

Measuring the Costs of Production and Pricing on Diversified Farms: Juggling Decisions Amidst Uncertainties

By Florence A. Becot, David S. Conner, Jane M. Kolodinsky, V. Ernesto Méndez

Introduction

Historically, farmers have been known to relegate farm management and cost measurement to the periphery of their activity even though these are crucial elements of the decision making process and financial health of the business (Brannstrom, 2008). Farm economic management is vital given the profitability struggle that farms face.

ABSTRACT

Farmers must earn revenues that both cover costs and provide adequate returns. The goal of this research was to understand how diversified farmers measure their cost of production and determine prices. We conducted in-depth interviews of diversified Vermont farmers and used the constant comparative method to analyze the data. Farmers and their operations, the process of measuring the cost of production and pricing, farmers' decision-making process, and tradeoffs in the face of uncertainty are described and analyzed. This study's findings contribute to current discussions of farmer decision making by developing practical implications for important, but difficult tasks.



Florence Becot is a Research Specialist at the Center for Rural Studies at the University of Vermont. Dr. David Conner is an Assistant Professor in the Department of Community Development and Applied Economics at the University of Vermont. Dr. Jane Kolodinsky is Professor and Chair of the Department of Community Development and Applied Economics at the University of Vermont, and she is also the Director of the Center for Rural Studies. Dr. V. Ernesto Mendez is an Associate Professor in the Department of Plant and Soil Science at the University of Vermont.

Acknowledgements: We would like to thank the farmers who participated in the research project, and our colleagues at the University of Vermont Extension Services. We would also like to thank our colleague Dr. Sarah Heiss for her comments on our manuscript.

This project was supported by the Agriculture and Food Research Initiative of the National Institute of Food and Agriculture, USDA, Grant # 2010-85211-20464, and by the Vermont Agricultural Experiment Station.

Fifty-three percent of U.S. farmers incurred losses in 2007, with 30 percent of these farmers losing \$10,000 or more, and 58 percent losing between \$1,000 and \$9,999 (USDA, 2009). In Vermont, our area of study, 56 percent of Vermont farms incurred losses, with 65 percent losing less than \$10,000 and 31 percent losing between \$10,000 and \$50,000 (USDA, 2007).

This study seeks to examine recordkeeping practices and decision-making on diversified farms in order to better understand strategies used by farmers to record production costs and how these practices influence their decision making processes, including pricing. Diversified farms may include multiple varieties of a crop and/or multiple crops, the integration of livestock with crops, crop rotation, cover-cropping, and rotational grazing (Kremen, Iles, and Bacon, 2012). To explore these issues, we conducted interviews with diversified farmers. We first review the extant literature on the costs associated with diversified farms, methods for monitoring costs, pricing decisions and farmer decision making. Then we discuss our results and their contributions to current theoretical and empirical understandings of the economics surrounding diversified farm management.

Production Costs on Diversified Farms

Tracking production costs helps not only to reveal overall farm profit or loss, but it can also signal which particular enterprise or products are financially viable (Newton, 2004; Wiswall, 2009). The literature contains many studies that look at the specific cost structure and enterprise budgets of farms (DePhelps et al., 2005; Klonsky et al.,

1994). Enterprise budgets are used to account farm revenues and expenses related to individual enterprises. There are many studies that examine dairy farms' production costs (Gloy & LaDue, 2003; Gloy, Hyde, and Ladue, 2002) or row crops (Mishra, El-Osta, and Johnson, 1999), but very few that look at diversified farm production costs (Conner & Rangarajan, 2008). Diversified farms differ from row crop farms because they tend to be more labor intensive, require a diversity of equipment and input, suggesting an increased complexity in management needs (Tavernier & Tolomeo, 2004). Moreover, since each farm uses a unique mix of resources – including access to land, equipment, and money, plant production experience, time availability, marketing expertise, and management training – directly comparing growers' costs and profits may be misleading (Estes, Kleese, and Lauffer, 2003; McBride & Johnson, 2006; Pasour, 1980). A difficulty diversified farms face when using enterprise budgets is that it is burdensome to differentially allocate labor for different tasks and crops (Conner & Rangarajan, 2008). This suggests that understanding methods for efficiently and accurately tracking one's own costs is more valuable to diversified farmers than are generalized cost profiles found in enterprise budgets.

Monitoring Costs on Diversified Farms

A search of university extension websites and the literature revealed that record keeping tools vary greatly, from pen and paper to computerized systems (Wolf, Lupi, and Harsh, 2011). These tools were widely available for row crop farms, but less for diversified farms. All else equal, lower costs are preferable as they allow for more competitive

prices and/or bigger profit margins (Paulson, 2013). Enterprise analysis, a widely recommended technique in the farm management literature, allows the analysis of performance of every enterprise the farm engages in (Miller et al., 2010). Farmers can gauge the performance of each enterprise and decide which enterprise they should keep and which one they should stop. Yet, enterprise analysis implies that farmers are keeping adequate production records for each enterprise. In contrast to other industries, agriculture does not have a long track record of recordkeeping and analysis (Brannstrom, 2008). Brannstrom proposes that farming has historically been a subsistence endeavor and it has been viewed as a way of life rather than a for-profit enterprise. A minority of farms seem willing to conduct analyses for all of their enterprises and maintain full records (Boehlje & Eidman, 1984), suggesting a need for farmer-friendly, efficient tools to measure costs on diversified farms.

