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Financial Performance and Other Characteristics of On-Farm Dairy Processing Enterprises in New York, Vermont and Wisconsin

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Preface

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Abstract

In the last decade or two there has been a resurgence of interest in value-added agriculture, driven by consumer characteristics and the desire of farmers to capture a larger share of the consumer dollar. Federal, state and local governments have funded various efforts to support value-added agriculture, often implicitly assuming that the enterprises would be profitable and that the transition from commodity producer to producer-processor-marketer-distributor would be relatively easy. Some analysts (e.g., Streeter and Bills, 2003) have questioned both of these assumptions, noting that available aggregate data do not allow assessment of the financial performance of value-added enterprises. In the major milk-producing states, on-farm processing of milk is seen as a way of adding value to milk, but previous research on value-added dairy consists largely of *ex ante* budgeting or qualitative case studies. Our study collected detailed financial information from 27 value-added dairy enterprises with cows, goats or sheep in three states. These businesses processed and marketed cheese, fluid milk products and yogurt; 17 had begun processing during the previous three years. The financial information was used to develop income statements and balance sheets for both the milk production and the dairy processing and marketing enterprises. Our results suggest that value-added dairy is not a panacea: despite much higher revenues per unit milk produced or processed, mean net income for the processing enterprise and for the combined milk production and processing business were modest at best and often negative. More than half of the on-farm processors had negative net incomes from processing, and seven processing enterprises had negative net worth. On average, returns per cwt milk processed were $90 per cwt and $209 per cwt (for cow and goat/sheep milk producers, respectively) lower than the full economic costs of production and processing that accounted for the value of owner/operator labor and the equity cost of capital invested. Total labor requirements for production, processing and marketing were roughly double those for milk production alone. Caution should be exercised about generalizing the results of this study because the number of businesses analyzed is small, many of the businesses are relatively new and data was collected for only one year. Future research efforts should seek to increase the sample size, collect panel data and explore in greater detail the reasons for observed financial performance. Efforts by governments can require better documentation of the financial performance of value-added enterprises, provide improved support for *ex ante* analysis of business opportunities by potential value-added processors and assist with identification of production and management strategies that are likely to be more successful.

Introduction

Not so many years ago, it was quite common for US dairy farmers to be both the producers of milk and the processors of dairy products. In addition to processing milk into less perishable product forms (e.g., cheese and butter), many farms also undertook home delivery of milk, butter

and cheese in local markets (Stephenson, 1998). This pattern of dairy farmers simultaneously undertaking milk production, processing, marketing and distribution was common in Europe as well (Slee, 1991). The transformation of the dairy sector from farmer-suppliers to specialized milk producers and larger, centralized dairy processing facilities began in the late 1800s in the US and, according to Slee (1991), farm processors "were marginalized by the development of an increasingly concentrated industrial structure" in dairy processing and in food processing more generally. The development of specialized dairy processing facilities probably resulted from their lower costs, greater product consistency and increased product diversity. These product characteristics became increasingly important as the US became more urban and affluent during the 20th century. By the 1950s, the large majority dairy farms had become almost entirely specialized in milk production and relatively few processed and sold dairy products (Slee, 1991). Increased specialization in milk production was one element of long-term structural changes in the US dairy industry towards, fewer, larger and more spatially aggregated farms (Pagel, 2005).

In the last decade or two[1], however, there has been a resurgence of interest in on-farm dairy processing, and in what is often called 'value-added'[2] agriculture more generally. On the one hand, this interest derives from changes in consumer preferences. Various authors cite different reasons for this increased interest by consumers, including increased incomes, out-migration from cities by affluent second-home owners, "demassifying" of food markets into many small segments, general disaffection with foods associated with the "agro-industrial complex," the desire of consumers for more direct contact with producers of their food, increased desire for "functional foods" that provide health and wellness benefits, consumer exposure to a broader variety of food flavors, and increased visibility of "food-based media outlets and personalities" (Gloy and Stephenson, 2006; Maynard, 2005; Gellynck and Viaene, 2002; DiPietre, 2000; Brester, 1999; Slee, 1991).

Some farmers also have perceived advantages in on-farm processing and other related activities (such as marketing). The farm-to-retail price spread for dairy products has grown markedly during the last 15 years, whereas the average farm milk price has not (Nicholson and Novakovic, 2001). On the surface, this seems to suggest strategies designed to capture a larger share of the consumer dollar can improve farm-household incomes—and redress what is perceived as an increasingly unfair relationship between the farm and retail prices (Morrison, 2001a). Other farmers have been concerned about the effects of consolidation on the number of potential milk buyers (Morrison, 2001b) and see on-farm processing as a way of maintaining more diverse marketing options. Still other farmers see an opportunity to diversify enterprises in response to limited land resources for expansion of milk production and(or) a desire to create additional opportunities for the next generation that may not be possible through increasing milk production alone (Gloy and Stephenson, 2006). Other factors that have facilitated the development of a "specialist food sector" in which farmers can more easily participate are improvements in communications technology (which enhances ordering and marketing, e.g., via the internet), improved and expanded physical distribution systems (Slee, 1991).

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[1] It is difficult to provide an exact date for these changes, in part because they are gradual but also because published statistics do not allow for particularly accurate assessments of the changes over time in on-farm processing or value-added agriculture more generally.

[2] In this document, the term 'value-added' refers to "business strategies that enable the farmer to capture some of the premium that is being harvested further up the marketing channel" (Streeter and Bills, 2003a), that is, means by which farmers can capture a larger share of the consumer food dollar. There are many such business strategies, of which on-farm processing (sometimes in combination with marketing and distribution) is only one.

As interest in on-farm processing (and 'value-added' activities more generally) has grown among farmers and consumers, governments at the national and regional levels have determined that there are benefits to supporting various types of 'value-added' agricultural activities. The main motivations of governments are enhancing or stabilizing farm-household incomes, creating rural employment and economic development, and maintaining land in agricultural (or open) use (Streeter and Bills, 2003a). To achieve these objectives, the US Federal and many state governments have funded "numerous programs dedicated to enhancing farm income with techniques referred to as value added" (Streeter and Bills, 2003a). For example, the 2002 Farm Bill authorized a Value Added Agricultural Product Market Development Grants Program, funded at $40 million per year over the next six years[3]. In New York, an Agricultural Development Program was authorized in 1999 to "help farmers refine specialty niches" and "improve the marketing, processing, storing and manufacturing of agricultural products" (Streeter and Bills, 2003a). Regional "Food Entrepreneurship" and "Agricultural Marketing Resource" research and training centers also have been established with Federal support to provide educational materials, workshops and direct assistance to would-be food processors (including farmers; Padilla-Zakour, 1994; Campbell, 2002). All told, it is estimated that nearly $300 million per year was being spent on (broadly defined[4]) value-added agricultural activities at the state level during the late 1990s (Kilkenny and Schluter, 2001). Although the funding provided to value-added activities is trivial compared to that for the major commodity programs, the sum is large enough that both the impacts of these efforts and their underlying premises should be examined.

Government assistance and financing specifically for the development of on-farm dairy processing efforts are also common, especially at the state level. Since 2003, New York has provided support for the New York State Farmstead and Cheese Makers Guild, which provides production and marketing assistance to artisanal[5] cheese makers. A predecessor to the Guild was the Value-Added Dairy Opportunities Project, operated under the Regional Farm and Food Project, which provided information about small-scale cheese-making, often through workshops linking current and prospective cheese makers beginning in the mid-1990s. In 2004, Wisconsin established an online resource for processors of specialty cheese and dairy products through their non-profit Dairy Business Innovation Center. The DBIC provides a range of services such as business planning, product development specialty cheese education and product marketing. Vermont recently established the Vermont Institute for Artisan Cheese, which promotes education, research, service and outreach efforts for the state's artisan cheese community. It emphasizes specialty cheese production and product marketing. Maryland government agencies sponsored a workshop on farmstead cheese processing in 2000 (Frank, 2000). Even Kansas—not a major milk-producing state—allocated funding to assess the financial feasibility of dairy processing by farmer groups (Hammarlund, 2003). In some cases, private funding has been used to support small-scale dairy processing enterprises. In California, the Artisan Cheese Guild was

[3] A similar grants program called Farm Diversification Grants was established in the UK in the early 1990s (Slee, 1991).

[4] Campbell (2002) defines value-added as "any activity that increases the per unit price received for farm production or "any activity that transforms a product into another product that fetches more revenue on the market". Kilkenny and Schluter (2001) use the accounting approach to value-added, essentially implying that it involves any further processing or handling of raw agricultural products.

[5] The terms on-farm processing, value-added, high value, artisanal, small-scale and farmstead are often used as synonyms or are defined differently by different authors. In this case, "artisanal" means "made in small quantities" (Gloy and Stephenson, 2006).

founded in September 2005 to "support and encourage the Californian cheese making community" with funding from Gallo of Sonoma and Clark Wolf Company, a food and restaurant consulting firm (Gloy and Stephenson, 2006).

As governments have become more involved in supporting value-added agricultural activities, a few observers have attempted to both clarify the underlying meaning of 'value-added' and the objectives of such programs. Some analysts have questioned whether existing knowledge supports the assumptions that appear to underlie them (Hammarlund, 2003; Streeter and Bills, 2003a; Streeter and Bills, 2003b; Stephenson, 1998; Dunn and Revell, 1993). The rhetoric surrounding these programs often seems to imply that value-added enterprises will be profitable (and will therefore increase farm-household incomes) and that the transition from being a primary commodity producer to a processor, marketer, or distributor is relatively easy.

Streeter and Bills (2003a, 2003b) take issue with both of these assumptions. First, they note that existing data do not allow an accurate assessment of the growth in value-added activities or their contribution to farm-household incomes, rural employment, or economic development. Available data are aggregated across households and are based on an accounting interpretation of value-added, rather than on detailed household-level information about income sources and expenses. Thus, they conclude, decision makers are proceeding with program development and funding largely on the basis of anecdotal evidence, and have no clear idea whether the stated objectives of the programs are being achieved. Second, they note that the transition from "commodity producer" to "value-added entrepreneur" typically will require a higher degree of overall managerial skill, key specific management talents, additional assets and additional employees. They emphasize that various types of value-added activities will require different amounts of these resources, and that a careful matching of resources with the type of value-added activity is necessary. They suggest that processing and marketing activities require high-level overall managerial skill, strong specific skills in sales, marketing and employee management, and a large investment in additional assets (Streeter and Bills, 2003a).

The most important element of their critique of existing efforts, however, relates to enterprise-level profitability. They stress that

> The term value-added strategy implies a return to farmers that exceeds what they can hope for in the marketplace for standardized or bulk commodities…the term may lead to the false hope that higher prices automatically equate to higher profits…

They go on to note that "like all entrepreneurial ventures, value-added ventures have some chance of succeeding and a non-trivial chance of failing," and decry the fact that value-added opportunities often are promoted as a way of rescuing farm businesses that "have not yielded satisfactory [financial] returns." They argue that encouraging "struggling" businesses to make additional investments in enterprises that require new skills and new customers often may make the household's financial situation worse rather than better. Other authors have raised similar concerns (e.g., Morrison, 2001c; Gegner, 2001; Stephenson, 1998; Dunn and Revell, 1993).

In addition, the environment for on-farm (value-added) dairy processing appears to be increasingly competitive. Dixon (no date) suggested that "it is becoming increasingly harder to find the niche needed to sustain a business," and Morrison (2001a) noted that although "specialty dairy products offer the best opportunities," larger dairy processing companies were already attempting to fill those niches. As a result, some authors have begun emphasizing the complexity and difficulty of starting a dairy processing business, asking potential on-farm

processors to answer a series of (often detailed) business strategy and financial questions prior to investing too much time or money (e.g., Gegner, 2001; Frank, 2000; Henehan, no date, Dixon, no date). Lower-cost and less risky alternatives to add value to farm milk have been discussed (Stephenson, 1998). Anecdotal reports about specific processing businesses and their successes and challenges have been published (e.g., Hulcoop, 2003; Ebel, 2002; Estrada, 2002; Morrison, 2001a, 2001b, 2001c; Smith and Smith, 2001; Value-Added Dairy Opportunities Project, 1997). Various *ex ante* economic feasibility studies of dairy processing have been undertaken (e.g., Dooley et al., 2005; Maynard, 2005; Hammarlund, 2003; Ekman and Andersson, 1998; Novakovic and Alexander, 1987), a number of which conclude that on-farm processing is likely not to be profitable under a wide range of alternative assumptions about investment costs and product volumes and product prices (of which more below).

Although these previous research and extension efforts are useful, what appears to be entirely lacking in the existing knowledge base is information on the financial performance[6] of currently operating on-farm dairy processing enterprises (and value-added agricultural enterprises more generally; Streeter and Bills, 2003a). This information is important for three principal reasons. First, it is necessary to provide empirical evidence about whether a key assumption underlying government support for on-farm processing is correct. Second, this information is likely to be useful in helping current on-farm processing enterprises to be more successful (through more appropriate educational programs and benchmarking against other on-farm processing businesses, for example). Finally, this knowledge can better illustrate the challenges and strategies of on-farm processing to those who are interested in on-farm processing but have not yet made a decision to invest in it. Streeter and Bills (2003a) highlight this need for information in the more general context of all value-added agriculture using the following strong language:

> …existing published data sources do not use the appropriate unit of study for a detailed empirical examination of value-added and its role in farm family incomes. *This means that policy makers are moving forward in the value added arena with little or no rigorous exposure to empirical evidence and with scant effort to help farmers make informed decisions in the marketplace*. [emphasis added]

They conclude that "household level data is [are] crucial to a meaningful research effort" on value-added agriculture. To a certain extent, it is understandable that such information is not readily available, as it relates to the financial performance of private firms (for whom such information is proprietary). However, previous efforts to collect financial performance data and provide benchmarking information to both dairy farms (Knoblauch et al., 2006) and dairy processors (e.g., Stephenson, 2006) have shown that these efforts are both feasible and useful.

Given the foregoing, the objective of this study is to examine the financial performance of the farm and processing enterprises of a sample of businesses engaged in dairy processing in New York, Vermont and Wisconsin[7]. Financial performance in this case means development of

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[6] It is important to note that an argument in favor of improving understanding the financial performance of on-farm dairy processors does not imply that only profitability is important. On-farm processors have many motivations, and profitability will not be of primary importance to some of them. However, there are two key reasons to study profitability: government policy has identified this as an objective, and for a business to be sustainable in the longer term it should at least break even.

[7] Note that the states are listed in alphabetical order, without this implying anything about their importance in the broader dairy universe.

income statements from both the farm (milk-production) enterprise and the processing (including marketing and distribution) enterprise, but also consideration of the balance sheet and the full economic costs of processing dairy products on-farm. In addition, we provide information on the basic characteristics (milk processed, number of animals) of these enterprises, their use of labor in milk production and processing and their choice of marketing outlets. We also describe an initial statistical analysis of factors associated with various financial performance indicators. A key conclusion of this research is that additional efforts of this type are both necessary and practicable.

The structure of the remainder of this document is as follows. We first briefly review selected research from the limited amount available on the financial performance of what are often termed 'value-added' dairy enterprises. This is followed by a description of the methods used to collect the data from 27 on-farm dairy processing businesses in New York, Vermont and Wisconsin. A summary of basic business characteristics, incomes statements and balance sheets and the factors associated with them is presented in the results section. We conclude with the implications of this study for future research efforts and policy decisions.

Previous Research on 'Value-Added' Dairy Processing Enterprises

As noted above, the previous research on the financial performance of value-added dairy processing enterprises is limited. Information is available primarily from three types of studies: descriptive case studies, studies of market potential or willingness to pay (which of course provide only indirect indications of the feasibility of a processing enterprise) and *ex ante* assessments, often in conjunction with a business planning exercise. The review below is intended to be illustrative rather than exhaustive, that is, to describe the types of information commonly available and their implications.

Descriptive Case Studies

The information in descriptive case studies[8] about financial performance is often of the non-specific "read between the lines" variety. Descriptions of farm characteristics, product lines and the number and types of customers are much more common than discussions of profitability (Hulcoop, 2003; Ebel, 2002; Estrada, 2001; Morrison, 2001b; Smith and Smith, 2001). Product selling prices and expected (often approximate) gross margins or gross revenues are mentioned by authors (Morrison, 2001b; Estrada, 2001). In most cases, the information is available from project-based newsletters (e.g., Value-Added Dairy Opportunities Project, 1997; Morrison, 2001a) that cater to an agricultural audience potentially interested in value-added opportunities or locally-oriented popular press articles discussing a new company or product (Ebel, 2002; Estrada, 2001).

In some cases, the article describes the businesses marketing strategy and other challenges faced by the business. Morrison (2001c) relates the history of a fluid milk processing and distribution business in Minnesota and its challenges, along with the factors that ultimately led them to sell that business to another processor. This example describes the large time commitments that "eventually got to be overwhelming." A director associated with the project publishing the newsletter noted that their experience "is not unusual among new small businesses, which are often stretched to the breaking point by lack of capital and labor." Echoing the issues raised by

[8] Most of the examples cited in this section are not full case studies in the formal sense but descriptive discussions of dairy processing enterprises owned and operated by individual farms or small cooperatives.

