact of IT on local and global food systems, something that is beyond the scope of this early stage, exploratory study.

At the ICIS meeting in December, we will present the results of the Phase I interviews, refined propositions, and plans for Phase II which will consist of one or more surveys focused on rigorously testing hypotheses about the impact and use of IT in LFSs.

Conclusion

Developing a better understanding of the nature and consequences of IT use in LFSs will have a range of practical, policy, and academic impacts. Studying IT in LFSs will provide important information about the generalizability, and limits, of existing theories regarding the impact of IT on organizations and markets and richer insight into the interaction of technology, distance, and place. For policymakers, better models of IT use and impact on LFSs increase the value of investments in IT and IT capabilities as a basis for influencing and promoting community and economic development. Lastly, this study will provide information and materials that can be used to facilitate the evaluation, training, and advocacy of IT use among LFS participants. By building a bridge between established

areas of IS research and the study and development of sustainable food systems, this work has the potential to create opportunities for IS scholars to use their knowledge and efforts to contribute directly to communities' economic health and quality of life.

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