Pricing strategies

Prices must be low enough to compete, yet high enough to cover costs. There is a dearth of advice on price discovery for diversified farms in the literature. Existing literature focuses mainly on contracts (Hueth et al., 1999), processing vegetables (Richardson, Patterson, and Acharya, 2001), cooperative bargaining (Hueth and Marcoul, 2002), or utilizing hypothetical experimental market mechanisms (Menkhous et al., 2003). Extension publications discuss cost-plus pricing where farmers should consider the cost of input as well as a reasonable wage for labor. Cost-plus pricing allows for estimating the minimum price at what the farmer should sell (Bruch & Ernst,

2010; Byczynski, 2009). Cost-plus pricing is a key element in determining fair prices within value-based supply chains, where business relationships are based on win-win situations within the chain and each partner commits to the welfare of the other partners (Stevenson & Pirog, 2008).

Farmer Decision Making

Farm management textbooks generally describe the decision making process as a set of linear steps (Öhlmer, Olson, and Brehmer, 1998). Researchers have found that the decision process typically is not linear (Mintzberg, Raisinghani, and Theoret, 1976; Witte, Joost, and Thimm, 1972) but rather iterative. Differences in information sources and in processing that information affect the quality of the decision making process, which in turn may affect farm performance (Johansson, 2007). Understanding decision capability requires the study of how people observe information, store and retrieve the information and how it is processed (Nuthall, 2001). Farmers' decisions are constrained by various factors such as pest pressure, weather, labor and input availability, financing, policies, education, and skills.

The current study seeks to contribute to the scholarly and professional literature on farming costs and decision-making. Specifically, it seeks to understand the strategies that diversified farmers use to record their cost of production and how diversified farmers' recordkeeping practices shape decision-making processes. This paper presents the results of in-depth interviews with diversified farmers.

Methods

Participants

Two types of purposeful sampling strategies were used: 1) intensity sampling; and 2) homogenous sampling (Patton, 2001). Intensity sampling allows for the selection of “information-rich cases that manifest the phenomenon of interest intensely” while homogenous sampling allows researchers “to describe some particular subgroup in depth” (Patton, 2002; p234). Intensity sampling was chosen because we wanted to learn “best practices” – in terms of measuring cost of production and setting prices – from farmers who are known to be successful. Homogenous sampling was chosen because we wanted to be able to describe diversified vegetable farmers in detail.

To select the sample, eight management and marketing farm service providers and educators across the state of Vermont were asked for the contact information of diversified vegetable farmers who were known to have a good understanding of their production costs and effective pricing strategies. The service providers and educators are directly involved with aspects of on-farm managing, financing, and planning. A list of 30 farmers was developed. For each farm, basic information was collected: acreage, number of years in business, produce grown, and sale avenues. For the majority, this information was available on the farm’s website. Service providers and educators provided the missing information. Once this basic information was obtained, we narrowed the sample to farms which had been recommended more than once

and which were comparable in terms of acreage, product grown, and markets. We interviewed two beginning farmers and two experienced farmers. ‘Beginning farmers’ are defined as having farmed for less than ten years.

Basic descriptive information on the four farmers interviewed is presented in Table 1. The farmers had between three and 13 years of farming experience and between 1.5 and 20 acres in vegetable production, representing an average of 12.87 acres. In comparison, the average vegetable farm acreage in Vermont is 19 acres (USDA, 2007). All of the farmers grew a wide variety of crops (up to 50), and processed some of their own production (freezing, canning, picking) for sale and/or personal consumption. Two of the farmers also raised animals for meat, eggs and/or milk. All of the farmers were involved in direct sales either through a community supported agriculture program (CSA), farm stand, or farmer’s market. The experienced farmers were more involved with wholesale accounts to restaurants, grocery stores, and institutions.

Interviews

Four in-depth interviews were conducted in February 2012. The in-depth semi-structured interviews took place on the farmers’ property and lasted about two hours. The use of an interview guide provided structure to guide the inquiry, while allowing flexibility for follow-up questions and explanations (Herndl et al., 2011; Patton, 2002). Questions were open-ended and structured around three main themes: 1) farmers and farm

characteristics; 2) cost of production; and 3) pricing. Interviews were audio-recorded and transcribed verbatim. The study's protocols were approved by the University of Vermont's Institutional Review Board.

Farmers were also asked to share their recordkeeping tools to help us better understand their method of collecting and managing farm data. All of the farmers agreed to share their tools after removing potentially sensitive information.