Streeter and Bills (2003b) about the types of skills and resources necessary to successfully make the transition to value-added processing, Morrison (2001c) notes that the owners were "really running four businesses themselves: milk production, milk processing, product distribution and marketing." The information on the financial performance of this business was that as long as the four family members "did everything, their venture paid the bills." Thus, these descriptive summaries provide relatively limited information about the financial performance of value-added dairy processing businesses, but they raise issues of importance for current and potential processors to consider. Although it is probably unreasonable to expect that popular press articles will adequately discuss issues of profitability, publications related to value-added oriented projects probably can—and probably should—increase their reporting of financial performance, even if only in a qualitative manner.

Studies of Market Potential and Consumer Behavior

A number of studies have examined the potential for value-added dairy processing by exploring the potential size of the market, perceptions of consumers or retailers about new, farm-processed dairy products, or competitive assessments of how easily new businesses can enter dairy processing. These studies do not predict the profitability of farm-level processing *per se*, but provide information helpful to making inferences about it. In most cases, these studies appear to have been implemented by agencies that have received Federal or state funds to support the development of value-added agriculture. In general, the methods used are descriptive (and the presentation of data is not overly detailed).

Morrison (2001a) describes two case studies funded by the Agricultural Utilization Resources Institute (AURI), a non-profit corporation that "helps businesses response to market opportunities with new and value-added uses for agricultural goods." Both studies were in response to the perceived gains available to farmers based on the farm-to-retail price spread for fluid milk. The first study was conducted in 1999 for the Agassiz Valley Cooperative, a group of 25 dairy farmers who were interested in on-farm fluid milk bottling. The Strategic Performance Group of Minneapolis studied dairy product consumption trends, wholesale and retail distribution channels, retail "slotting" and promotional fees, demand for "specialty milk" products like organic milk and private-label processing for retailers. The SPG study found that the satisfaction of retailers with current fluid milk supplies was high, and that competing against them was likely to "lead to price concessions and marginal profitability." As a result, Agassiz Valley Cooperative eschewed investment in a processing facility and began exploring a collective supply agreement with "an established milk processor." A second study, carried out by staff at the University of Minnesota, Crookston, sought to identify "economic and market barriers" to on-farm milk processing. This study found that the largest challenge is gaining market access, due to the high concentration and competitiveness of the fluid milk processing industry in the Upper Midwest. In the face of this competition, the study concluded that "specialty dairy products" likely present the best opportunities for new processing enterprises, but that the "established processors are already moving aggressively to fill and promote those niches." In the final analysis, Morrison (2001a) concluded that

> The current milk processing distribution system is too well established for small newcomers to enter easily. However, there are niches in natural food markets for producers willing to work long hours in a high-risk, shoestring venture.

Although the niches for other dairy products may be more easily accessed and maintained, it appears that fluid milk for distribution through existing retail outlets would be a challenging endeavor for would-be on-farm processors. Other on-farm fluid milk processors undertake home delivery or promote special characteristics of their milk (e.g., "grass fed" or "Guernsey") that differentiate their products from the milk sold through the major retail outlets (Morrison, 2001b, 2001c). These enterprises may have different financial prospects than those reviewed above.

Hammarlund (2003) describes a study in Kansas that had the objective of assessing whether the demand for "differentiated milk products" (essentially, organic milk) in metropolitan areas of the state was sufficient to support value-added enterprises[9]. The study employed a mail survey of consumers at retail supermarkets that sold conventional, organic and natural food products. A sample of 1000 consumers was identified based on transaction data, and these were classified into "milk drinkers" and "organic food consumers." The mail survey resulted in a total of 547 usable responses. The survey included an assessment of willingness to pay for organic milk by each of these two types of consumers. The study concluded that although the "organic food consumers" would be willing to pay a considerable premium for organic milk (up to $4.05 per gallon), for "milk drinkers" this premium was considerably smaller. Smaller families were more likely to consider purchases of organic milk, and household income was not a significant factor explaining organic milk purchases. Based on these and other summary statistics, Hammarlund (2003) concluded that "clearly there is a market for organic milk [in Kansas] but its size is small."

Other studies have examined whether the market for "specialty cheeses[10]" is adequate to support value-added dairy processing. Focusing on New York, Gloy and Stephenson (2006) indicated that available data on specialty cheese production is limited, so it is not possible to accurately estimate the current size of the overall market, recent rates of growth in production or sales, or future market potential. They believe that "…market signals suggest that consumers are eager to try high quality specialty cheeses." Instead of quantifying market size, they focused on understanding the extent to which certain key buyer segments (wineries, specialty food stores and expensive restaurants) are interested in new specialty cheese products and how much they might be willing to pay for them. They also identify the preferences for each of these buyer groups in terms of product quality and delivery schedules, and indicate various distribution arrangements that could be used by on-farm cheese makers.

This study employed a series of mail surveys for each of the buyer groups and 31 small-scale dairy processors identified by the New York Department of Agriculture and Markets. Although the number of respondents from these groups was often small (11 specialty food stores, 16 restaurants and 56 wineries responded), the surveys found that in general there was interest in new specialty cheese products among each of the buyers. Wineries and specialty food stores indicated a willingness to pay about $7 per lb for farm-produced cheeses (the study was not

[9] This study is rather typical of others (e.g., Maynard, 2005; Gloy and Stephenson, 2006) in which "market size" and consumer "willingness to pay" are assessed to determine the "potential" for value-added agricultural enterprises. Of course, these studies provide only indirect evidence on profitability, and would typically be one component of a formal business planning exercise.

[10] The definition used by Gloy and Stephenson for "specialty cheese" is cheese with a small total volume of production. Based on the definition employed in Wisconsin, "small" can mean up to 40 million lbs of cheese per year. This definition is rather non-specific. For example, is a "farmstead cheddar" a specialty cheese even though the overall volume of cheddar cheese manufactured in the US is about three billion lbs.

specific about cheese varieties and there was a good deal of variation in responses, particularly for wineries) and restaurants considerably more ($19 per lb, but for relatively small quantities). Despite these large reported premiums over commodity cheese prices, Gloy and Stephenson note that "specialty cheese production can have high unit costs of production" and potential on-farm cheese makers should "study their production cost structure carefully." In addition, most of the buyers stated that their volume of cheese purchases would vary by season, with potentially-important implications for a small-scale cheese producer. Specialty food stores also indicated that they source product from the entire US (not just New York or the Northeast), and that imported specialty cheeses are often less costly than their US-produced competitors. This implies that despite their proximity to major urban markets, New York specialty cheese makers must still compete with others elsewhere on the basis of quality, price, and convenience. The eight on-farm processors who responded to the survey indicated that they marketed their product largely through farmer's markets and other local retail outlets (rather than through the buyer groups examined by the study).

Maynard (2005) examined the market potential for fluid milk and dairy products (butter and yogurt) made from milk high in conjugated linoleic acid (CLA; there is evidence that this compound helps prevent cancer and has other health benefits). This paper reports the results of two types of consumer-oriented studies. The first was a taste-testing of products by 111 consumers made with high-CLA milk to determine if they were acceptable; because fish oil was used in the ration fed to dairy cows to induce higher-CLA milk, there were concerns about off-flavors. The taste tests indicated that although there were "no persistent, identifiable off-flavors," there is "a need for caution and testing by experienced processors" because consumers either had no preference or preferred a set of "control" products made with standard milk. In the study of willingness-to-pay, the same 111 consumers were asked to indicate how much more they would pay for "cancer-fighting" products above the regular price. Respondents were provided with information on recent retail prices and were asked to choose one of fifteen responses ranging from a premium of 0 to 85 percent, or write in a response if that was preferred to any of the offered choices. On average, the respondents indicated that they were willing to pay $0.41 per gallon more for fluid milk, $0.38 per lb more for butter and $0.15 per 8 oz cup of yogurt made from high-CLA milk[11]. The analysis also identified households with children and health-conscious consumers as the market segments likely to have the highest willingness-to-pay values.

Gellynck and Viaene (2002) discuss the additional challenges faced by value-added farmers, including the small (and sometimes dispersed) nature of niche markets, the reluctance of traditional retailers to work with smaller producers, and consumer market segments with different motivations for purchasing "processed farm products." They argue that value-added producers need to adopt a pricing strategy based on knowledge of product characteristics valued by consumers. To demonstrate one approach to generating this information, they discuss important characteristics of on-farm processed skim set yogurt with a small group of yogurt consumers, then surveyed 249 Belgian consumers about packaging, sales outlet, price, shelf life and extent of information about the product. A conjoint analysis of the survey data indicated that packaging, not price, was the most important product attribute. Purchase of the product at the farm was also a desirable characteristic. Different segments of the consumers surveyed had

[11] The distributions of responses shown in Maynard (2005) are decidedly non-normal and it appears that for each product the median value is less than the mean value reported herein.

different willingness to pay for yogurt processed on farm, and a range of "acceptable prices" based on expressed consumer preference indicated that this range was large (from 0.77 to 1.26 Euros for 500 grams, or $0.70 to $1.21 per lb at 2002 exchange rates), and that prices currently charged by some farmers were too low relative to these ranges. They used two preference score indicators to predict the market share of yogurt with various combinations of packaging, market outlet, price, shelf life and information. The product with the largest market share overall was predicted to have 20.4% of the market; the least, 4.9%. This large difference in shares for what is essentially the same physical product illustrates, as Gellynck and Viaene put it "adequate market positioning can result in capturing additional…income." The also found that "pricing higher than the conventional, industrial counterparts" was the best strategy for retaining a larger part of what the final consumers pay at the regional level," due to inelastic demand.

Ex Ante Profitability Estimates

A third approach to assessment of the financial performance of on-farm dairy processors is to develop *ex ante* (or forecast) analyses, often based on budgeting approaches or economic engineering methods. Thus, these analyses are undertaken prior to the initiation of an actual business endeavor and are based on the best available information about the costs of various processing technologies. Often, they assume that a given quantity of product processed by the farm can be sold at a given price, with greater emphasis on the costs of processing. These type of analyses are often one component of a formal business plan, but some are structured as tools (software) that allow different individuals to assess the likely costs and returns of their individual proposed business.

Novakovic (1986) and Novakovic and Alexander (1987) studied the financial feasibility of on-farm ultrafiltration. This is an example of a value-added strategy that involves relatively minor modification of the product on-farm with processing, and for which sales of the product are made to the same buyers. These studies examined economic impact of on-farm ultrafiltration (UF), alone or in combination with 'thermalization,' on New York and Wisconsin dairy farms. These practices can increase storability of milk and reduce farm milk hauling charges. The material that passes through the filters (the permeate) can be feed back to cows and provides primarily energy (rather than protein or other nutrients). There can also be benefits to cheese manufacturers in terms of increased plant efficiency and cheese yield. They examined the investment and operating costs for the farm compared with the savings due to a reduced volume of milk to be cooled and feed savings. They also examined the impact of a number of farm sizes, milk production per cow, reduced hauling charges and a price premium for the concentrated product (the retentate). When only farm-level costs and savings were considered, net farm returns were negative for all farm sizes and milk production levels. When hauling and plant cost savings were accounted for, some combinations of farm size and current hauling costs resulted in on-farm UF being profitable. They concluded that on-farm UF would be more profitable for large farms (those with larger than 400 cows), farms with very high hauling costs, and understandably, when cost savings to cheese plants are larger and shared to a greater extent with farmers. More recent analyses by Stephenson (1998) suggest that on-farm UF is profitable for farms with 7,000 or more cows located in low-milk-price areas.

Frank (2000) describes an overview of the questions to be asked by those considering a dairy processing business. It includes a spreadsheet to begin assessing the financial returns from the proposed enterprise. It includes input screens on Products, Sales and Prices, Labor and Management Costs, Production Rates (Set up and clean up information), Miscellaneous Costs

and Capital Investment and Financing. For an example of a cheese processor selling 1,100 lbs of cheese a week during April through November at farmers markets and through local retailers, predicted profits were $5,009. Frank notes, however, that "…there are no typical results. Every business opportunity is different and each one has to be analyzed on its own. That is the reason the spreadsheet decision aid was developed." He also shows how the spreadsheet decision aid can be used for sensitivity and break-even analyses. Initial break even quantities are about half a million lbs of milk processed. If labor costs increase by 20%, returns are negative. Under the best case scenario analyzed (a cost decrease of 20%), net cash increases to $16,000 and the break-even quantity is about 400,000 lbs of milk processed (i.e., 20 cows producing 20,000 lbs per year).

In addition to reviewing the evidence about market potential for fluid milk products in Kansas, Hammarlund (2003) summarized evidence about the likely returns for organic milk production and calculated profitability of on-farm fluid milk and cheese processing. These latter analyses are aimed at groups of producers who would begin a moderate-scale processing 'cooperative venture' making 'traditional' products (e.g. fluid milk), rather than at individual small-scale fluid milk or cheese producers, so the cost estimates are for moderate-sized processing facilities. With regard to the returns to organic milk production, Hammarlund (2003) cites an analysis using the financial software FINPACK provided by the Kansas Organic Producers Assocation. For a farm plan that includes 60 cows producing 17,000 lbs of organic milk per cow, 250 acres of cropland, total assets of $479,840 and a debt-asset ratio of 0.45, projected net incomes ranged from $48,000 to $84,000. He notes that the projected per-acre from this activities are above average, so should spur growth. From the observation that major growth in organic milk production has not occurred, he concluded that these reported financial returns are overestimated.

The analysis of fluid milk and cheese processing uses best estimates of processing costs for what Hammarlund terms (small to moderate) size plants[12]. He notes that "Data from Cornell University studies of the cheese and fluid milk processing industries document the tremendous economies of scale in dairy processing…therefore smaller processors must find market opportunities that provide substantially larger gross margins." For both fluid milk and cheese, he compares estimated cost of processing with assumed gross margins. This is done to minimize the effects of variation in milk costs. This assumption will be more appropriate when the profitability of processing is the only element of the analysis. For on-farm dairy producers whose costs of milk production and processing will influence overall business returns, it is necessary to consider both costs. In this case, the gross margin approach provides only limited information.

For fluid milk processing (of basic white milk, not home delivery, organic, etc.), an operation processing 86,000 lbs of milk per day (milk from about 1,800 cows producing 17,000 lbs per cow per year) would have estimated expenses totaling $0.93 per gallon, including charges for milk delivery to buyers. The largest of these costs is labor, which for processing and delivery totaled $0.24 per gallon. Net returns were calculated for four assumed gross margins (which included cream sales), $0.53, $0.63, $0.84, and $0.99. Of course, only the last of these is profitable, yielding 0.06/gallon, or about $18,606 in net income for the processing enterprise (or about $10/cow). Stephenson (1999) estimated that gross margins for fluid milk processors with

[12] These plants are small relative to the largest plant sizes, but often quite large compared to the proposed size of many 'value-added' dairy processing enterprises.

volumes of 1 to 2 million lbs per day (i.e., 10 to 20 times larger than the volume assumed by Hammarlund) were about $0.64/gal. Although this gross margin may have increased somewhat in the intervening years, it is likely that the assumed $0.99/gal is too high for commodity fluid milk. Estimated expenses for a plant processing four times more milk than the previous case (340,000 lbs per day) were $0.60 per gallon, which implies a small positive net income based on the estimated gross margin from Stephenson. Hammarlund noted that smaller facilities would likely have higher transportation costs, as much as $0.06 per gallon larger, and therefore lower profitability for a given gross margin.

For a cheese plant producing commodity just over 1 million lbs of cheddar per year (about 28,300 lbs per day or 566 cows) total expenses were estimated to be $0.32 per lb. This estimate may be quite a bit too low, given that cost functions developed from recent cheddar cheese plant surveys (Stephenson, 2006) indicate that a plant of this volume would have average costs around $0.85 per lb. According to Hammarlund, however, a gross margin of $0.40 would provide a return of $79,464 to a cheese plant of this size. For both fluid milk and cheese processing, Hammarlund notes that the initial investment, maintenance and deprecation costs are difficult to estimate. This is because, for cheese plants in particular, "Most small dairies that process their own production (producer/handlers) build their plants using used processing equipment. It is technologically inferior to the new automated plants, but it is extremely serviceable for operations of this type." Ultimately, Hammarlund found that in general the highest assumed gross margins were necessary for the processing enterprise to be profitable at the scales examined.

In a study somewhat reminiscent of the Novakovic and Alexander study of on-farm ultrafiltration, Dooley et al. (2005) examined the price premium that would be necessary for farmers to break-even with on-farm segregation of milk by various characteristics. They note that "Natural variation exists between cows and herds in the many proteins, fats, carbohydrates, vitamins and micro-elements that constitute milk…An opportunity exists for dairy processing companies to take advantage of this natural variation by ensuring milk from different cows, herds or regions is kept separate until processing can commence at the factory…greater interest in developing niche markets and better meeting customer requirements has lead to interest in the possibility of on-farm milk segregation." Farmers can modify milk characteristics by management, genetics and feeding. Extra on-farm costs may be incurred in the production and storage of specialized milk, and greater transport and processing costs may be incurred because of the need for milk tanker re-routing and separation of milk at the factory. They examined two traits: B beta lactoglobulin (superior to milk from cows with AA or AB beta lactoglobulin for cheese making, milk powder production and UHT milk production) and milk color (whiter milk—less beta carotene—is "preferred by consumers in some markets"[13]). Changes were made either by breeding and segregating cows based on milk color, or by breeding or selecting cows with BB. Milk processing was not modeled, but a "transport sub-model" was used to assess the cost implications of "differentiated milk collection logistics" using a least cost (evolutionary algorithm) where none, 25%, 50% and all farms switched over to another milk type during the 20-year period. They used cost-benefit analysis over a 20-year time frame to calculate the break-even premium over 10 and 20 years. A 38.4% premium was required for "whiter" milk segregation on-farm for the farmer to break even over 20 years. Required premiums for the BB

[13] In contrast, the Whole Farm and PastureLand cooperatives discussed in Morrison (2001b) market dairy product to consumers interested in *higher* amounts of beta carotene.

herd to break even were generally much lower, on the order of 5%. An important element of these strategy is that the time required for implementation and a positive return is more than a decade.

In addition to research on product acceptability and willingness to pay, Maynard (2005) estimated the profitability of producing high-CLA milk and small-scale processing[14] Additional milk production costs for feed were estimated at $0.97 per cwt. Increased transportation costs were estimated to be $0.11 per cwt, $0.10 per cwt for milk testing, feed mixing, and other unforeseen costs. Thus, the total cost increase for milk production was estimated to be $1.18 per cwt. The analysis used milk equivalent conversion factors to get yields of products (fluid milk, butter and yogurt), and assumed that the farmers' share of the dairy retail dollar for these products would be the same as what USDA said in 1999. This assumes that another business entity is doing the processing and the farmer receives the price a fixed proportion of the retail price. The increases in retail prices required for farmer breakeven were $0.35 per gal milk, $0.33 per lb for butter and $0.04 per cup for yogurt, which Maynard concluded were attainable based on the willingness to pay research results.

An analysis of on farm-processing was based on capital costs using information from the Pladot Company, which sells equipment for mini-dairies. Milk production costs were assumed to be $17.38 per cwt for KY producers, based on the full economic cost. To estimate processing costs, information from California's survey of smaller, higher-cost butter and cheese plants high-cost was multiplied by three to estimate a likely upper limit. This resulted in processing costs of $0.39 per lb for butter and $0.64 per lb for cheese[15]. Yogurt processing was assumed to cost $0.30 per lb and fluid milk costs were assumed to be $0.20 per lb. Given fixed proportions of each product processed on-farm, processing costs totaled $21.20 per cwt of raw milk processed Distribution and retailing costs were assumed to be $8 per cwt, promotion $4 per cwt and $10 per cwt were added to reflect unforeseen costs. The analysis assumed a retail cheese price of $4 per lb. Total revenue was estimated to be $81.15 cwt, before tax profits were $6.83 per cwt for 250 gal per day (2,150 lbs per day), profits were calculated to be $53,584 and return on processing capital was 15%. Maynard concluded "These results suggest that small-scale dairy product manufacturing offers potentially attractive opportunities for farmers willing to develop expertise in value-added processing and marketing." However, he also noted that this outcome was derived based on a number of uncertain assumptions, particularly on the price and cost of processing side.

One recent study conducted a relatively qualitative assessment of the profitability of specialty cheese processors (i.e., processors of cheese varieties produced in limited volumes) in Wisconsin (Greenberg, 2005). As a part of a larger survey, 14 artisan cheese makers were asked whether or not they were profitable in 2002, and 54% of them responded positively[16]. However, the definition of profitability in this case was left to the processors, and a more detailed assessment of financial records was not conducted. Thus, the limited evidence from previous studies presents a rather mixed picture. In most cases, on-farm processing required fairly optimistic assumptions about costs or price premiums to be profitable. The focus of many previous studies

[14] However, if this is a profitable product with sufficient demand, larger processors would probably be interested in the opportunity and have lower processing and distribution costs.
[15] Again, based on cost estimates from Stephenson (2006), this estimate for cheese processing appears markedly low.
[16] Presumably, this is 7 of 13 artisanal cheese makers who answered the question.

on costs of processing (but not milk production) and the need for assumptions about the likely returns again suggests that *ex post* (or after-the-fact) assessment of the financial performance of on-farm processors would be a useful complement to existing information.

Methods

The principal methods employed in this analysis are survey data collection and statistical analysis. The former involves the identification and selection of survey participant, collection and review of their financial information, and generation of reports describing individual business performance and benchmarking compared to other businesses processing the same product. The statistical analyses are primarily tabular summaries of key variables, but simple regression analysis provides some additional insights about the business characteristics associated with net business income from the farm and processing enterprises.

Participant Selection

In many surveys, a random sample is selected from an appropriate sampling frame, which, if all of the randomly-selected participants provide complete information, allows the strongest inferences to be made about the population of interest. For New York, the sampling frame consisted of 31 small-scale processors identified by the New York State Department of Agriculture and Markets, which regulates dairy processing facilities. These 31 businesses represented the entire population of on-farm processing facilities in New York at that time, and included businesses processing milk from cows, goat and sheep. For Vermont and Wisconsin, a complete listing of on-farm processors was not available, so the sampling frame was developed based on various sources, such as these states' equivalent of the Department of Agriculture, from on-going research and assistance projects that identified on-farm processors as a part of their previous experience, from agricultural lenders, and from various on-line information sources about companies operating on-farm dairy processing businesses. The sampling strategy was essentially the same in each case: identify all possible small-scale dairy processing businesses and request their participation.

Each of the businesses identified was sent a letter inviting them to participate in a survey of value-added dairy processing enterprises. The participants were told they would receive a summary of their business' financial performance (primarily a net income statement and a balance sheet), a report allowing them to compare selected types of financial performance to other value-added dairy processing businesses selling the same products, and $250 to compensate them for the time required to compile the requested financial information. A total of 27 businesses in the three states agreed to participate (7 in New York, 12 in Vermont and 8 in Wisconsin)[17]. Although the overall sample size is small, the seven New York respondents represent just under one-quarter of the 31 identified small-scale dairy processors. The extent to which the sample is biased through self-selection is difficult to determine given limited information on the non-participating on-farm processors. Thus, we exercise caution in the extrapolation of the results of this research to the larger population of on-farm dairy processors in these three states.

[17] A more complete discussion of the characteristics of farms is found in the results section.

Data Collection and Checking Methods

Data collection was undertaken by different enumerators in the three states. Each of these individuals has significant experience in the collection of farm financial data. Participants were first sent a summary of the financial information required for the survey (more below and in Appendix A), then were visited by the survey enumerators to review the available information. Once the data were determined to be reasonably complete and accurate, they were entered into a stand-alone data entry and analysis application developed specifically for this project. The records entered into this program were automatically emailed to the principal investigators, and were then reviewed for completeness, internal consistency and extreme values using the approach described in Randolph (1991). Questions about missing or internally inconsistent data were referred back to the enumerators and the business owners, then entered or modified as appropriate. When data from an individual business was finalized, an individual business performance report (Appendix B) was generated and mailed to the participant. When all data collection and clarification efforts were completed, a benchmark report was generated for each business (Appendix C), comparing selected financial measures to the other businesses processing the same products.

Data were collected to allow enterprise accounting on an accrual basis[18]. The principal types of information included are farm receipts and expenses, processing enterprise receipts and expenses, farm and processing assets and liabilities, labor provided by the owner operator, family members and hired labor for the farm, processing or marketing. The participants also provided information on the percentage of their product sold through various outlets and the price they received in each outlet. In order to assess motivations and educational needs, participants were also asked to indicate their primary reason for undertaking dairy processing, principal sources of information used to start the processing business, key challenges facing the business in the next year, and the extent to which the participants cooperate with other value-added processors. Additional details on the type of information collected and definitions of the data categories can be found in Appendix A.

Data Analysis

A key objective of this analysis was to determine the financial performance of the farm and the processing enterprises for on-farm processors. This separation provides additional information about the factors underlying overall business performance. Streeter and Bills (2003b) and Morrison (2001c) note that it is more challenging to manage a multiple-enterprise business than a single-enterprise one. Enterprise accounting allows us to address questions such as "Would financial performance be enhanced for on-farm processors by focusing on one or the other of the enterprises?," for example, buying milk for processing rather than producing it on-farm. Another advantage of the enterprise accounting approach is that it facilitates the identification of labor usage in milk production, dairy processing and marketing. Previous authors have noted that the labor requirements for on-farm dairy processors can be large (Morrison, 2001c).

Although in most cases, the separation of farm and processing enterprise accounts is straightforward, the one exception is the value of the milk used in processing. This "transfer

[18] The methods are similar to those employed in the collection of data for the Dairy Farm Business Summary project (e.g., Knoblauch et al., 2006), but data collection includes processing and is less detailed for the farm enterprise. Some of the participants used cash accounting procedures, but for these businesses it appeared that there would have been relatively small differences between the results of cash versus accrual methods.

value" is used to calculate revenue for the farm enterprise and expenses for the processing enterprise. When the farm sold raw milk in addition to processing, the transfer value was the milk price received. If the farm did not sell raw milk, they were asked to provide a value at which they believed the milk could be sold, and this value was used calculate the transfer value. Because the transfer value is calculated so that the revenues to the farm and the expense to the processing enterprise are equal, the transfer value affects individual enterprise performance but not overall business performance.

The key analyses include a net income statement for the farm enterprise, the processing enterprise and the overall business, a per-hundredweight income statement, a balance sheet for the farm enterprise, the processing enterprise and the overall business, and the calculation of the full economic costs and returns per hundredweight of milk processed. The calculations and assumptions used to develop the net income statement are similar to those used by the Dairy Farm Business Summary Project (DFBS; Knoblauch et al., 2006). Net income is calculated as receipts less expenses, expansion livestock (for the farm enterprise) and depreciation. Labor and management income is calculated as net income less unpaid family labor (valued at $2,200 per month) and real interest of equity assuming a 5% rate of return on equity. The net income statement per hundredweight uses the amount of milk produced for the farm enterprise and the amount of milk processed for the processing enterprise. The balance sheet is based on information on the market value of all assets and liabilities (including leases) as of December 31, 2003 and is used to calculate standard measures of financial performance such as net worth, debt-to-asset ratios and the current ratio. Dwellings and other personal assets were excluded from the reported debts and assets. The buildup of economic costs and returns includes expense items from the net income statement per hundredweight, but adds the value of operator's labor and management (provided by the participants), unpaid family labor and interest on equity. This total cost per hundredweight of milk processed is compared to the average per revenue received from product sales to calculate a net return per hundredweight over total economic costs.

To assess the associations between multiple factors and the financial performance of the processing enterprise, a simplified linear regression analysis was performed. Due to the small size of the sample this analysis includes a limited number of variables, including the amount of milk processed, the number of years the processing enterprise has been operating, the total value of assets employed in processing, full-time equivalents (FTEs) of hired labor used in processing, whether the principal product was cheese or not and whether the majority of the product was sold through a retailer or farm stand. Analyses of the determinants of firm-level financial performance are often conducted using panel data (e.g., Goddard et al., 2004; Vlachvei, 2002). Observations are available for only a single year in this case, so the analysis does not employ more sophisticated econometric modeling techniques. The results of this statistical analysis should be viewed as providing initial insights about the determinants of processing enterprise profitability rather than as definitive.

Results

On-Farm Dairy Processor Characteristics

A majority of the participants produced and processed cow's milk; one business processed both goat and cows milk (Table 1). The most common main product produced and sold was cheese,

Table 1. Selected Characteristics of N=27 On-Farm Dairy Processors

Characteristic	Number of Participants
State	
New York	7
Vermont	12
Wisconsin	8
Type of milk processed	
Cow	16
Goat or sheep	10
Both cow and goat	1
Main product sold[1]	
Cheese	18
Fluid milk	6
Yogurt	3
Sold product	
Cheese	19
Fluid	8
Yogurt	5
Ice Cream	2
Butter	1
Cream	1

[1] Main product sold is defined as product from which the majority of processing revenues are received.

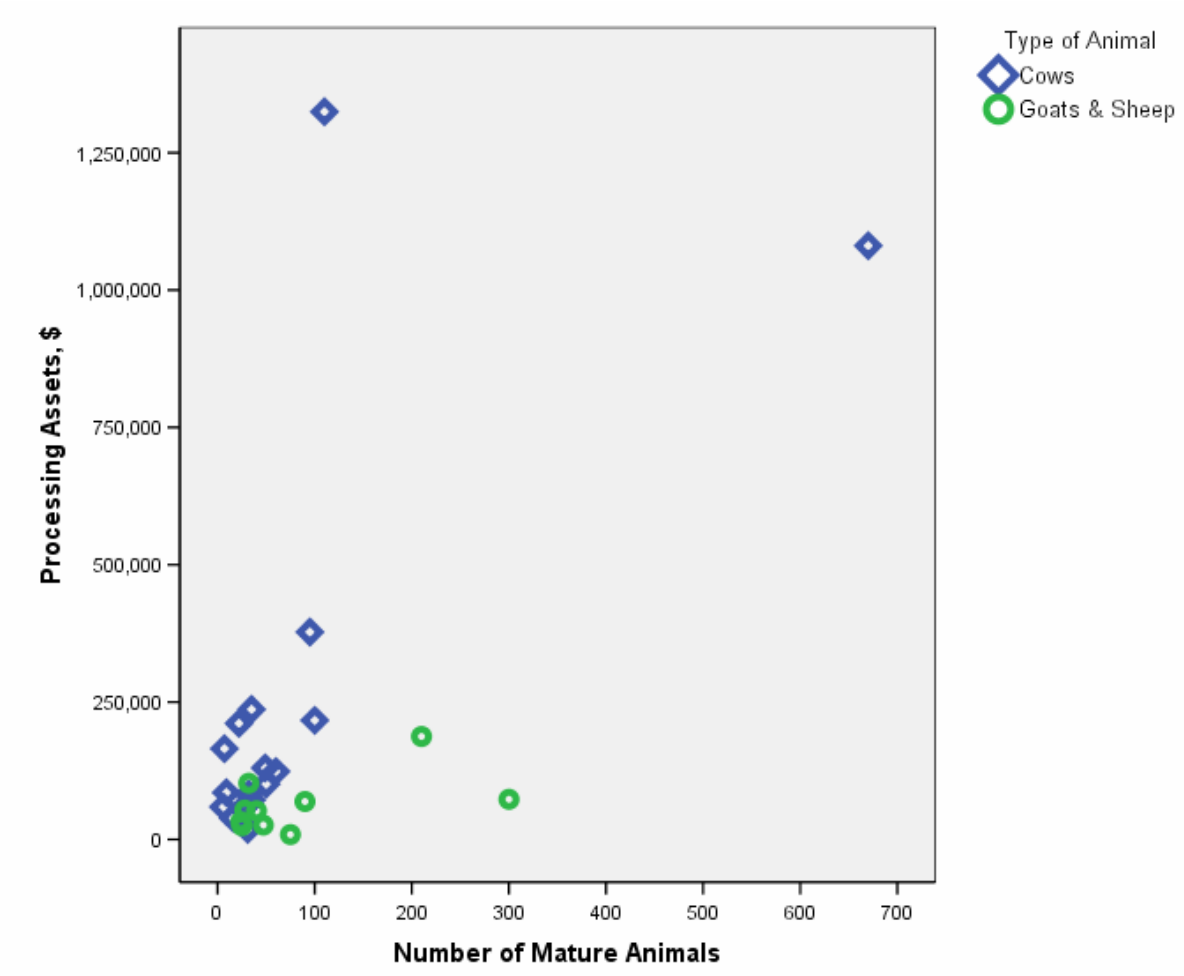
followed by fluid milk products and yogurt. Three on-farm processors sold ice cream, butter or cream in addition to a main product. There is a great deal of variation in the number of years the businesses surveyed have been operating a farm (Table 2), and both the mean and the maximum values are higher for businesses producing and processing cow's milk. Milk production averaged nearly 600,000 lbs per year, and milk per cow was relatively low at about 11,500 lbs per year. For cow's milk processors, slightly more than half of the milk produced was sold rather than processed; 10 of 16 cow's milk farms sold some raw milk (Table 2). This implies that on-farm cow's milk processors retain traditional market outlets for a substantial proportion of their raw milk production, and may imply that this is a necessary component of a successful transition strategy to on-farm processing for larger cow's milk producers. The proportion of

Table 2. Selected Farm Characteristics of On-Farm Dairy Processors, by Animal Species

Characteristics	Statistic	Type of Animal		
		Cows (N=17)	Goats & Sheep (N=10)	Total (N=27)
Years in Farming	Mean	16.9	9.5	14.1
	s.d.	17.7	7.1	15.0
	Maximum	62.0	20.0	62.0
	Minimum	1.0	1.0	1.0
Milk Production, lbs	Mean	563,037.1	66,743.2	372,154.8
	Minimum	43,307.0	12,242.0	12,242.0
	Maximum	1,789,626.0	332,000.0	1,789,626.0
	s.d.	527,345.1	95,130.8	480,357.4
Milk Production Per Animal, lbs	Mean	11,554.6	891.8	7,453.5
	Minimum	4,402.0	163.0	163.0
	Maximum	17,896.0	2,300.0	17,896.0
	s.d.	4,466.0	602.4	6,331.2
Milk Sold, lbs	Mean	290,348.2	9,770.0	182,433.5
	Minimum	0.0	0.0	0.0
	Maximum	1,209,232.0	86,000.0	1,209,232.0
	s.d.	406,887.9	26,965.7	344,927.0
Total Tillable Acres, Owned and Rented	Mean	166.0	45.9	119.8
	Minimum	0.0	0.0	0.0
	Maximum	650.0	130.0	650.0
	s.d.	208.0	46.5	174.1
Total Acres Pasture	Mean	43.0	31.4	38.5
	Minimum	0.0	3.0	0.0
	Maximum	108.0	110.0	110.0
	s.d.	29.7	32.3	30.6
Number of Mature Animals	Mean	42.9	87.1	59.9
	Minimum	6.0	24.0	6.0
	Maximum	110.0	300.0	300.0
	s.d.	33.0	93.6	65.5

sheep or goat's milk sold rather than processed was much smaller, only about 15% of total production, and only 3 sheep farms sold milk. In addition, four farms purchased milk to be used in processing as a supplement to the milk they produced. There was a wide variation in the total number of animals owned (from 6 to 660); goat and sheep processors had larger average animal numbers (Table 2 and Figure 1). The average cow's milk processor had 43 cows; the average goat and sheep milk processor had 87 mature animals.