Interview and Document Analysis

The Constant Comparative Method was used throughout the data collection and analysis processes to conduct a thematic analysis of the interview discourses (Strauss & Corbin, 1998). The Constant Comparative Method represents a rigorous analysis procedure by which categories or themes are constructed using discursive patterns (Tesch, 1990). Two researchers simultaneously conducted multiple readings of transcripts, farmers' records, notes, and extant literature to develop an understanding of farmers' assessments of cost and their implications on decision making (Charmaz & Mitchell, 2001). Specifically, we open coded the interviews and developed analytical categories and themes using NVivo 9 (QSR, 2010). This qualitative analysis software allows for a more efficient management of data while offering tools to compare codes and acceptance between researchers.

After several rounds of coding, we identified three themes to organize and explain the patterns of understandings, practices, and meaning that emerged from the interviews. We refined our

original research question into a more focused set of research questions to guide our discussion of the interviews:

RQ 1. What strategies do diversified farmers employ to record production costs?

RQ 2. How do diversified farmers' recordkeeping practices influence their decision making processes?

We created cross-classification matrices to generate new insights and examples based on these research questions.

Analysis

Constant comparative analysis of the interviews transcripts and farm records indicated that diversified farmers were keeping record of the costs associated with production and using those for pricing in varying degrees. We thread together our sense making as researchers and interview quotations that were especially meaningful, powerful, and reoccurring in order to use the interviewee's voices as support for the themes that emerged (Charmaz & Mitchell, 2001).

The process of measuring the cost of production and pricing

Measures of cost of production and price setting were similar across all farms, but the intensity of the process varied from one farm to another. Processes included recordkeeping, data analysis, and planning. Recordkeeping involved collecting data to be used for bookkeeping, planning, and decision-making. Farmers measured and recorded data on sales for different distribution channels,

yields, overhead expenses, input, and labor. These data were used for future farm operation planning.

“We look at our budget from aiming towards profitability, and kind of a combo of what can we manage to grow, what will that cost and what can we sell it at. As we do our budget we go back and forth a little bit. Ok; if that was our sales pool from our farm share that would mean that we would have to grow this much and it would cost that much.” (Farmer 4)

The quality and quantity of records that farmers kept during the growing season affected their planning process as well as their ability to accurately measure costs of production. We found a clear divide between two groups of farmers: micro record-keepers and macro record-keepers. Micro record-keepers, which included one beginning and one experienced farmer, kept many records, and reported enjoying the management side of farming. These farmers felt that this practice contributed to a positive impact on profitability. They felt more confident about calculating costs of production. Analysis of Excel spreadsheets revealed that the farms engaged in complex recordkeeping. Farmers used numerous worksheets such as one worksheet per crop or one worksheet per week and they used formulas, allowing for increased accuracy and faster calculations. The farmers kept detailed records of their inputs, yields, and sales. Information was recorded in real time basis, meaning that the information was entered at least on a weekly basis. Farmers revealed that they might not have the time to analyze the data during the growing season, but they did not have to go back over their field records at the end of the season as the data were already in

their system. These farmers reported that the aim was to develop a price that covered their cost of production. They refrained from selling crops that would not generate adequate revenue. The macro record-keepers, which also included one beginning and one experienced farmer, kept fewer records. They reported being unclear about how much data they should be tracking and how much time they should dedicate to it. For instance, one farmer reported that he used to have his crew record their time spent on activities directly related to crops, but due to inconsistencies, he stopped doing it on a regular basis. The other farmer reported that her worker kept track of her time but that she and the other owner did not. Analyzing their data tracking system, we found that one of the farmers did not track yields (only sales), and the other farmer mostly tracked data for larger enterprises (vegetables, meat). Consequently, these two farmers appeared to not be as confident about the price they set because they used estimates. We also found that, unlike the two other farmers, these farmers were more flexible with their price setting and willing to negotiate.

Labor represented the largest costs on all farms and was considered to be the hardest input to measure and to allocate to different crops. Farmers' practices ranged from keeping track of labor for each crop by the minute, to not tracking labor at all. Similarly, farmers talked about the difficulty of knowing how to attribute overhead expenses, including tractor use and time spent on non-farm tasks such as marketing and management. Farmer 2, an experienced micro-record-keeper, mentioned attributing most of the overhead costs on the price of the most profitable enterprises of the farm,

while Farmer 3, a beginning micro-record-keeper, attributed an average breakdown of the costs across all the crops. Overall, farmers were concerned that they needed to manage their costs and keep them from increasing significantly, even though the price of inputs might be increasing. One emerging theme was the need to control the cost of production by becoming more production efficient.