Figure 1. Animal Numbers and Processing Assets of On-Farm Dairy Processors, by Animal Type



Both cow's milk processors and sheep and goat's milk processors had been processing on average for about 6 years (Table 3). Seventeen of the processors had been processing for three years or less, and only 6 of the processors had been doing so for more than 10 years. Thus, this sample represents relatively new processing businesses that are probably still learning about how to develop a financially successful processing enterprise. Farm milk used in processing averaged about 750 lbs per day for cow's milk and about 150 lbs per day for goats and sheep. Thus, these

Table 3. Selected Processing Enterprise Characteristics of On-Farm Dairy Processors, by Animal Species

Characteristics	Statistic	Type of Animal		
		Cows (N=17)	Goats & Sheep (N=10)	Total (N=27)
Years in Processing	Mean	6.5	5.9	6.3
	s.d.	13.3	6.2	11.0
	Maximum	54.0	16.0	54.0
	Minimum	0.0	0.0	0.0
Farm Milk Used in Processing, lbs	Mean	272,063.9	56,973.2	189,336.7
	Minimum	9,000.0	2,242.0	2,242.0
	Maximum	1,204,500.0	246,000.0	1,204,500.0
	s.d.	305,084.9	69,556.6	262,632.6
Purchased Milk Used in Processing, lbs	Mean	40,296.5	736.8	25,081.2
	Minimum	0.0	0.0	0.0
	Maximum	540,277.0	5,368.0	540,277.0
	s.d.	135,850.8	1,744.4	107,049.5
Total Milk Used in Processing, lbs	Mean	312,360.4	57,710.0	214,418.0
	Minimum	9,000.0	4,242.0	4,242.0
	Maximum	1,744,777.0	246,000.0	1,744,777.0
	s.d.	427,174.6	69,467.2	356,632.1

are quite small operations in comparison to most commercial dairy processors. In addition, four farms purchased milk to be used in processing as a supplement to the milk they produced. The amounts of dairy products produced are small relative to those assumed in many previous analyses of value-added dairy processing (e.g., Hammarlund, 2003; Table 4). Not surprisingly, fluid milk and yogurt processors reported selling all of their production, whereas cheese producers—cow's milk or goats and sheep—sold only 90% of their production on average (Table 4). The difference between production and processing for cheese probably indicates increases in inventories (particularly for aged cheeses), but may also include some product losses or inferior product that could not be sold. Milk required per lb of cheese (calculated based on reported milk used in processing and cheese production) averaged 11.97 lbs for cow's milk cheese makers and 5.13 lbs for goat and sheep processors.

Income Statement Evaluation

A key objective of this research is to evaluate financial performance of the farm enterprise, processing enterprise and the overall business, and income statements for the individual

Table 4. Production and Sales Quantities by On-Farm Dairy Processors, by Product

Characteristics	Statistic	Type of Animal		
		Cows	Goats & Sheep	Total
Cheese Production, lbs	Mean	75,294.8	7,963.9	45,369.9
	Minimum	918.0	3,740.0	918.0
	Maximum	642,725.0	24,203.0	642,725.0
	s.d.	199,753.3	6,824.7	149,427.8
	Valid N	N=10	N=8	N=18
Cheese Sold, lbs	Mean	68,237.3	7,334.3	42,593.9
	Minimum	681.0	2,396.0	681.0
	Maximum	642,725.0	21,657.0	642,725.0
	s.d.	190,777.2	6,187.8	145,565.3
	Valid N	N=11	N=8	N=19
Fluid Production, gal	Mean	31,315.0	[1]	31,175.9
	Minimum	753.0	[1]	753.0
	Maximum	114,316.0	[1]	114,316.0
	s.d.	43,270.0	[1]	40,062.1
	Valid N	N=7	N=1	N=8
Fluid Product Sold, gal	Mean	31,315.0	[1]	31,175.9
	Minimum	753.0	[1]	753.0
	Maximum	114,316.0	[1]	114,316.0
	s.d.	43,270.0	[1]	40,062.1
	Valid N	N=7	N=1	N=8
Yogurt Production, gal	Mean	29,238.0	[1]	23,433.4
	Minimum	6,759.0	[1]	215.0
	Maximum	78,644.0	[1]	78,644.0
	s.d.	33,916.3	[1]	32,112.3
	Valid N	N=4	N=1	N=5
Yogurt Sold, gal	Mean	29,183.3	[1]	23,389.6
	Minimum	6,667.0	[1]	215.0
	Maximum	78,644.0	[1]	78,644.0
	s.d.	33,963.9	[1]	32,140.2
	Valid N	N=4	N=1	N=5

Characteristics	Statistic	Type of Animal		
		Cows	Goats & Sheep	Total
Ice Cream Production, gal	Mean	10,779.5	[2]	10,779.5
	Minimum	2,400.0	[2]	2,400.0
	Maximum	19,159.0	[2]	19,159.0
	s.d.	11,850.4	[2]	11,850.4
	Valid N	N=2	N=0	N=2
Ice Cream Sold, gal	Mean	10,779.5	[2]	10,779.5
	Minimum	2,400.0	[2]	2,400.0
	Maximum	19,159.0	[2]	19,159.0
	s.d.	11,850.4	[2]	11,850.4
	Valid N	N=2	N=0	N=2

[1] Not reported because there was only one respondent in the category.

[2] No producers of goat or sheep milk processed ice cream.

Note: Production and sales data are annual for 2003.

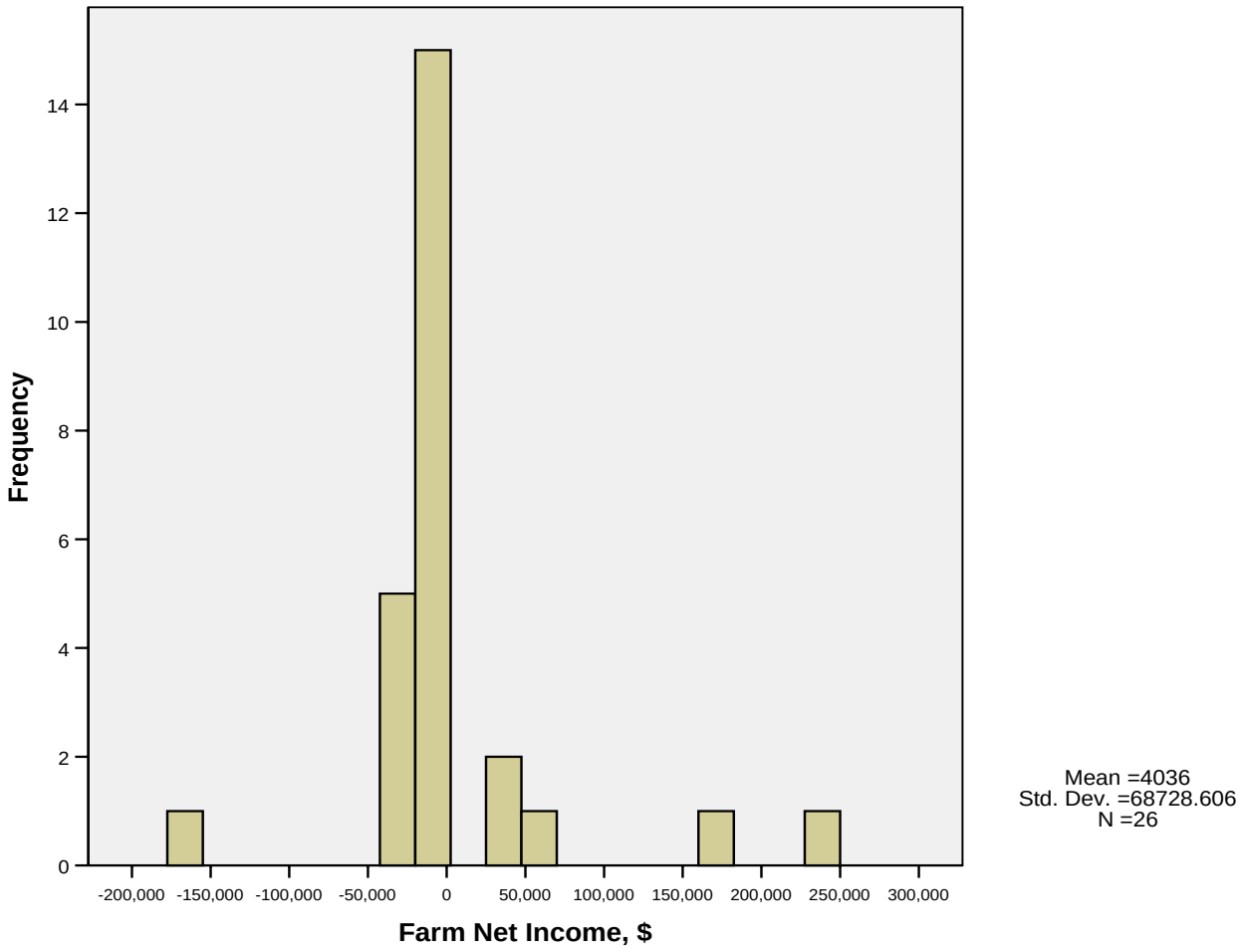
enterprises and the overall business are a main component of this evaluation. For the farm enterprise, the principal sources of revenues are raw milk sales (especially for cow's milk) and the transfer value for the milk used in processing (Table 5). About 25% of revenues for cow's milk producers and 17% of sheep and goat's milk producers was received from livestock sales, crop sales, government payments or other receipts. Average revenues for the goat and sheep producers were about one-third of those for cow's milk producers The most important expense categories were purchased feed (28% for both types of farms), hired labor expenses (22% for both types of farms), farm machinery and expenses and livestock expenses. Farm net income for the cow's milk producers averaged about $15,000, but was negative for the goat and sheep producers. All goat and sheep producers had negative net farm income, but the range in farm net income was much broader for cow's milk producers (Table 5). The distribution of farm net income has a mode value of $-25,000 to $0, with 20 of the values clustered between $-50,000 and 0 (Figure 2).

The income statement for the processing enterprise indicates that the principal source of revenue (accounting for more than 98% of revenues) is dairy product sales (Table 6). For producers of both types, average revenues from dairy product sales were about 2.2 times revenues to the farm enterprise. The structure of expenses for the processing enterprise differed by animal species. For the cows milk producers, materials and supplies were by far the largest expense, accounting for nearly 45% of expenses. Marketing expenses accounted for 7% of total operating expenses. Hired labor and the value of milk used in processing amounted to an additional 17 and 12%, respectively, of processing expenses. For sheep and goat's milk processors, the value of the milk was the largest expense, amounting to 42% of total processing operating expenses. Materials and supplies accounted for only about 23% of processing expenses, and marketing expenses accounted for about 8% of operating expenses. The average processing net income for the cow's

Table 5. Farm Enterprise Net Income of On-Farm Dairy Processors, by Animal Type

Element of Farm Net Income	Cows (N=16)				Goats & Sheep (N=10)			
	Mean	s.d.	Minimum	Maximum	Mean	s.d.	Minimum	Maximum
Raw milk sales, $	50,819	73,316	0	226,100	4,732	12,801	0	40,811
Transfer Value to Processing, $	48,107	53,250	2,098	186,698	27,126	34,226	1,281	116,738
Livestock Sales, $	10,708	10,138	457	29,803	3,468	4,787	0	16,257
Crop Sales, $	11,814	37,200	0	149,250	591	1,841	0	5,831
Government and Other Receipts (Farm), $	12,759	12,065	0	36,404	2,371	2,899	0	8,534
Total Farm Receipts, $	134,207	130,314	8,818	454,493	38,288	52,064	10,502	176,675
Farm Hired Labor Expenses, $	22,424	35,401	0	122,512	8,583	14,338	0	40,012
Purchased Feed Expenses (Farm), $	29,903	23,292	1,926	71,995	11,243	8,310	2,854	33,467
Farm Machinery & Equipment Expenses, $	16,596	17,266	1,225	63,416	2,963	4,013	0	13,871
Livestock Expenses, $	12,976	9,167	1,604	29,547	6,305	11,436	916	38,471
Crop Expenses, $	5,623	11,135	0	45,081	998	2,121	0	6,964
Farm Real Estate and Building Expenses, $	5,954	7,284	0	29,558	2,477	1,089	870	4,862
Farm Utilities Expenses, $	4,392	4,047	122	13,356	1,596	1,832	214	5,973
Farm Interest Expenses, $	2,586	3,198	0	12,298	2,625	3,248	0	9,208
Farm Miscellaneous Expenses, $	5,471	5,210	333	20,776	2,173	2,661	0	8,978
Total Farm Operating Expenses, $	105,924	86,915	14,157	289,448	38,963	45,777	12,988	161,806
Expansion Livestock Expenses (Farm), $	935	1,710	0	4,800	154	487	0	1,540
Farm Depreciation Expense, $	12,597	17,140	0	51,850	12,280	16,184	464	57,029
Farm Net Income, $	14,751	86,380	-156,183	235,841	-13,109	12,439	-42,160	-2,116

Figure 2. Distribution of Farm Net Income for On-Farm Dairy Processors



milk producers was negative—nearly $90,000 less than processing receipts. One outlier with a large negative processing net income has a strong influence on the mean value; without this minimum value, the mean is about negative $13,000. Sheep and goat's milk processors generated a positive processing net income of about $15,000 from a revenues about one-fourth of those for the cow's milk processors (Table 6). The distribution of processing net income values has a mode in the range of $0 to $25,000 per year, and more than half of the values fall in the range of $0 to $50,000 (Figure 3). Only one processing enterprise had a processing net income greater than $50,000, and 11 enterprises had negative processing net income. These results indicate that it is quite possible—but not inevitable—for on-farm dairy processing not to be profitable, and even when profitable, they may not generate large processing net incomes. The factors influencing processing net income are explored in greater detail with simple regression analysis below.

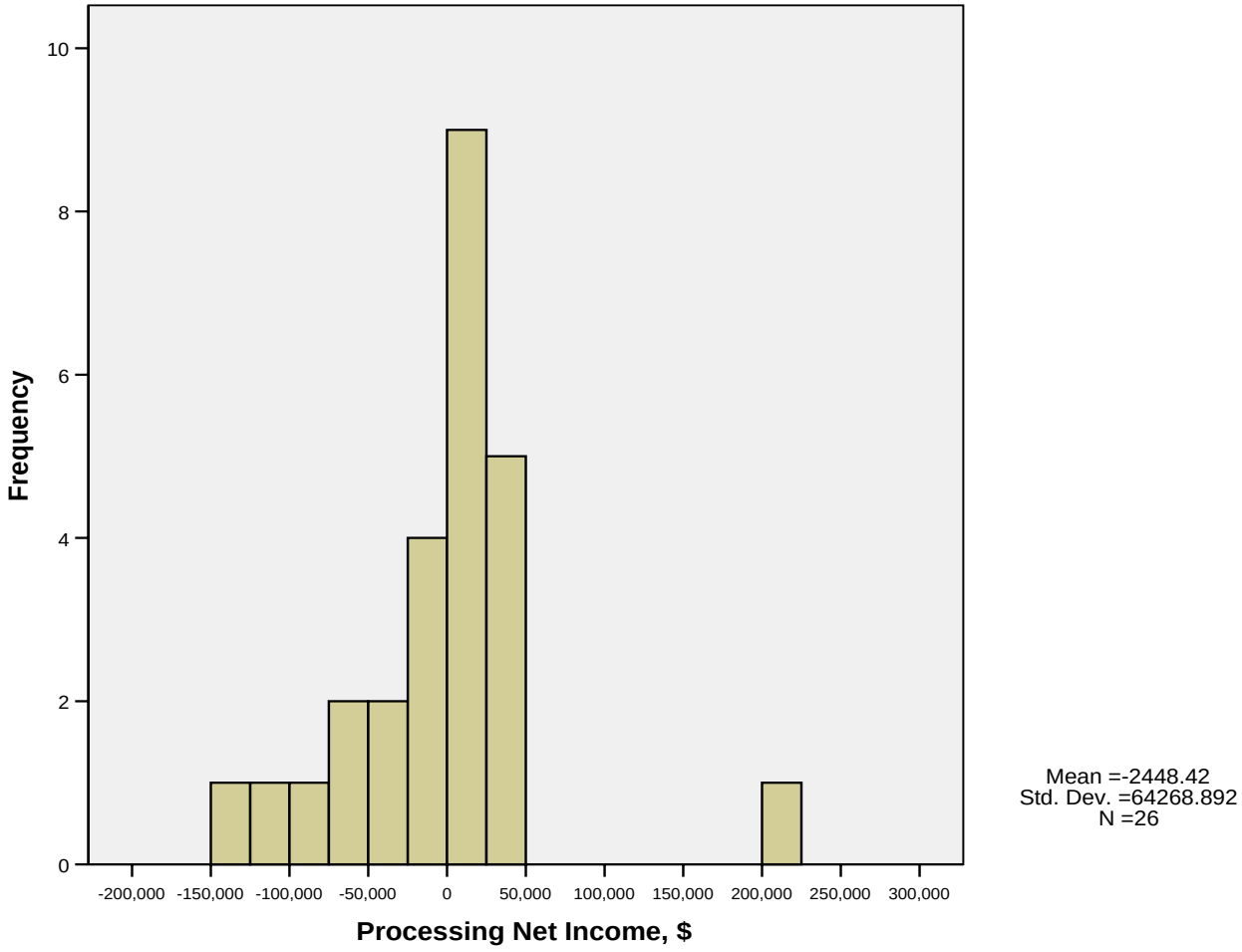
Average overall business net income is similar for the processors of the two types of milk (less than $2,000; Table 7), despite differences in the amount of milk processed and the product mix. On average, cow's milk processing businesses had profitable milk production enterprises, but lost money on processing. Goat and sheep milk processors lost money on milk production but earned positive net income from processing activities. Although these average values are useful,

Table 6. Processing Enterprise Net Income of On-Farm Processors, by Animal Type

Element of Processing Net Income	Cows (N=17)				Goats & Sheep (N=10)			
	Mean	s.d.	Minimum	Maximum	Mean	s.d.	Minimum	Maximum
Dairy Product Sales, $	303,992	553,322	5,105	1,986,045	82,260	86,480	4,497	244,483
Other Processing Receipts, $	1,589	3,978	0	15,200	1,494	4,386	0	13,944
Total Processing Receipts, $	305,581	552,682	5,105	1,986,045	83,755	89,377	4,497	258,427
Transfer Value to Processing, $	45,277	52,863	0	186,698	27,126	34,226	1,281	116,738
Processing Hired Labor Expenses, $	61,452	129,997	0	488,401	9,064	19,072	0	62,082
Materials and Supplies Expenses (Proc), $	165,822	456,282	1,989	1,874,108	15,592	23,748	1,344	77,641
Machinery and Equipment Expenses, $	12,480	37,348	0	156,012	1,039	2,168	0	7,006
Real Estate and Building Expenses, $	6,658	14,322	0	50,313	418	397	0	1,000
Processing Utilities Expenses, $	14,895	33,334	0	139,516	2,789	1,914	250	6,224
Processing Interest Expenses	9,519	18,075	0	73,547	862	938	0	3,029
Marketing Expenses (Proc), $	26,147	64,947	0	274,600	4,899	5,476	0	18,501
Processing Miscellaneous Expenses, $	22,273	54,645	110	228,950	2,350	2,811	283	7,765
Total Processing Operating Expenses, $	364,524	712,766	8,493	2,411,466	64,137	77,448	9,471	228,873
Processing Depreciation Expense, $	28,986	62,733	0	256,711	4,650	4,227	867	14,257
Processing Net Income, $	-87,929[1]	317,176	-1,281,450	208,888	14,968	15,810	-5,841	35,689

1 The mean value of processing net income excluding the minimum value (an outlier) is $-13,333.

Figure 3. Distribution of Processing Net Income of On-Farm Dairy Processors



Note: This figure omits the results for one processing enterprise for which net income was less than negative $1 million per year.

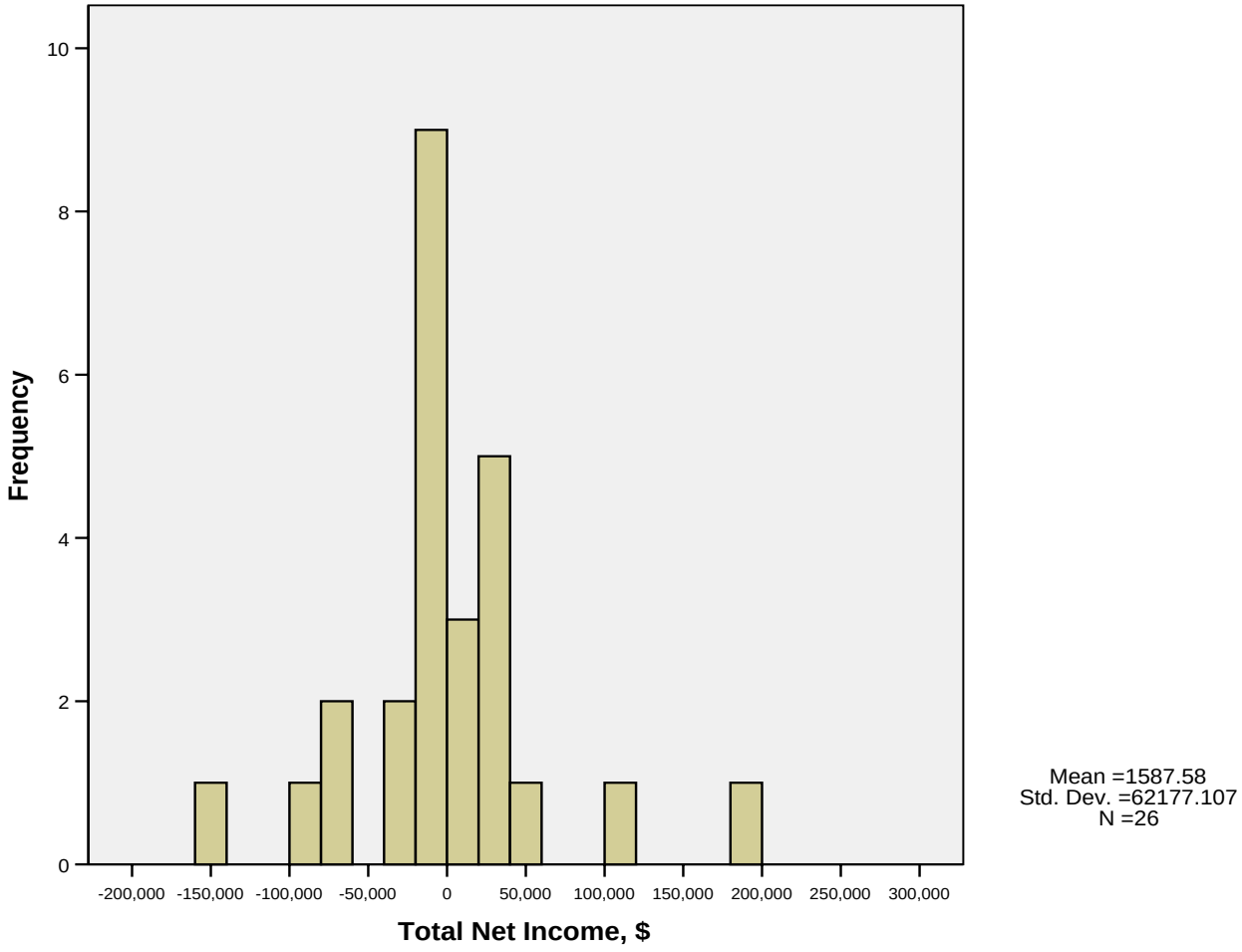
the variation from one business to another (and the coefficient of variation, the standard deviation divided by the mean) is quite large. For cow's milk processors, the range in overall net income values was more than $300,000 (negative $150,000 to $190,000). The distribution of overall business net income is centered at about zero (Figure 4). Twenty values fall within the range of negative $50,000 to$50,000, and more than half of the participating businesses (N=15) had a negative net income. Streeter and Bills (2003b) and Morrison (2001c) note that it can be challenging to simultaneously (and profitably) manage production of a raw material and its transformation via processing into a value-added product. Only one of 27 participants earned a positive net income from both the farm and processing enterprises (Figure 5). The most common outcome was for the processing enterprise to be somewhat profitable, but not the farm. The evidence supports the idea that it can difficult at a relatively small scale to successfully manage both a farm and a processing enterprise.

Net income by enterprise and the overall business can also be examined by the main dairy product sold (although the numbers of fluid and yogurt producers are small). Each of these

Table 7. Overall Business Net Income of On-Farm Processors, by Animal Type

Element of Business Net Income	Cows (N=16)				Goats & Sheep (N=10)			
	Mean	s.d.	Minimum	Maximum	Mean	s.d.	Minimum	Maximum
Total Business Receipts, $	372,216	540,319	28,422	2,211,906	122,043	135,609	17,327	409,627
Total Business Operating Expenses, $	342,514	548,626	30,059	2,272,867	103,100	117,208	22,459	349,197
Total Depreciation Expense, $	27,350	25,676	3,252	88,926	16,930	19,976	1,921	71,286
Total Net Income, $	1,418	79,062	-149,887	188,868	1,860	17,910	-23,448	31,850

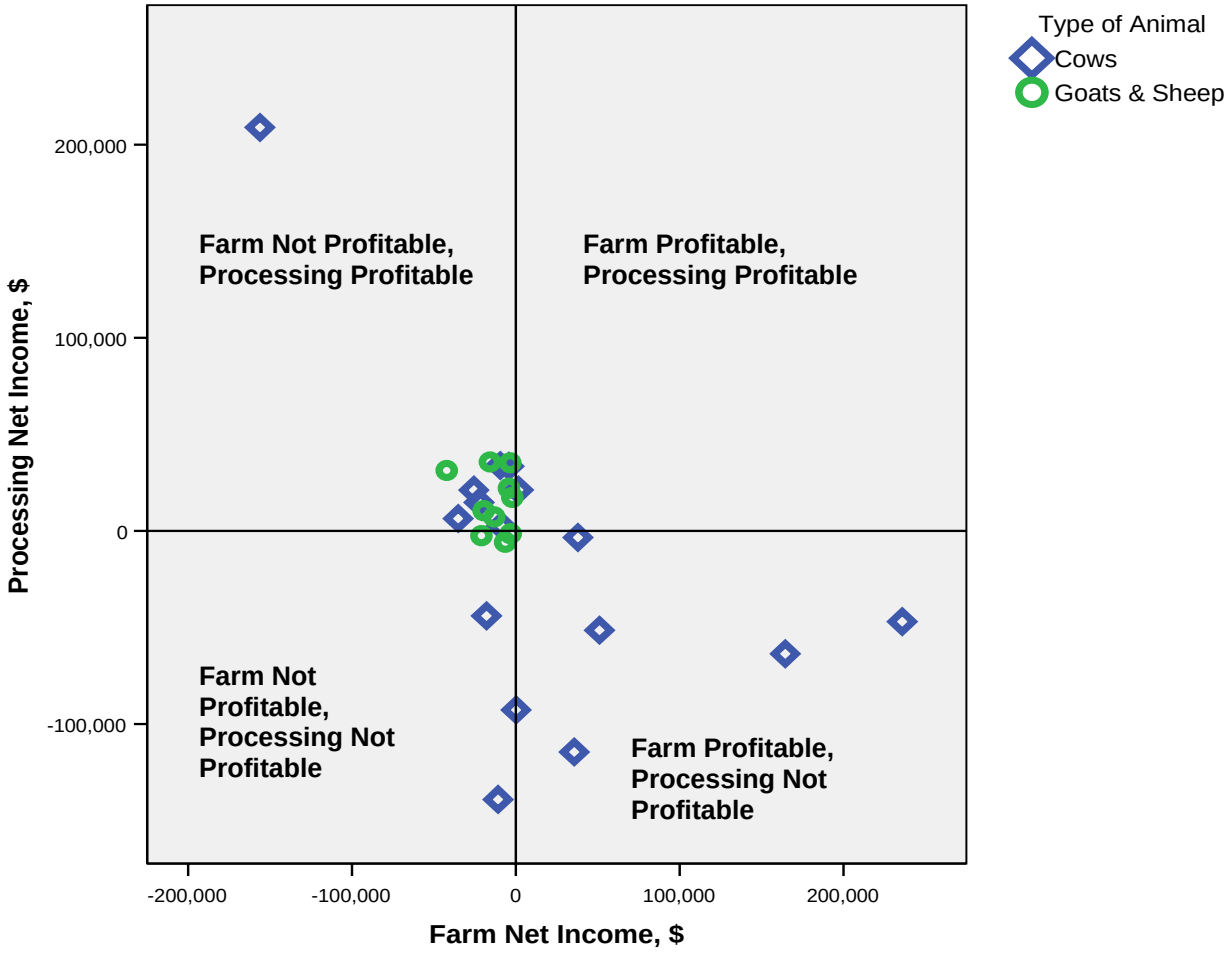
Figure 4. Distribution of Total Business Net Income for On-Farm Dairy Processors



product categories demonstrates a different relationship between farm net income, processing net income and business net income (Table 8). On average, the 17 cheese makers had a small negative farm net income, decidedly negative processing net income, and an average total net income of just under $2,000. Fluid milk bottlers had positive farm net income, lost money on processing and earned about $10,000 in net business income. The three yogurt processors, on average, lost money on milk production, made money on processing, but had the largest negative business net income of the three groups.

What explains the patterns of net income—especially for processing—observed in these data? One approach to explore this is to undertake tabular comparisons that explore differences due to individual factors. If experiential learning contributes to more effective management of the farm and processing businesses, we might expect that businesses that have been processing longer will be more profitable. Processors with more than three years of experience had processing net income values much larger than those with three years of experience or less (Table 9). Somewhat curiously, however, the farm net income of the older businesses was lower than for younger businesses. On average, the surveyed businesses with greater experience were more profitable than those with less. Another possible effect is whether the businesses made a transition from a traditional dairy farm to an on-farm processor, or if both milk production and

Figure 5. Farm and Processing Net Income for On-Farm Dairy Processors, by Animal Type



dairy processing were essentially new enterprises for individuals with limited previous agricultural experience. We defined each participating business as "transitional" or "new" based on the number of years they had produced milk and the number of years they had processed dairy products. Net income for the transitional businesses was lower than for the new businesses, sometimes rather dramatically so (Table 10), despite the fact that transitional processors had more than double the number of years of processing experience, on average, of new businesses. Finally, it appears that product pricing has an important effect on processing net income. The relationship between processing receipts per cwt and processing net income suggests that the value of receipts must be about $100 per cwt of milk processed (i.e., the prices received need to be about $10 per lb of cheese or yogurt and $8.60 per gallon of milk) in order to cover the costs of processing and marketing the products (Figure 6), or that ways must be found to substantially reduce costs.

Another approach to assessment of the factors underlying processing net incomes is regression analyses. In a simple linear regression, we explored the relationship between amount of milk processed, the number of years in processing, total value of processing assets, main product,

Table 8. Farm, Processing and Overall Business Net Income of On-farm Dairy Processors, by Main Product Sold

Element of Business Net Income	Cheese (N=17)[1]		Fluid (N=6)		Yogurt (N=3)	
	Mean	s.d.	Mean	s.d.	Mean	s.d.
Farm Receipts, $	53,455	59,249	216,377	170,991	107,730	87,468
Farm Operating Expenses, $	48,154	53,325	140,733	70,742	140,465	139,479
Farm Net Income, $	-2,139	23,001	50,626	118,456	-54,151	88,425
Processing Receipts, $	149,865	314,656	423,683	768,678	264,252	379,825
Processing Operating Expenses, $	198,588	556,328	438,399	788,089	211,100	243,856
Processing Net Income, $	-67,460	305,096	-40,199	62,041	36,786	155,241
Total Business Receipts, $	130,563	103,360	640,060	795,236	371,982	455,211
Total Business Operating Expenses, $	116,572	112,120	579,132	838,277	351,565	382,747
Total Net Income, $	1,812	28,397	10,427	119,682	-17,364	72,740

[1] N=18 observations are used for processing values.