Informal information goes into the formation of a price, including cost of production, historical trends, experience, what competitors charge, and what buyers are willing to pay:

“It’s kind of funny because I have all these records then it comes to pricing things and it’s a fair amount of just hoping it works out.”
(Farmer 3)

Farmers were either price makers or price takers depending on their customer. Price makers had some control over their price, and the farmers interviewed were able to get a price premium due to their growing practices and the quality of their products. Farmers were most often price makers in direct marketing situations. When selling to restaurants or supermarkets, farmers were usually price takers, where buyers named the price based on a predetermined and well known “going rate”. There were, however, situations when farmers were able to negotiate the price with the buyer due to cultivated relationships. There is a division between the farmers in terms of their willingness to negotiate prices and modify them throughout the season. The micro record-keepers mentioned that they would not lower their price below their

cost of production while macro record-keepers were willing to lower the price if they were trying to get rid of a bumper crop. A summary of farmers’ practices around cost of production measurement and pricing are presented in Table 2.

We also uncovered important and deeper insights into farmers’ management practices that are seldom explored in the literature and hard to comprehend. These are: 1) making choices; and 2) dealing with the unknown and ambiguity.

Making choices

We found that choices were influenced by farmers’ goals. Some of the stated goals were profit, fulfilling their livelihoods, marketing opportunities, customer satisfaction, soil improvement, or environmental preservation. As with operations, values influence the decision making process:

“I do feel there’s a balance of getting paid a livable wage as a farmer and meeting your production costs against making food available to anybody who wants it, and making healthy food available to anyone who wants it.” (Farmer 3)

The decision-making process takes place within two sets of parameters: the external and internal environment. The first set of parameters – external environment – is composed of the factors that farmers cannot control, including the weather, geography, soil characteristics and legislation. Farmers must work within these parameters. The second set of parameters – internal environment – includes crops grown, quantity, growing practices, and markets. Farmers have more control over

these, although they are heavily influenced by the external environment. For instance, farmers must grow crops that are weather appropriate for their region. Farmers use a variety of information, yet the quantity and level of details information varies. All of the farmers interviewed utilize a similar process to measure costs of production and price, including recordkeeping, data analysis, and planning. The main difference between farmers was the level of data collection and analysis. We concluded that the difference is influenced by farmer experience, education and personality. Furthermore, we concluded that their decision making processes were not linear, but rather based on feedback loops. Farmers make adjustments and reconsider their decisions:

“We do enterprise budgets for everything and then we take the farm as a whole and if this is as profitable as we budgeted, this is what we are going to take home as income after we pay our crew and we can live on that and, is this going to take us where we want to go? If the answer is no, then we go back to see where we can tweak things. Do we cut cost of production somewhere or do we raise prices somewhere, or do we scale down somewhere? If there’s something that’s barely breaking even, should we even be doing this?” (Farmer 2)

Farmers must also pay attention to the factors mentioned above and adjust their practices in order to achieve the desired results. One adjustment might be the decision to grow less of one crop if the weather is not be favorable to optimal yields or they may decide to increase price given lower yields. Adjustments may be immediate or made

at the end of the growing season. Three of the farmers interviewed (Farmers 1, 2, and 4) reported that most price adjustments were done during the planning process, when they had time to sit down and examine the data. During the growing season, farmers reported being too busy to spend time processing information. The constant adjustment of the decision-making process helped farmers achieve their goals of profitability, production efficiencies or cost reduction. The more experience farmers gain, the more fine-tuning they will be able to do.

Two key tradeoffs, requiring balancing and choosing between two incompatible goals, emerged within the farmers’ decision-making processes. The first trade-off is between management activities and production activities. Farmers have to choose how much time they should dedicate to planning and recordkeeping, versus how much time they should spend farming the land. The micro record-keepers, who were more comfortable with their measure of costs of production and prices, were the ones who made the choice to spend a significant amount of time on the management tasks:

“This is something I always tell people who are working for us and who are going to start their own farms. No matter how much you hate numbers, you’ve got to keep track of this stuff, you’ve got to price your product appropriately because otherwise, why are you doing it?” (Farmer 2)

These farmers saw a direct relationship between the time they spent paying attention to numbers and their profitability. The macro record-keepers

also perceived the importance of these activities, but they were less certain as to how much time they should dedicate to the activity. Throughout the year, farmers shift their time allocation: during the winter, more importance is given to management practices whereas in the spring and summer, farmers shifted more of their attention to farming:

“What is the essential piece of information? Just gather that, inevitably it’s just too difficult to get any kind of comprehensive data collection, there’s too many opportunities for things to get in the way of that.” (Farmer 1)

The second trade-off that we found is related to the measurement of the cost of production. Ideally, farmers have detailed information for all crops, but this is often unrealistic. Therefore, all farmers interviewed had chosen to track in detail a handful of crops they considered important for their bottom line. They traded less precise accounting for more time farming, using general figures to inform their production and management decisions. As the micro record-keepers pointed out, another way to deal with it might be to time the farm crew as they are weeding or harvesting a certain crop and extrapolating that number to similar weeding or harvest situations. In each case, if the numbers they came up with were favorable, they considered the farm to be in good standing:

“Part of the trick is figuring out which data to keep track because you could drive yourself nuts trying to keep all this data, so you have to figure out what is important.” (Farmer 2)

Dealing with the uncertainties

As with any business, farmers must manage both controllable and uncontrollable factors. Among controllable factors, the biggest uncertainties that farmers mentioned include cost of production per crop, overhead expenses, labor and price. The farmers interviewed all grew a diversity of crops and none of them were able to say exactly how much each crop cost them to grow. Farmers had a good idea of how much input, such as seeds and compost goes into crops, but they were not sure how to allocate (or did not have the time to track) overhead expenses and labor attributable to each crop. Only one farmer reported having detailed information on labor, but he only had one person working with him (Farmer 3, a beginning micro-record-keeper). In contrast, the farmer with the biggest crew simply found it too difficult to force the workers to track their time (Farmer 1, an experienced macro-record-keeper). The main difficulty in having precise information for each crop comes from the fact that collecting data in the field over the whole growing season is complicated. Farmers also brought up the point that tracking data takes time and the opportunity cost of knowing the information might be lower than doing farm work:

“The place where we struggle is any time you track something, you are putting time into tracking it and finding that balance of what’s worth tracking and what is going to give us some information that we are going to do something with and how do we track it efficiently.” (Farmer 4)

The lack of data on production costs has an impact on the farmer's ability to come up with a price that covers those costs. As previously mentioned, several factors are at play in the formation of a price. These factors are: what buyers are willing to pay, what the demand is, what other farmers are charging, what the farmer is charging for the other crops and what the price has historically been. The pricing strategy involved balancing consumers' willingness to pay, demand, competition and hoping for the best:

"That's the thing that is kind of funny because I have all these records then when it comes to pricing things, it's a fair amount of just hoping it works out." (Farmer 3)

Farmers have found ways to mitigate some of the uncertainties around measuring costs and pricing. All farmers found it important to first get a general understanding of the farm's costs as well as determining the data crucial for them to track. The farmers tracked information for a handful of crops that they considered important for their bottom line. In order to get a general idea for each crop farmers considered planning the growing season an important part of the process as it helps remove certain uncertainties.

"For each crop, I literally plan out how many beds, where does it go, when it's going to be planted or transplanted, so when does it have to be started in the greenhouse; so it's a whole system of spreadsheets." (Farmer 2)

Part of the planning process is to come up with enterprise budgets for each crop to get an idea

of the numbers. During the growing season, if farmers stay close to the numbers they projected, they should have a good idea of what their costs are and how the farm is performing. The micro-record-keepers, who spent more time tracking data, associated that practice with being more efficient and more cost effective: when they sat down at the end of the season to plan for the next period, they had more data to analyze and they were better able to pinpoint both the profitable and unprofitable products. Finally, the farmer's experience level plays an important role in minimizing uncertainty. As farmers gain experience, they are able to base their decisions on the performance of the previous years. They also build an understanding of what to sell to which market and at what price. In the end, farmers know that no matter how much time they spend on the various management operations, there will always be an element of unknown. However, they progressively learn how to deal with it and constantly seek to improve their practices.

Discussion

This research focused on understanding how diversified farmers measure their cost of production and price their products and how these practices influence their decision making. Through the analysis of the data from the interviews and the recordkeeping tools, we learned more about how diversified farms operate (Table 2).

The process of measuring the cost of production and pricing

The processes followed to measure the costs of production and prices were fairly similar across the farms, but each farmer has developed their unique

system. The level of detail and involvement varied from one farm to another. The variation reflected farmer's personalities and skills. For example, two of the farmers interviewed reported loving numbers (the micro record-keepers) while the two other farmers were not as comfortable with them (the macro record-keepers). This echoes farmers' variability in their recordkeeping, attention to detail and patience levels found in previous research (Conner & Rangarajan, 2008). Differences in information sources and in processing information may also affect the quality of the decision making process, which in turn may affect farm performances (Johansson, 2007). The more information a farmer collects, the more information he/she will have to make a decision based on the reality of the farm. The most important similarity we found across the farms was farmers choosing to track a handful of crops considered important for their bottom line. Keeping records to monitor performance in key areas that affect profitability and sustainability has often been recommended to farmers (Cuykendall, LaDue, and Smith, 2002; Grubinger, 1999; Wiswall, 2009).

The decision making process

The decision making process was a feedback loop with readjustments. Decision-making has been described as a six-step process, which includes problem definition, observation, analysis, decision, action and responsibility bearing (Johnson et al., 1961). Moreover, decision making in the literature has been studied through the lens of addressing a problem. In our study, we were concerned with a recurring decision process, which takes place every year. Farmers did not start from scratch every year;

rather, they built on the previous years' information and experience. When planning the growing season, farmers used that information and made necessary adjustments. They were also able to make some adjustments during the growing season equating to a non-linear but cyclical decision making process as it has been previously described in the literature (Öhlmér, Olson, and Brehmer, 1998).