Table 9. Farm, Processing and Overall Business Net Income for On-farm Dairy Processors, by Years of Processing Experience

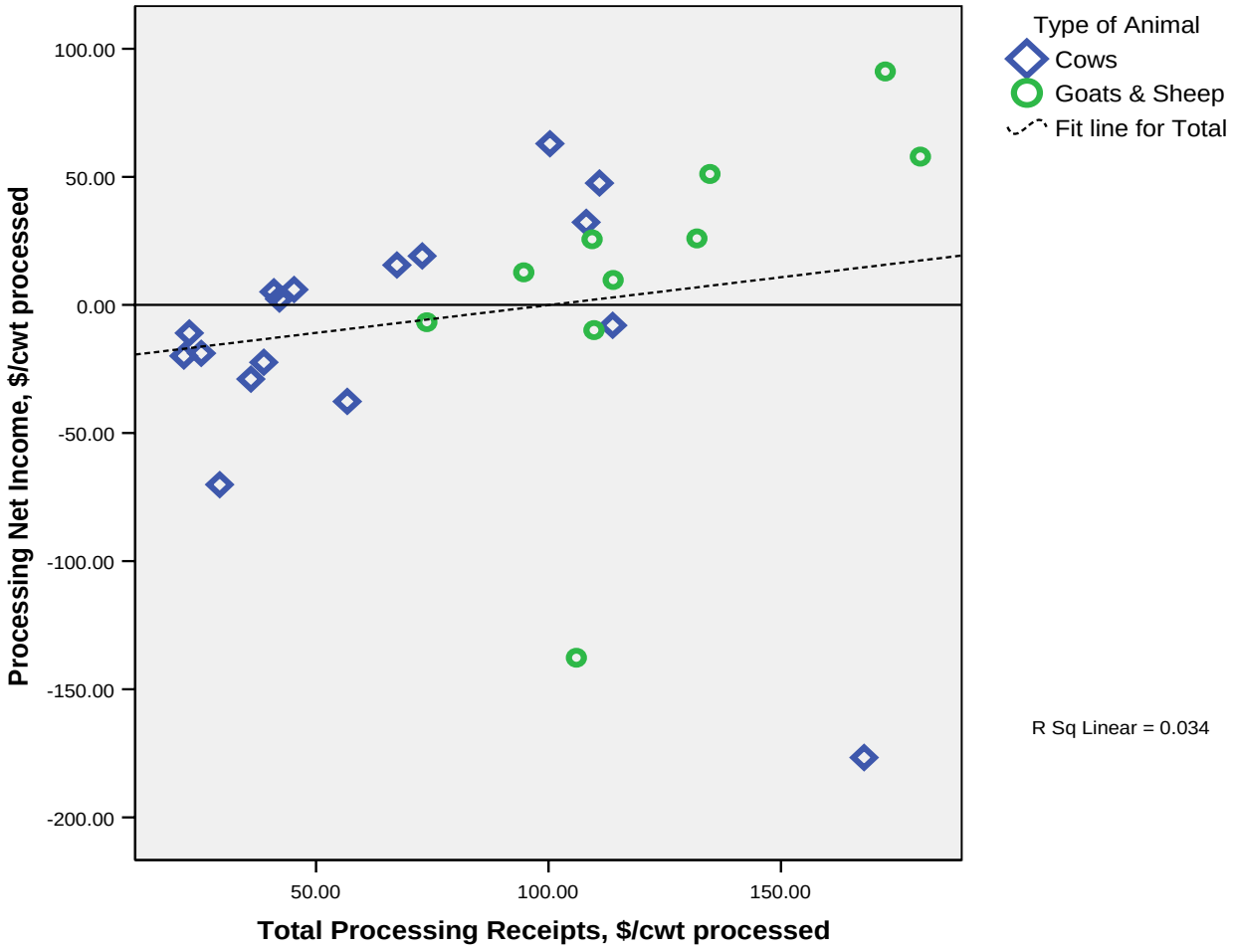
Element of Business Net Income	Less than 4 Years[1] (N=17)		More than 3 Years (N=10)	
	Mean	s.d.	Mean	s.d.
Total Farm Receipts, $	79,198	115,284	126,302	116,777
Total Farm Operating Expenses, $	57,124	55,453	117,042	100,857
Farm Net Income, $	13,411	63,648	-10,964	77,222
Total Processing Receipts, $	136,113	325,288	371,850	598,715
Total Processing Operating Expenses, $	202,326	572,488	339,873	613,521
Processing Net Income, $	-90,173	309,722	18,784	87,517
Total Business Receipts, $	137,147	140,751	498,152	652,403
Total Business Operating Expenses, $	121,379	112,373	456,915	675,688
Total Net Income, $	-2,308	61,887	7,820	65,462

[1] N=17 values used for processing variables, N=16 used for farm and overall variables.

amount of hired labor, and market outlet and processing net income (Table 11)[19]. The volume of milk processed had a positive impact on processing net income, but with diminishing returns (as indicated by the negative sign on the amount of milk squared variable). A similar nonlinear effect was found for the number of years of processing, indicating that experience does influence processing profitability. However, this interpretation is complicated by the fact that only more

[19] Note that this is actual processing net income, not processing income per cwt of milk processed. Regression analysis with this dependent variable resulted in no significant explanatory variables.

Figure 6. Processing Receipts per Hundredweight and Processing Net Income per Hundredweight for On-Farm Dairy Processors, by Animal Type



successful businesses (or those with significant external sources of funding) will survive the first few years of operation. The only other variables with a large t-value were processing assets, for which the negative sign indicates that it is possible to be overcapitalized, and hired labor FTE, which also had a negative sign. The main product sold by the business and the outlet through which the product was sold did not appear to have strong effects on processing profitability, controlling for the other variables.

Income Statement per Hundredweight Evaluation

In the New York Dairy Farm Business Summary (Knoblauch et al., 2004), elements of the income statement per cwt are employed to provide an additional perspective on farm financial performance. Businesses processing cow's milk had larger total farm receipts per cwt of milk produced than the average of 201 New York dairy farms participating in the DFBS (Table 12). The total value of milk receipts is equal to the value of raw milk sales plus the transfer value of milk used in processing. Milk receipts per cwt were 35% higher for on-farm processors than for dairy farms, as were all other elements of total farm receipts per hundredweight. This results in a

Table 10. Farm, Processing and Overall Business Net Income for On-farm Dairy Processors, by New or Transitional Business

Element of Business Net Income	Transitional Business[1] (N=14)		New Business (N=13)	
	Mean	s.d.	Mean	s.d.
Total Farm Receipts, $	138,644	98,795	55,986	120,487
Total Farm Operating Expenses, $	123,971	85,945	36,368	42,077
Farm Net Income, $	-713	71,252	8,785	68,668
Total Processing Receipts, $	373,638	594,627	61,652	36,922
Total Processing Operating Expenses, $	446,272	767,284	45,421	34,319
Processing Net Income, $	-107,579	348,113	12,385	22,620
Total Business Receipts, $	434,352	581,706	117,638	134,551
Total Business Operating Expenses, $	419,074	590,725	81,789	73,210
Total Net Income, $	-17,994	66,102	21,169	53,421

Note: Transitional business means a traditional dairy farm that made the transition to on-farm processing. New business means that the business was begun by owner operators with limited previous dairy farming experience.

[1] N=14 values used for processing variables, N=13 used for farm and overall variables.

Table 11. Factors Influencing Processing Net Income for On-Farm Dairy Processors, Linear Regression Analysis

Variable	Coefficient	s.e.	t-statistic
(Constant)	-12,132.74	23,139.29	-0.52
Total Milk Used in Processing, 100 lbs	28.88	91.55	3.15
Milk Processed Squared, 100 lbs	0.00	0.00	-5.46
Years in Processing	11,086.34	2,722.56	4.07
Year Processing Squared	-264.36	59.70	-4.43
Hired Labor Processing FTE	-3,404.55	1,858.07	-1.83
Is Cheese Main Product	-22,067.06	20,424.41	-1.08
Sold Majority Through Retailer	-24,347.85	21,824.26	-1.12
Sold Majority Through Farm Stand, Market	21,454.76	23,418.25	0.92
Processing Assets, $1000	-202.31	89.14	-2.27
Observations	26		
Degrees of freedom	17		
Adjusted R^2	0.97		

difference of $10.76 per cwt in total farm receipts. However, all of the operating expenses are larger for the cow's milk processors, so that although the milk receipts were much larger, average net farm income per cwt was positive for the DFBS farms in 2003, but negative for the on-farm processors (Table 12). Milk receipts for the goat and sheep milk processors were higher still (nearly $48 per cwt) and total receipts per cwt of milk produced were over $60. However, given the relatively small amounts of milk produced by goats and sheep, operating expenses per cwt were significantly larger than for cow's milk production—especially for purchased feed, nearly $26 per cwt. These high operating costs of production for goat and sheep milk lead to average farm net incomes that are highly negative (Table 12).

Although there are no additional sources of processing data comparable to those from the DFBS for dairy farms, it is still useful to examine the returns and operating expenses per cwt (of milk processed) for the processing enterprise. For cow's milk processors, the value of processing receipts per cwt is nearly $65 (roughly equivalent to a $6.50 per lb cheese price). However, operating expenses per cwt of milk processed total more than $66, and net processing income is therefore negative (Table 13). In contrast to larger conventional processors, for whom the value of the milk input is often more than two-thirds of total operating expenses, the value of milk used by on-farm dairy cow's milk processors only accounts for about 15% of operating expenses. Materials and supplies and hired labor total more than $27 per cwt of milk processed, or 41% of total operating expenses. Operating expenses excluding the value of the milk input are more than $50 per cwt, the equivalent of a $5.00 per lb cost of processing for cheese[20]. In contrast to cow's milk processors, sheep and goat's milk processors receive nearly double the receipts per unit milk processed (Table 13). Although their milk transfer value is much higher than that for cow's milk and many operating expense items are also higher, average total processing operating expenses are only slightly over $100, so average processing net income per cwt is positive (Table 13).

Unit Processing Costs for Products

Based on the information provided by the participants, it is possible to calculate per unit product processing costs and to develop cost curves based on the amount of milk being processed. This information may be useful, because many *ex ante* analyses of the feasibility of on-farm dairy processing require a unit processing cost (e.g., Hammarlund, 2003; Maynard, 2005), and often these costs are based on much larger plants multiplied by some additional factor. Unit costs use the total processing operating costs (including processing and marketing but excluding milk input costs) divided by the quantity of the main product produced. The fact that small quantities of other products are produced by some businesses makes this an approximate calculation. However, when significant quantities of products other than the main product were produced, the observation was omitted from the analysis. The average processing cost per lb of cheese produced was $3.37 per lb (N=15 observations), per gallon fluid processing costs averaged $2.38 (N=5 observations) and per gallon yogurt processing costs averaged $20.77 (N=3 observations). The costs for cheese and fluid milk are substantially higher than those used by Hammarlund (2003) and Maynard (2005) in *ex ante* feasibility studies.

This unit information can be used in a simple regression model with a constant term and a variable equal to one divided by the amount of milk processed. This analysis was conducted

[20] Additional information on processing costs is presented subsequently.

Table 12. Farm Enterprise Net Income Per Hundredweight for On-Farm Dairy Processors, by Animal Type

Element of Net Farm Income	Cows (N=16)			Goats & Sheep (N=10)	
	Mean	s.d.	DFBS (2003)[1]	Mean	s.d.
Raw Milk Sales, $/cwt	7.02	6.90	13.24	6.08	14.76
Transfer Value to Processing, $/cwt	10.87	7.36	--	41.75	18.01
Livestock Sales, $/cwt	3.71	5.06	1.21	7.50	7.87
Crop Sales, $/cwt	1.14	2.78	0.39	0.19	0.55
Government and Other Receipts (Farm), $/cwt	3.48	5.21	0.62	6.03	10.89
Total Farm Receipts, $/cwt	26.22	12.72	15.46	61.55	26.23
Farm Hired Labor Expenses, $/cwt	3.57	5.66	2.51	10.00	13.88
Purchased Feed Expenses (Farm), $/cwt	6.91	3.40	4.27	25.75	13.50
Farm Machinery and Equipment Expenses, $/cwt	4.31	4.14	1.24	4.74	2.54
Livestock Expenses (Farm), $/cwt	3.36	1.84	2.89	8.82	5.19
Crop Expenses (Farm), $/cwt	0.98	1.98	0.64	0.93	0.76
Farm Real Estate and Buildings Expenses, $/cwt	1.33	1.24	0.59	7.18	6.10
Farm Utilities Expenses, $/cwt	0.96	0.78	0.34	3.64	3.63
Farm Interest Expenses, $/cwt	1.63	3.25	0.56	5.19	5.75
Farm Miscellaneous Expenses, $/cwt	1.47	1.07	0.33	3.91	2.84
Total Farm Operating Expenses, $/cwt	24.51	11.89	13.39	70.16	25.15
Farm Net Income, $/cwt	-2.55	12.64	0.54	-30.47	26.27

Note: All values are per hundredweight milk produced.

[1] Data from 201 New York dairy farms participating in the Dairy Farm Business Summary for 2003 (Knoblauch et al., 2004)

Table 13. Processing Net Income Per Hundredweight for On-Farm Dairy Processors, by Animal Type

Element of Processing Net Income	Cows (N=17)		Goats & Sheep (N=10)	
	Mean	s.d.	Mean	s.d.
Dairy Product Sales, $/cwt	62.76	37.81	121.66	33.53
Other Receipts (Processing), $/cwt	1.96	6.99	1.02	2.21
Total Processing Receipts, $/cwt	64.72	41.73	122.68	33.10
Transfer Value to Processing, $/cwt	10.23	7.60	41.75	18.01
Processing Hired Labor Expenses, $/cwt	10.07	19.12	12.58	25.46
Materials and Supplies Expenses (Proc), $/cwt	17.66	17.63	31.53	36.61
Processing Machinery and Equipment Expenses, $/cwt	2.01	2.59	1.29	2.07
Processing Real Estate and Buildings Expenses, $/cwt	1.29	1.42	0.93	1.05
Processing Utilities Expenses, $/cwt	2.96	2.29	8.21	7.60
Processing Interest Expenses, $/cwt	4.14	10.42	3.85	6.93
Marketing Expenses (Proc), $/cwt	6.60	8.21	12.64	11.63
Processing Miscellaneous Expenses, $/cwt	5.52	6.61	5.98	7.04
Total Processing Operating Expenses, $/cwt	66.39	57.20	101.05	46.12
Operating Expenses Less Milk Transfer Value, $/cwt	50.26	57.48	56.10	50.31
Processing Net Income, $/cwt	-11.91	53.24	11.99	61.03

Note: All values are per hundredweight milk processed.

only for cheese given the limited number of fluid and yogurt observations, using the approach outlined in Stephenson (2006). A cost function of this type indicated that the minimum processing cost of cheese with the business configuration and cost structure reported by the cheese makers in this study would be about $1.12 per lb for an operation processing about 500,000 lbs of milk per year. The minimum reported value for cheese processing costs among the study participants is $1.60 per lb. Although these estimates could be further refined with cost of processing studies like those reported in Stephenson (2006) they should provide a better benchmark for *ex ante* analyses of small-scale dairy processing costs and the financial feasibility of dairy processing enterprises.

Balance Sheet Evaluation

The DFBS also provides an evaluation of the average farm balance sheet, and this assessment is relevant for on-farm dairy processing businesses as well. Average farm assets for the cow's milk processors were about $530,000, with nearly $500,000 of those assets in the form of farm land and buildings and intermediate assets (Table 14). As for some of the other characteristics and performance of cow's milk processors, there is considerable variation in total asset values (the range is more than $1.5 million). The total assets of cow's milk on-farm processors were about one-fourth of those reported for the 201 farms in the DFBS for 2003, which is not surprising given the difference in the average number of cows (43 cows versus 314 cows). Intermediate assets and livestock assets of processors were only about 15% of the comparable values for DFBS farms. Processing farms had low average liabilities and a low debt-to-asset ratio (Table 14). Current ratios were large for the cow's milk processors also. Goat and sheep milk processors had about one-third the total assets of their cow's milk counterparts, and a larger proportion of assets in livestock (Table 14). The farm liabilities for goat and sheep processors were roughly double those of the cow's milk processors; debt-to-asset ratios were correspondingly higher but relatively low (0.26).

Processing assets for the cow's milk processors averaged over $250,000 (Table 15). Machinery and equipment accounted for nearly half of total processing assets, with processing land and buildings comprising more than one-fourth of the total. The largest component of processing liabilities was intermediate debt, which accounted for more than one-half of the total. On average, processing liabilities totaled more than $300,000, so that the average net worth was negative. If one large, negative outlier is excluded, however, the average liabilities were about $225,000 and net worth about $30,000. The debt-to-asset ratio is quite high for the cow's milk processing enterprises (Table 15). Average processing assets held by goat and sheep milk processors were about one-fourth of the amount held by cow's milk processors, and liabilities amounted to about 65% of that total. The average net worth of the processing enterprise assets for goat and sheep was just less than $35,000, which is roughly equal to the net worth of the cow's milk farms excluding the outlier. When the balance sheets of the farm and processing enterprises are combined, the net worth of both cow's milk and small ruminant processors are positive, and debt-to-asset ratios are within reasonable ranges (Table 16).

It is also useful to consider the processing enterprise balance sheet by main product sold in addition to the type of milk processed. Fluid milk bottlers own the largest average total assets, mostly in form of machinery and equipment (more than $200,000), more than twice the total

Table 14. Farm Balance Sheet for On-Farm Dairy Processors, by Animal Type

Element of Farm Balance Sheet	Cows (N=16)					Goats & Sheep (N=10)			
	Mean	s.d.	Minimum	Maximum	DFBS (2003)	Mean	s.d.	Minimum	Maximum
Farm Cash Assets, $	7,903	23,281	0	94,643	13,970	1,351	2,448	-2,500	6,681
Farm Accounts Receivable, $	1,896	5,691	0	22,800	68,998	0	0	0	0
Farm Prepaid Expenses, $	506	1,513	0	6,000	1,664	0	0	0	0
Farm Feed and Supplies, $	28,336	39,980	2,750	149,550	192,404	5,386	6,306	602	19,450
Farm Current Assets, $	38,642	57,850	3,550	183,643	277,036	6,738	6,500	1,050	19,401
Livestock Assets (Farm), $	88,798	77,226	7,375	270,000	583,318	24,981	22,772	7,050	77,700
Machinery and Equipment Assets, $	77,536	95,259	0	317,600	383,751	43,955	61,777	2,350	215,000
Farm Credit and Other Stock, $	2,128	7,464	0	30,000	56,763	0	0	0	0
Farm Intermediate Assets, $	168,462	168,703	11,375	553,300	1,023,832	68,936	82,964	11,350	292,700
Farm Land and Buildings Assets, $	322,225	298,704	0	1,200,000	872,606	162,950	97,982	40,000	330,000
Other Farm Assets, $	961	2,756	0	9,972	0	0	0	0	0
Farm Assets, $	531,196	431,257	31,266	1,571,000	2,173,474	238,623	173,283	57,800	642,101
Farm Operating and Short-term Debt, $	4,950	12,539	0	45,000	67,289	2,013	3,895	0	12,000
Farm Accounts Payable, $	4,048	9,591	0	37,000	61,943	636	2,012	0	6,363
Current Portion, $	3,242	4,210	0	14,875	106,324	6,635	8,255	0	23,213
Farm Current Debt, $	12,240	15,515	0	46,356	220,293	9,284	8,980	0	25,409
Farm Intermediate Debt, $	22,139	41,552	0	126,441	383,761	28,426	49,359	0	137,950
Farm Long-term Debt, $	20,520	37,550	0	111,844	361,456	42,227	76,802	0	196,972
Farm Net Present Value of Leases, $	906	3,625	0	14,499	0	0	0	0	0
Farm Liabilities, $	55,806	68,809	0	260,434	965,510	79,936	116,856	0	358,135
Farm Net Worth, $	475,391	423,139	31,266	1,503,643	1,207,964	158,687	86,542	48,632	283,966
Farm Debt-to-Asset Ratio, %	13.1	15.7	0.0	57.3	44.0	25.1	26.4	0.0	63.6
Farm Current Ratio, %	392.8	760.7	28.9	2,876.9	126.0	151.5	292.7	16.7	873.0

Table 15. Processing Balance Sheet for On-Farm Dairy Processors, by Animal Type

Element of Processing Balance Sheet	Cows (N=17)				Goats & Sheep (N=10)			
	Mean	s.d.	Minimum	Maximum	Mean	s.d.	Minimum	Maximum
Processing Cash Assets, $	8,064	16,406	-1,000	49,481	350	944	0	3,000
Processing Accounts Receivable, $	26,581	58,954	0	204,313	7,574	14,191	0	45,756
Processing Prepaid Expenses, $	11,268	44,623	0	184,390	645	1,117	0	3,000
Processing Supplies, $	19,188	23,045	0	65,000	11,978	23,720	0	77,835
Processing Current Assets, $	65,101	111,485	3,212	455,525	20,547	36,552	200	123,591
Machinery and Equipment Assets, $	118,896	161,903	0	627,500	16,816	10,982	3,500	38,000
Farm Credit and Other Stock, $	706	2,443	0	10,000	0	0	0	0
Processing Intermediate Assets, $	119,602	161,405	2,000	627,500	16,816	10,982	3,500	38,000
Processing Land and Building Assets, $	69,371	125,403	0	503,806	25,675	24,818	0	80,000
Other Processing Assets, $	118	485	0	2,000	0	0	0	0
Processing Assets, $	258,116	369,061	18,158	1,324,750	63,038	51,690	9,050	187,591
Operating and Short-term Debt, $	25,497	99,508	0	411,361	102	323	0	1,022
Processing Accounts Payable, $	39,819	106,098	0	414,163	1,844	5,830	0	18,437
Processing Current Portion of Intermediate and Long-term Debt, $	9,283	12,622	0	46,627	2,363	3,004	0	9,237
Processing Intermediate Debt, $	155,666	293,131	0	1,133,528	12,825	17,011	0	48,000
Processing Long-term Debt, $	72,643	167,357	0	628,673	11,610	24,798	0	78,134
Processing Current Debt, $	74,599	170,492	0	612,686	4,309	6,859	0	21,991
Net Present Value of Leases, $	3,925	16,183	0	66,725	0	0	0	0
Processing Liabilities, $	306,833	595,755	0	2,374,887	28,743	32,468	0	100,125
Processing Net Worth, $	-48,716[1]	357,810	-1,294,043	374,047	34,295	31,528	-21,977	87,466
Processing Debt-to-Asset Ratio, %	90.0	103.8	0.0	363.0	65.8	102.4	0.0	342.8
Processing Current Ratio, %	592.7	831.8	9.8	2,901.6	487.7	276.7	162.4	941.8

[1] For cow's milk processors, mean net worth excluding the minimum value (an outlier) is $29,117.

Table 16. Overall Business Balance Sheet for On-Farm Dairy Processors, By Animal Type

Element of Business Balance Sheet	Cows (N=16)				Goats & Sheep (N=10)			
	Mean	s.d.	Minimum	Maximum	Mean	s.d.	Minimum	Maximum
Total Cash Assets, $	13,379	32,691	-1,000	129,954	1,701	2,798	-2,500	6,681
Total Accounts Receivable, $	20,527	50,330	0	204,313	7,574	14,191	0	45,756
Total Prepaid Expenses, $	12,478	45,886	0	184,390	645	1,117	0	3,000
Total Current Assets, $	95,108	124,820	8,278	495,525	27,285	40,640	1,250	139,973
Machinery and Equipment Assets, $	180,502	211,195	12,000	777,500	60,771	69,164	22,700	253,000
Total Farm Credit and Other Stock, $	2,878	9,959	0	40,000	0	0	0	0
Total Intermediate Assets, $	272,178	274,682	46,375	958,500	85,752	90,208	31,650	330,700
Total Land and Building Assets, $	364,444	329,561	0	1,375,000	188,625	111,818	50,000	350,000
Total Other Assets, $	1,086	2,755	0	9,972	0	0	0	0
Total Business Assets, $	737,892	689,151	196,555	2,895,750	301,661	205,536	82,900	715,105
Total Operating and Short-term Debt, $	6,331	12,700	0	45,000	2,115	3,969	0	12,000
Total Accounts Payable, $	35,615	112,498	0	451,163	2,480	7,842	0	24,800
Total Current Portion of Intermediate and Long-term Debt, $	11,263	12,078	0	49,885	8,998	10,732	0	32,450
Total Current Debt, $	53,209	111,758	0	460,519	13,592	15,092	0	47,400
Total Intermediate Debt, $	116,689	180,900	0	571,815	41,251	56,669	0	155,000
Total Long-term Debt, $	58,411	90,813	0	297,175	53,837	98,070	0	248,834
Total Net Present Value of Leases, $	5,077	16,833	0	66,725	0	0	0	0
Total Business Liabilities, $	233,385	296,636	0	1,099,059	108,680	139,113	0	408,736
Total Business Net Worth, $	504,507	515,308	93,878	1,796,691	192,982	108,798	53,540	340,800
Total Business Debt-to-Asset Ratio, %	30.8	23.5	0.0	86.9	29.8	27.0	0.0	66.5
Total Business Current Ratio, %	870.1	2127.9	18.0	8198.3	201.9	191.7	43.3	638.2

assets of cheese and yogurt processors (Table 17). Fluid processors are also the only product category with positive net worth. If the one outlier is again excluded from the average cheese value, net worth for cheese makers would be just over $30,000. The three yogurt processors have, on average a negative net worth of more than $80,000. Moreover, debt-to-asset ratios are large for all product categories[21]. Although this discussion highlights the processing enterprise, it is important to remember that despite the low level of financial performance indicated by the balance sheet, the combined farm-processing balance sheet appears much more favorable.

Rates of return on farm, processing and overall business assets are negative on average, whether evaluated by type of milk processed (Table 18) or by main product sold (Table 19). Only five businesses generated positive returns on processing assets, and more than half of on-farm processors had rates of return below negative 25% (Figure 7). However, one on-farm processor achieved a rate of return greater than 100% on assets used to process cow's milk. There does not appear to be a strong relationship between the total processing assets and the rate of return they generate (Figure 7), which may imply that over-capitalization is not the principal cause of low (negative) rates of return.

Buildup of Economic Costs and Returns

It is also quite common in analyses of farm business financial performance to calculate the full economic cost of milk production. In this analysis we extend this concept to the dairy processing enterprise as well, and calculate the full economic cost of dairy products processed on farm. The full economic cost includes the value of the operator's and unpaid family labor[22], and an equity charge to reflect the opportunity cost of assets used in the farm and processing enterprises. Because these additions are often large, the full economic cost is often much larger than the operating costs. The average full economic cost for milk production for the cow's milk processors is more than $50 per cwt of milk produced (Table 20)—in large measure because of operator and unpaid family labor contributions of more than $24 per cwt. The farm interest equity contributes about an additional $8.50 per cwt. The full economic cost of processing products from cow's milk is more than $100 per cwt of milk processed (Table 20), with operator labor again contributing nearly 40%. The equity charge for processing is lower in this case, about $2.50 per cwt. Overall the total economic cost of producing and processing cow's milk products is more than $150 per cwt (roughly equivalent to $15 per pound of cheese or yogurt or $12.90 per gallon of fluid milk). Average returns on product sales are about $65, so the net return over full economic product costs is a large negative number—a negative value roughly 50% of the average return (Table 20).

The full economic costs of milk production for goat and sheep milk production are nearly $180 per cwt of milk produced (Table 20). Nearly $80 per cwt of this amount is due to operator and unpaid family labor, but the farm interest charge is also larger than $20 per cwt. The average full economic cost of making goat and sheep milk products is also higher than for cow's milk—

[21] The debt-to-asset ratio for fluid milk processors is greater than 1.0 even though on average assets are larger than liabilities because the reported value is a simple average rather than a weighted average.

[22] The operator's value of labor is based on information provided by the operator about what they would need to be paid by some other business to perform the services they do for their own business. If this value is large, this will imply a large contribution of this category to the full economic cost, which appears to have occurred in this case.

Table 17. Processing Balance Sheet for On-Farm Dairy Processors, by Main Product Sold

Element of Processing Balance Sheet	Cheese (N=18)		Fluid (N=6)		Yogurt (N=3)	
	Mean	s.d.	Mean	s.d.	Mean	s.d.
Processing Cash Assets, $	3,237	11,590	13,389	19,306	667	2,082
Processing Accounts Receivable, $	14,741	36,460	36,820	82,263	13,783	21,865
Processing Prepaid Expenses, $	464	881	31,607	74,863	0	0
Processing Supplies, $	21,816	26,360	7,691	10,011	2,383	1,151
Processing Current Assets, $	40,258	52,315	89,506	179,844	16,833	20,240
Processing Machinery and Equipment Assets, $	43,468	85,710	201,413	219,178	66,167	63,258
Processing Farm Credit and Other Stock, $	556	2,357	333	816	0	0
Processing Intermediate Assets, $	44,023	85,444	201,746	218,894	66,167	63,258
Processing Land and Building Assets, $	50,225	117,163	67,833	75,579	41,667	52,042
Other Processing Assets, $	0	0	0	0	667	1,155
Processing Assets, $	134,507	242,013	370,206	481,443	125,333	113,928
Processing Operating and Short-term Debt, $	23,304	96,857	2,500	6,124	0	0
Processing Accounts Payable, $	11,266	40,398	81,761	165,686	667	1,155
Processing Current Portion of Intermediate and Long-term Debt, $	5,343	7,833	6,070	6,232	16,285	26,301
Processing Current Debt, $	39,913	143,196	90,331	162,301	16,951	27,455
Processing Intermediate Debt, $	77,714	264,836	183,170	212,772	92,230	135,573
Processing Long-term Debt, $	56,808	152,948	5,219	9,765	99,058	171,574
Processing Net Present Value of Leases, $	0	0	11,121	27,240	0	0
Processing Liabilities, $	174,435	552,501	289,840	374,823	208,240	334,172
Processing Net Worth, $	-39,928[1]	314,650	80,366	206,945	-82,907	249,222
Processing Debt-to-Asset Ratio, %	53.1	58.2	106.7	134.7	197.9	177.4
Processing Current Ratio, %	694.6	725.1	366.2	648.1	129.5	169.3

1 For cheese processors, mean net worth excluding the minimum value (an outlier) is $33,843.

Table 18. Return on Assets for On-Farm Dairy Processors, by Enterprise and Animal Type

Enterprise	Cows (N=17)				Goats and Sheep (N=10)			
	Mean	s.d.	Minimum	Maximum	Mean	s.d.	Minimum	Maximum
Return on Assets, %								
Farm	-23.7	59.0	-237.0	25.1	-24.4	17.3	-65.2	-8.3
Processing	-34.5	64.9	-121.9	147.0	-44.1	49.6	-126.7	7.5
Overall Business	-16.5	22.5	-68.1	20.9	-26.7	18.5	-58.6	-9.4

Note: N=16 for Cows Farm ROA.

Figure 7. Processing Assets and Rate of Return on Processing Assets for On-Farm Dairy Processors, by Animal Type

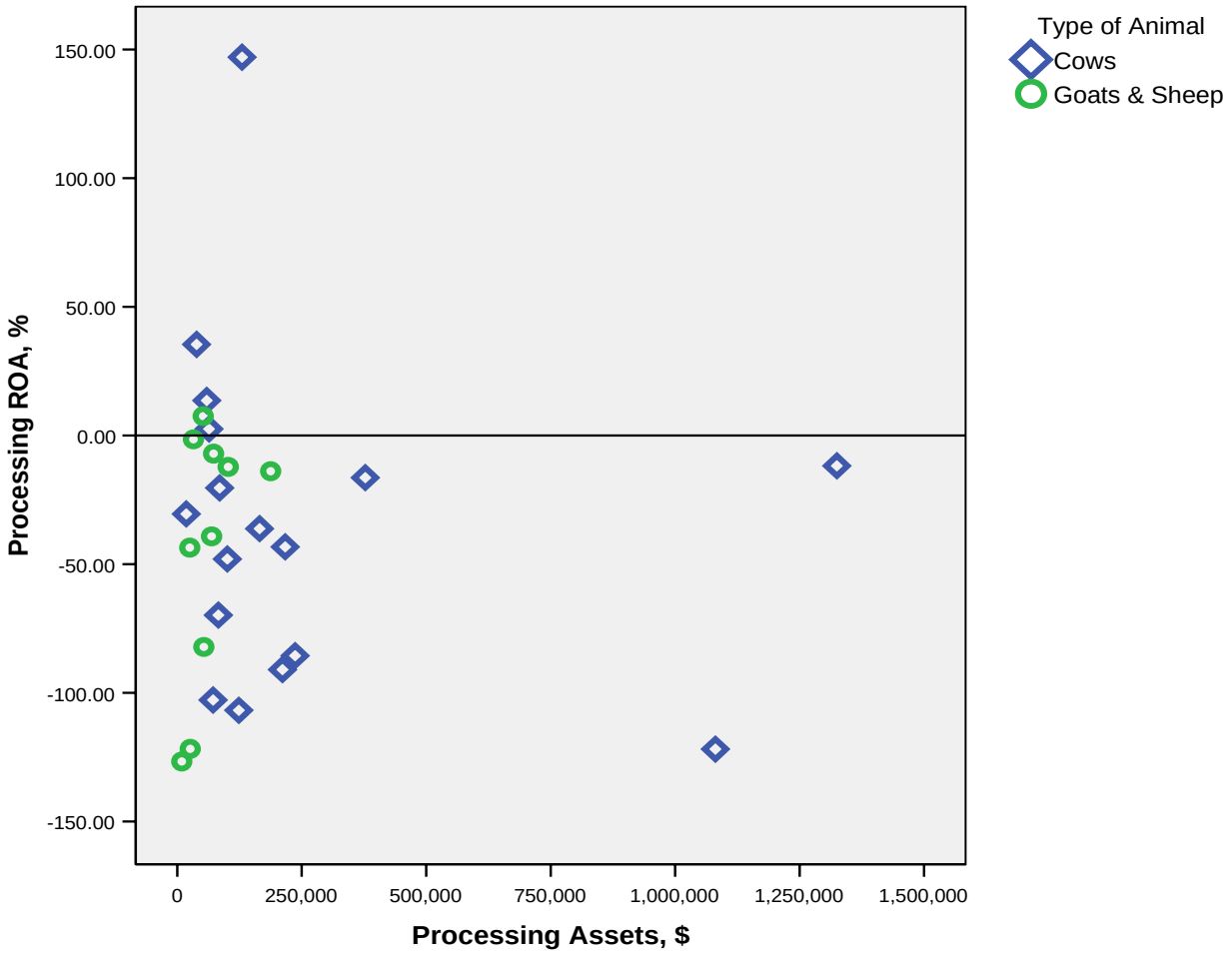


Table 19. Return on Assets for On-Farm Dairy Processors, by Enterprise and Main Product Sold

Enterprise	Cheese (N=18)		Fluid (N=6)		Yogurt (N=3)	
	Mean	s.d.	Mean	s.d.	Mean	s.d.
Return on Assets, %						
Farm	-19.8	16.8	-40.2	97.7	-15.2	15.8
Processing	-47.2	48.8	-18.7	17.6	-21.8	147.6
Overall Business	-22.5	20.9	-15.7	27.7	-16.3	13.2

Note: N=16 for Cheese maker Farm ROA.

nearly $175 per cwt milk processed. Nearly $100 of this amount arises from operator and unpaid family labor. The full economic costs of goat and sheep milk products averaged over $350 per cwt of milk processed (or roughly $21 per lb of cheese). The full economic costs of on-farm processing can also be examined by product (Table 21). Fluid milk processors had the lowest average full economic costs of milk production ($45 per cwt milk produced compared to more than $100 for cheese and yogurt processors). The three yogurt processors had by far the highest average full economic cost of processing and the highest average full economic cost accounting for milk production and product processing. For all products, the net return over full economic costs was decidedly negative (Table 21).