Dealing with the uncertainties

Farmers' time and resources were limited, and it was not possible to have complete information for all crops. As a result they had to face tradeoffs and make difficult decisions related to their time allocation. The decision to allocate time to farming or management tasks was the major trade-off facing farmers. The other trade-off we found was that in the management itself, farmers had to choose between tracking all their crops versus tracking only a handful, but in more in detail. As Wiswall (2009) recommended, farmers should focus on the handful of crops that are important for their bottom line. To help alleviate uncertainties, we also found that farmers collected data and used their experience to plan their growing season. Making decisions on the farm involves a certain amount of risks and decisions may be a gamble, as the consequences of their choice are not fully known (Anosike and Coughenour, 1990). However, the farmers interviewed were constantly seeking for new information to improve their practices (Sassenrath et al., 2010) and their chances that the decisions made would be beneficial for the farm (Öhlmér, Olson, and Brehmer, 1998).

Implications

We can draw important implications from the results. By understanding the process that the farmers experience and, the trade-offs they face, we can be better equipped to direct them towards tools and practices that will fit their needs. First, no matter how much farmers dislike recordkeeping and tracking it has to be done as “you can’t manage what you don’t measure.” If farmers do not want to do the management work, they should hire someone who is proficient at it and who will enjoy doing it. In terms of tracking data in the field, it is crucial to have full collaboration from crew members. Recordkeeping should not be optional for crew members; it should be part of the job description. Second, real time data tracking will make the process easier in the long term. Either the farmer or a crew member should take the time to enter the data collected in the field into a data software management tool (spreadsheet, database, etc.) on a regular basis. This practice reduces the chance that field data will be lost and it eliminates the daunting task of having to enter all the data at the end of the growing season. Third, farmer training should encourage precise recordkeeping and teach ways to better measure performance (Marcellino & Wilson, 2006b). However, the training should be flexible enough to allow farmers to come up with a system, or modify an existing one, that will fit their needs and working style. This is where new technologies such as smart phones and cloud computing offer interesting solutions to help farmers with recordkeeping tools that will allow for real time data input that can later be analyzed. Such tool would help reducing recordkeeping and data manipulation burden while offering flexibility.

Conclusion

This research article summarized interviews of diversified farmers about their recordkeeping practices and decision making processes around cost of production measurements and pricing. We found that while the measure of their costs of production and price setting were similar across the farms, the intensity and quality of the process varied which in turn affected the planning process of the next season. Labor, while representing the largest costs on all the farms, was also considered the hardest input to measure and to allocate to the different enterprises. Farmers are faced with a recurring decision making process building on previous years’ experiences and information. Last, farmers are faced with tradeoffs requiring balancing and choosing between measurement, management or production activities.

Limitations to our study include no generalization to a broad population of diversified farmers, as we conducted a qualitative study with a very small sample. Also, we chose to study farmers who are known to keep records, while the literature suggested that it was not the case for most farmers (Conner & Rangarajan, 2008; Marcellino & Wilson, 2006a). The implications discussed earlier provide many avenues for future research. In order to increase the understanding on how diversified farmers measure their cost of production and price their products, additional research could include quantitative research methods to get a representative sample of diversified farmers. Another area is more precise measurement of the opportunity cost of farmer time spent on management versus production activities and implications for farmer time allocation.

References

- Anosike, N., and C.M. Coughenour. 1990. "The Socioeconomic Basis of Farm Enterprise Diversification Decisions." *Rural Sociology* no. 55 (1):1-24.
- Boehlje, Michael , and Vernon Eidman. 1984. *Farm management*. New York, NY: Wiley & Sons.
- Brannstrom, A. 2008. *Using Farm Records Effectively for Business and Financial Management*. Madison, WI: UW Center for Dairy Profitability.
- Bruch, Megan L. , and Matthew D. Ernst. 2010. *A Farmer's Guide to Marketing through Community Supported Agriculture (CSA)*. Knoxville, TN: University of Tennessee Extension.
- Byczynski, Lynn 2009. *Setting prices: A Balancing Act*. In *Growing for market*. Lawrence, KS: Fairplain Publications, Inc.
- Charmaz, Kathy, and Richard G Mitchell. 2001. "Grounded Theory in Ethnography." *Handbook of ethnography*:160-174.
- Conner, D, and Anusuya Rangarajan. 2008. "Production Costs of Organic Vegetable Farms: Two Case Studies from Pennsylvania." *Plant Science* no. 19 (1):193-196.
- Cuykendall, Charles, Eddy LaDue, and R. David Smith. 2002. *What Successful Small Farmers Say: The Results of A Survey of Successful Small Farm Operators*. In *A.E.M. Extension Bulletin*. Ithaca, NY: Cornell University.
- DePhelps, Colette, Cinda Williams, John Foltz, John Potter, and Karen Faunce. 2005. *Farm Case Study Series. Mid-size Producer, Capturing Local Value*. Moscow, ID.
- Estes, Edmund A., Tony Kleese, and Laura Lauffer. 2003. *North Carolina Organic Vegetable Production Cost Study*. In *Agricultural and Resource Economics Report*. Raleigh, NC: North Carolina State University.
- Ford, Stephen, and John Scott Shonkwiler. 1994. "The Effect of Managerial Ability on Farm Financial Success." *Agricultural and Resource Economics Review* no. 23 (2):150-156.

- Gloy, Brent A., Jeffrey Hyde, and Eddy L. Ladue. 2002. "Dairy Farm Management and Long-Term Farm Financial Performance." *Agricultural Economics* no. 2 (10):233-247.
- Gloy, Brent A., and Eddy L. LaDue. 2003. "Financial Management Practices and Farm Profitability." *Agricultural Finance Review* no. 63 (2):157-174.
- Grubinger, Vern. 1999. "Farm Business Management." In, 23-37. Ithaca, NY: NRAES.
- Herndl, C.G., J. Goodwin, L. Honeycutt, G. Wilson, S.S. Graham, and D. Niedergeses. 2011. "Talking Sustainability: Identification and Division in an Iowa Community." *Journal of Sustainable Agriculture* no. 35 (4):436-461.
- Hueth, Brent, Ethan Ligon, Steven Wolf, and Steven Wu. 1999. "Incentive Instruments in Agricultural Contracts: Input Control, Monitoring, Quality Measurement, and Price Risk." *Review of Agricultural Economics* no. 21 (2):374-389.
- Hueth, Brent, and Phillipe Marcoul. 2002. Observations on Cooperative Bargaining in U.S. Agricultural Markets. Ames, IA: Center for Agricultural and Rural Development, Iowa State University.
- Johansson, H. 2007. How Can Farmer Managerial Capacity Contribute to Improved Farm Performance? A Study of Dairy Farms in Sweden. In *American Agricultural Economics Association Annual Meeting*. Portland, OR: American Agricultural Economics Association .
- Johnson, G., A. Halter, H. Jensen, and D. Thomas. 1961. *A Study of Managerial Processes of Midwestern Farmers*. Ames, IA: Iowa State University Press.
- Klonsky, Karen, Laura Tourte, David Chaney, Pete Livingston, and Richard Smith. 1994. Production Practices and Sample Costs for a Diversified Organic Vegetable Operation on the Central Coast of California. In *Information Series*. Berkely, CA: Giannini Foundation of Agricultural Economics, UC Berkeley.
- Kremen, Claire, Alastair Iles, and Christopher Bacon. 2012. "Diversified Farming Systems: An Agroecological, Systems-Based Alternative to Modern Industrial Agriculture." *Ecology and Society* no. 17 (4):44.
- Marcellino, Dana M., and Christine A. Wilson. 2006a. The Current State and Value of Farm Record Keeping. Paper read at Agricultural and Rural Finance Markets in Transition Annual Meeting, at Washington, D.C.

- Marcellino, Dana, and Christine Wilson. 2006b. Valuing Farm Financial Information. In *American Agricultural Economics Association Annual Meeting*. Long Beach, CA.
- McBride, William, and James Johnson. 2006. "Defining and Characterizing Approaches to Farm Management." *Journal of Agricultural and Applied Economics* no. 38 (1):155-167.
- Menkhous, Dale J., Owen R. Phillips, Allison F. M. Johnston, and Alla V. Yakunina. 2003. "Price Discovery in Proviante Negotiation Trading with Forward and Spot Deliveries." no. 25 (1):89-107.
- Miller, Alan, Freddie L Barnard, Norman Brown, Brenda Duckworth, Barbara Wheeling, and RL Whittman. 2010. "Farm Enterprise Analysis: Has It Lost Its Usefulness?" *Journal of the ASFMRA*.
- Mintzberg, Henry, Duru Raisinghani, and Andre Theoret. 1976. "The Structure of 'Unstructured' Decision Processes." *Administrative science quarterly*:246-275.
- Mishra, Ashok K., Hisham S. El-Osta, and James D. Johnson. 1999. "Factors Contributing to Earnings Success of Cash Grain Farms." *Journal of Agricultural and Applied Economics* no. 31 (3):623-637.
- Newton, Jon. 2004. *Profitable Organic Farming*. Garsington, United Kingdom: Blackwell Publishing.
- Nuthall, PL. 2001. "Managerial Ability—A Review of its Basis and Potential Improvement Using Psychological Concepts." *Agricultural Economics* no. 24 (3):247-262.
- Öhlmér, B., K. Olson, and B. Brehmer. 1998. "Understanding Farmers' Decision Making Processes and Improving Managerial Assistance." *Agricultural Economics* no. 18 (3):273-290.
- Pasour, E. 1980. "Cost of Production: a Defensible Basis for Agricultural Price Supports?" *American Journal of Agricultural Economics* no. 62 (2):244-248.
- Patton, Michael Quinn. 2002. *Qualitative Research and Evaluation Methods*. Vol. 3rd. Thousand Oaks, CA: Sage Publications.
- Paulson, Nicholas. 2013. "The Impact of Revenues and Costs on the Relative Returns of Illinois Grain Farms." *Journal of the American Society of Farm Managers and Rural Appraisers*:268-281.
- QSR. 2010. "NVivo 9 qualitative data analysis software." *QSR International Pty Ltd*.

- Richardson, T. J., P. M. Patterson, and R. N. Acharya. 2001. "Price Behavior in a Dynamic Oligopsony: Washington Processing Potatoes." *American Journal of Agricultural Economics* no. 83 (2):259-271.
- Sassenrath, GF, JM Halloran, D. Archer, RL Raper, J. Hendrickson, P. Vadas, and J. Hanson. 2010. "Drivers Impacting the Adoption of Sustainable Agricultural Management Practices and Production Systems of the Northeast and Southeast United States." *Journal of Sustainable Agriculture* no. 34 (6):680-702.
- Stevenson, G.W., and R. Pirog. 2008. "Values-Based Supply Chains: Strategies for Agrifood Enterprises-of-the-Middle." In *Food and the Mid-Level Farm*, edited by T. Lyson, G.W. Stevenson and R. Welsh. Cambridge, MA: MIT Press.
- Strauss, A.L., and J.M. Corbin. 1998. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*: Sage Publications.
- Tavernier, Edmund M., and Vic Tolomeo. 2004. "Farm Typology and Sustainable Agriculture: Does Size Matter?" *Journal of Sustainable Agriculture* no. 24 (2):33-46.
- Tesch, Renata. 1990. *Qualitative research: Analysis types and software tools*: Routledge.
- USDA. 2011. *Vegetables, Potatoes, and Melons Harvested for Sale: 2007 and 2002. Vermont*. USDA, 2007 [cited 10 September 2011]. Available from http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_1_State_Level/Vermont/st50_1_034_034.pdf.
- USDA. 2009. 2007 Census of Agriculture. Washington, D.C.
- Wiswall, Richard. 2009. *The Organic Farmer's Business Handbook: a Complete Guide to Managing Finances, Crops, and Staff - and Making a Profit*. White River Junction, VT: Chelsea Green Publishing.
- Witte, Eberhard, Norbert Joost, and Alfred Thimm. 1972. "Field Research on Complex Decision-Making Processes – The Phase Theorem." *International Studies of Management & Organization* no. 2 (2):156-182.
- Wolf, Christopher, Frank Lupi, and Stephen Harsh. 2011. "Farmer Demand for Financial Record-Keeping System Attributes." *Agricultural Finance Review* no. 71 (2):259-276.

Table 1. Characteristics of interview participants

	Year started	Acreage	Crops grown	Markets
Farmer 1	1999	20 acres	Vegetables Herbs Value added products (sauerkraut)	Wholesale (restaurant, food coop, schools, hospital) Farmers' market
Farmer 2	2002	200 acres 15 acres in vegetable production	Animals (meat and eggs) Vegetables Herbs Value added products (salsa, jams, frozen vegetables) Flowers	CSA (between 100 and 150 members) Farmers' market Farmstand Wholesale accounts (restaurants, stores, schools)
Farmer 3	2009	1.5 acres	Vegetables Herbs	CSA (15 members) Farmers' market Wholesale accounts (food coop, food bank)
Farmer 4	2007	40 acres 15 in production	Animals (meat, milk and, eggs) Vegetables Value added products	CSA Farmstand Farmer's market Wholesale accounts (restaurant, food coop)

Note: Data is for the 2011 growing season

Table 2. Summary of farmers' practices around cost of production measurement and pricing

	Farmer 1	Farmer 2	Farmer 3	Farmer 4
Recordkeeping focus	Sales, input	Yields, input, labor	Input, labor, sales	Input, sales
Labor tracking	Farmer	Farmer and workers	Farmer and workers	Workers
Data processing	End of the season	Weekly or more often	Weekly	End of the season
Record-keeping type	Macro	Micro	Micro	Macro
Cost of production measure	Last year data, sales	Last year data, input, labor	Input, labor	Input costs
Pricing base	-Based on estimates and previous years -Everything should make money	-Based on cost and production data, what market will bear -Covers at least cost of production	-Based on cost of production, previous years and what others are charging -Covers at least cost of production	-Prices based on estimates, previous years, what others are charging
Pricing variations	-Comes up with a list of price in the beginning of the season -Prices are flexible and can change weekly and during the farmers' market	-Sets prices for the season and stick to it for consistency -Negotiation with wholesale buyers to reach happy medium	-Comes up with a list of prices in the beginning of the season -If drop in sales readjust prices during the season based on cost of production, labor that has already occurred and what others are doing	-Comes up with a list in the beginning of the season and might re-evaluate and change prices during the season