Labor Requirements and Returns

Previous studies have suggested that value-added dairy processors must often work long hours due to the additional responsibilities of processing their milk and marketing the products (Morrison, 2001c). The owners of cow's milk processing businesses contributed about 24 months of full-time equivalents (230 hours/month) to their businesses during 2003. The majority of this time was devoted to the farm business, but on average owners spent nearly 10 months on processing and marketing activities (Table 22). Paid and unpaid family labor contributed an additional 5 months, but hired labor accounted for more than 50% of the total full-time equivalents (FTE) devoted to the combined farm and processing business. The processing activity required nearly 24 FTE months for cow's milk processors and marketing activities required an additional 10 FTE months. Goat and sheep milk processors employed considerably fewer FTE months for their combined farm and processing businesses (Table 22). The amount of owner and family labor was somewhat smaller than for cow's milk processors, but a major difference was the limited use of hired labor by goat and sheep milk processors. Goat and sheep business owners provided nearly 20 FTE months to their businesses, about three-quarters of the total labor employed. In addition, the small ruminant businesses devoted only about one-third of the time to processing and marketing their products as their cow's milk counterparts.

The total labor employed was highest for fluid milk processors (Table 23), largely due to additional owner labor for the farm enterprise and hired labor for processing and marketing. Hired labor accounted for more than half of total FTE months for both fluid milk and yogurt processors, and accounted for more than three-quarters of processing labor for those products. On average, cheese makers used less hired labor as a proportion of the total labor employed and more of that labor was devoted to farm activities (Table 23). Although what constitutes a heavy workload is arguably subjective, it appears that the time demands of on-farm dairy processing

Table 20. Buildup of Economic Costs and Returns Per Hundredweight for On-Farm Dairy Processors, by Animal Type

Element of Economic Cost Buildup	Cows (N=16)		Goats & Sheep (N=10)	
	Mean	s.d.	Mean	s.d.
Milk Production, $/cwt milk produced				
Net Feed and Crop Expense	3.28	5.83	20.46	17.91
Farm Hired Labor Expenses	3.57	5.66	10.00	13.88
Farm Operator's and Unpaid Family Labor	24.04	25.10	78.87	38.56
Farm Total Labor Expense	27.61	23.78	88.87	38.18
Net Farm Machinery Expense	4.23	4.17	4.74	2.54
Net Livestock Purchases Expense	-2.58	4.48	-6.38	7.73
Marketing and Livestock Expense	3.25	1.90	8.43	5.29
Farm Utilities Expenses	0.96	0.78	3.64	3.63
Farm Real Estate and Buildings Expenses	1.33	1.24	7.18	6.10
Farm Depreciation Expense	3.30	3.34	21.62	13.78
Farm Interest Expenses	1.63	3.25	5.19	5.75
Farm Equity Charge	6.94	5.70	21.87	15.88
Total Farm Interest Expense	8.57	8.29	27.06	17.87
Farm Miscellaneous Expenses	1.47	1.07	3.91	2.84
Total Farm Operating Costs	51.40	36.88	179.53	63.03
Product Processing, $/cwt milk processed				
Processing Hired Labor Expenses	10.43	19.69	12.58	25.46
Processing Operator's and Unpaid Family Labor	39.21	60.75	81.20	49.04
Processing Total Labor Expense	49.65	76.81	93.79	53.90
Processing Materials and Supplies Expenses	16.94	17.95	31.53	36.61
Processing Machinery and Equipment Expenses	2.12	2.64	1.29	2.07
Processing Real Estate and Buildings Expenses	1.34	1.45	0.93	1.05
Processing Utilities Expenses	3.11	2.28	8.21	7.60
Processing Depreciation Expense	10.63	22.51	10.32	6.11
Processing Interest Expenses	4.32	10.73	3.85	6.93
Processing Equity Charge	2.49	4.05	4.83	4.04
Total Processing Interest Expense	6.81	10.59	8.67	6.74
Processing Marketing Expenses	6.97	8.33	12.64	11.63
Processing Miscellaneous Expenses	5.82	6.71	5.98	7.04
Total Processing Operating Costs	103.38	131.14	173.36	104.13
Total Production and Processing Operating Costs	154.79	132.37	352.89	135.89
Average Return on Product Sales, $/cwt	65.33	37.48	144.00	73.65
Net Return over Total Product Costs, $/cwt	-89.45	114.29	-208.89	133.89
Net Return over Total Product Costs, %	-49.16	22.86	-56.07	18.46

Table 21. Buildup of Economic Costs and Returns Per Hundredweight for On-Farm Dairy Processors, by Main Product Sold

	Cheese (N=18)		Fluid (N=6)		Yogurt (N=3)	
	Mean	s.d.	Mean	s.d.	Mean	s.d.
Milk Production, $/cwt milk produced						
Net Feed and Crop Expense	12.49	16.23	3.87	6.90	-0.01	10.53
Farm Hired Labor Expenses	6.07	10.91	4.23	4.79	8.03	12.60
Operator's and Unpaid Family Labor	52.09	40.65	17.48	21.99	43.96	60.41
Farm Total Labor Expense	58.17	43.57	21.71	22.56	51.99	55.30
Net Farm Machinery Expense	3.98	3.03	4.41	4.87	5.85	5.05
Net Livestock Purchases Expense	-4.35	7.03	-1.43	0.62	-6.27	4.43
Marketing and Livestock Expense	4.81	3.63	4.05	3.87	8.67	8.54
Farm Utilities Expenses	1.71	2.02	1.36	1.08	4.34	6.31
Farm Real Estate and Buildings Expenses	3.62	2.93	0.99	0.76	8.34	12.50
Farm Depreciation Expense	10.22	10.30	3.98	6.60	20.65	26.94
Farm Interest Expenses	3.16	4.41	0.58	1.08	5.95	8.48
Farm Equity Charge	14.17	13.12	4.21	2.09	16.55	20.27
Total Farm Interest Expense	17.33	14.69	4.79	2.36	22.50	28.66
Farm Miscellaneous Expenses	2.35	1.79	1.60	0.80	3.90	5.47
Total Farm Operating Costs	110.33	79.32	45.31	37.74	119.96	126.59
Processing, $/cwt milk processed						
Processing Hired Labor Expenses	8.78	19.54	7.74	11.22	30.90	40.38
Operator's and Unpaid Family Labor	52.82	40.22	13.15	8.72	137.18	126.40
Processing Total Labor Expense	61.59	46.86	20.89	8.59	168.08	156.07
Materials and Supplies Expenses	19.07	23.19	12.70	8.57	65.37	34.87
Machinery and Equipment Expenses	1.17	1.98	3.90	3.01	0.86	0.76
Real Estate and Buildings Expenses	0.96	0.89	1.51	2.02	1.62	1.86
Processing Utilities Expenses	3.87	3.11	4.09	2.54	12.74	13.66
Processing Depreciation Expense	5.55	5.50	13.51	23.20	32.11	37.91
Processing Interest Expenses	1.72	1.74	1.86	2.31	22.24	22.05
Processing Equity Charge	3.92	3.98	2.75	5.15	0.34	0.58
Total Processing Interest Expense	5.64	4.41	4.61	4.50	22.57	21.55
Processing Marketing Expenses	8.58	9.41	4.45	5.71	19.16	14.50
Processing Miscellaneous Expenses	4.58	5.55	4.68	4.44	14.38	11.57
Total Processing Operating Costs	111.01	72.49	70.33	40.30	336.92	264.07
Total Operating Costs	221.34	131.16	115.64	62.97	456.88	281.93
Average Return on Product Sales, $/cwt	99.32	75.51	61.02	37.30	117.68	18.43
Net Return over Product Costs, $/cwt	-122.03	83.83	-54.61	63.96	-339.20	274.89
Net Return over Total Product Costs, %	-53.83	16.98	-41.68	23.83	-59.41	36.09

Table 22. Labor Usage for On-Farm Dairy Processors, by Labor Type and Animal Type

Labor Category	Cows (N=17)		Goats & Sheep (N=10)	
	Mean	s.d.	Mean	s.d.
Farm FTE				
Owner	14.5	11.6	10.6	8.6
Unpaid Family Labor	2.4	4.7	0.0	0.1
Paid Family Labor	1.1	3.8	0.1	0.3
Hired Labor	14.9	27.9	4.0	6.0
Total Farm	33.0	34.5	14.7	13.5
Processing FTE				
Owner	6.8	5.6	6.2	4.1
Unpaid Family Labor	2.2	7.2	0.0	0.0
Paid Family Labor	0.0	0.0	0.0	0.1
Hired Labor	14.5	25.6	1.7	2.0
Total Processing	23.5	28.1	7.9	5.1
Marketing FTE				
Owner	3.4	3.4	2.5	1.5
Unpaid Family Labor	0.7	1.4	0.1	0.3
Paid Family Labor	0.1	0.3	0.0	0.0
Hired Labor	6.1	20.0	0.6	1.1
Total Marketing	10.3	21.2	3.1	2.3
Total FTE				
Owner	24.8	14.5	19.2	10.3
Unpaid Family Labor	5.3	8.6	0.1	0.4
Paid Family Labor	1.1	4.1	0.2	0.4
Hired Labor	35.5	62.3	6.3	7.9
Total	66.7	68.2	25.8	16.6

Note: One FTE is defined as 230 hours per month.

are substantial, consistent with previous anecdotal evidence. Hired labor undoubtedly can provide a useful resource to economize on the owner or operator's time, but this appears not to limit owner workloads to more manageable levels, and represents a major operating cost.

It is also illustrative to examine the returns to owner labor in processing. For this analysis, the labor and management income (net income less unpaid family labor and the opportunity cost of capital used in processing) divided by the number of amount of labor (in hours) the owner provided to the processing enterprise. This provides an indicator of the hourly earnings of the owner, which is roughly comparable to an hourly wage rate. For half of the processing enterprises, labor and management income per hour was negative (Figure 8). For only eight of the processing enterprises did hourly labor and management income exceed $5.15 per hour, the minimum wage in New York in 2003.

Marketing Outlets Used

Previous case-study research has described various marketing outlets used by specific value-added dairy processors, but there is a dearth of quantitative information on the volume of dairy

Table 23. Labor Usage for On-Farm Dairy Processors, by Labor Type and Main Product Sold

Labor Category	Cheese (N=18)		Fluid (N=6)		Yogurt (N=3)	
	Mean	s.d.	Mean	s.d.	Mean	s.d.
Farm FTE						
Owner	11.3	8.8	19.7	13.8	10.4	12.2
Unpaid Family Labor	1.7	4.2	1.7	4.3	0.0	0.0
Paid Family Labor	0.2	0.5	0.0	0.0	5.2	9.1
Hired Labor	10.1	26.6	12.2	13.5	12.9	16.5
Total Farm	23.3	32.5	33.6	17.0	28.5	37.5
Processing FTE						
Owner	7.1	5.3	7.1	4.6	2.7	3.4
Unpaid Family Labor	1.9	7.0	0.5	1.3	0.0	0.0
Paid Family Labor	0.0	0.1	0.0	0.0	0.0	0.0
Hired Labor	6.6	17.4	18.5	32.8	11.0	13.2
Total Processing	15.6	20.8	26.2	35.2	13.7	12.8
Marketing FTE						
Owner	2.7	2.3	3.8	4.4	4.2	2.7
Unpaid Family Labor	0.7	1.4	0.0	0.0	0.0	0.0
Paid Family Labor	0.0	0.0	0.0	0.0	0.4	0.6
Hired Labor	0.8	1.3	14.3	33.9	3.5	3.3
Total Marketing	4.1	2.9	18.0	36.0	8.0	6.1
Total FTE						
Owner	21.0	12.5	30.6	14.5	17.3	12.4
Unpaid Family Labor	4.3	8.2	2.3	5.6	0.0	0.0
Paid Family Labor	0.2	0.5	0.0	0.0	5.6	9.7
Hired Labor	17.5	43.8	45.0	77.7	27.3	30.9
Total	43.0	52.4	77.8	77.3	50.2	52.5

Note: One FTE is defined as 230 hours per month.

products sold through different channels. Our data on the weighted average proportion of different marketing outlets suggest that on-farm dairy processors market their products through a variety of channels (Table 24). Cow's milk processors sell the largest proportion of their volume (nearly 30%) through wholesalers, but other retailers and farm stands also account for nearly 20% of sales. Goat and sheep milk processors also rely on wholesalers, but traditional retailers and farmer's markets are more important outlets for them than other retailers or farm stands. Cheese makers market more half of their production through wholesalers or other retailers (Table 25), but farmer's markets also account for more than one-fifth of their sales. Fluid milk processors use different market outlets than cheese makers; fully 40% of their sales are at farm stands, and another one-quarter of sales are home delivery. More than 80% of yogurt sales are through wholesalers or traditional retailers (Table 25).

Figure 8. Owner Processing Labor Inputs and Processing Labor and Management Income per Hour, by Animal Type

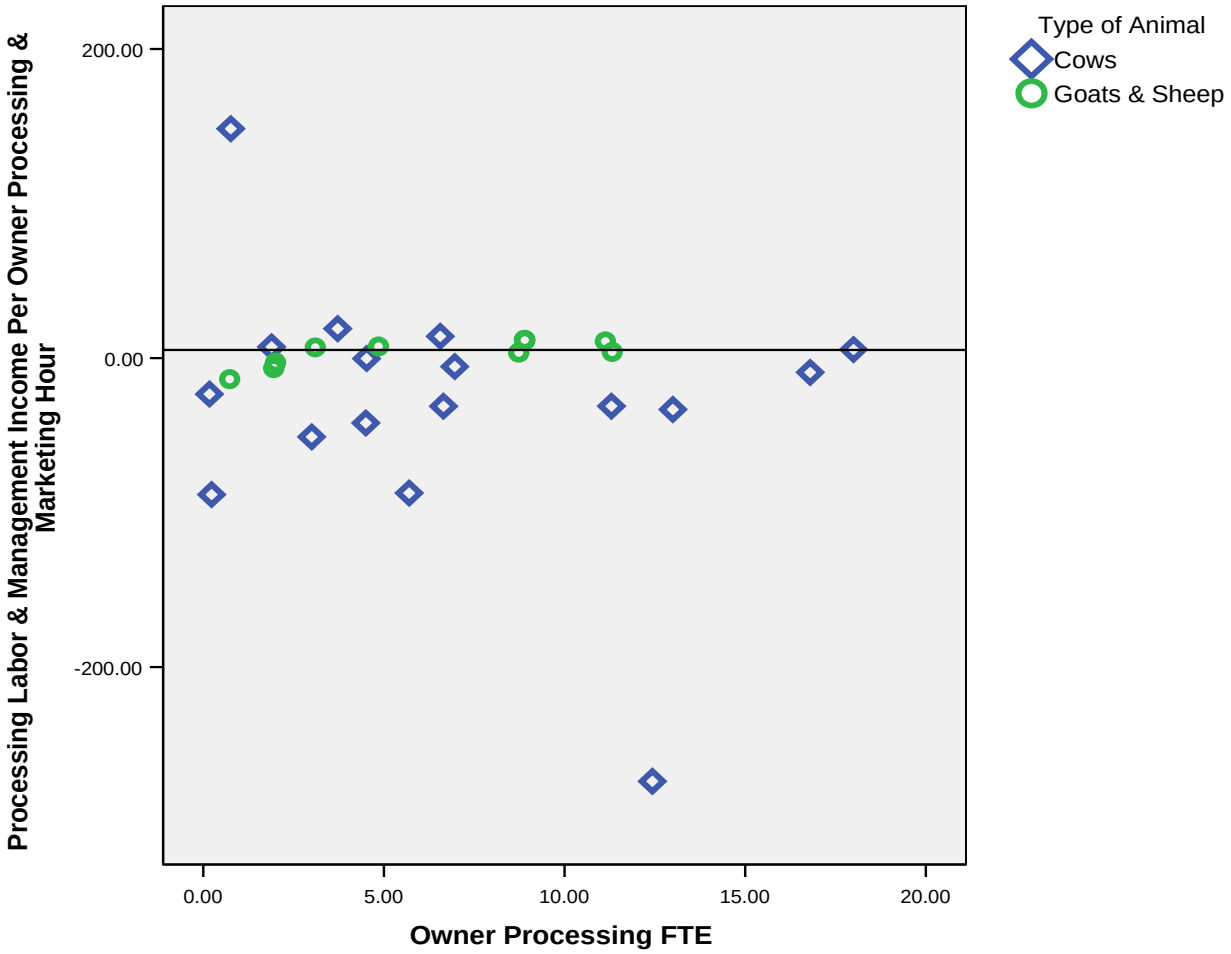


Table 24. Sales Outlets Used by On-Farm Dairy Processors, by Animal Type

Sales Outlet	Cows(N=17)		Goats & Sheep (N=10)	
	Mean	s.d.	Mean	s.d.
Weighted average % sales through				
Farm Stand	17.6	30.6	2.0	4.0
Own Retail Outlet	1.7	6.7	0.0	0.0
Farmer's Market	8.8	16.3	23.1	28.0
Home Delivery	8.7	26.5	0.0	0.0
Traditional Retailer	14.1	27.7	20.4	35.2
Other Retailer	19.5	30.4	12.2	20.3
Wholesaler	29.4	39.1	38.2	38.3
Other	0.1	0.5	4.0	5.5

Table 25. Sales Outlets Used by On-Farm Dairy Processors, by Main Product Sold

Sales Outlets	Cheese (N=18)		Fluid (N=6)		Yogurt (N=3)	
	Mean	s.d.	Mean	s.d.	Mean	s.d.
Weighted average % sales through						
Farm Stand	4.1	8.7	40.6	45.0	3.7	5.5
Own Retail Outlet	1.5	6.3	0.0	0.0	0.0	0.0
Farmer's Market	21.4	24.4	0.0	0.0	0.0	0.0
Home Delivery	0.0	0.0	26.2	43.4	0.0	0.0
Traditional Retailer	15.1	30.3	13.6	19.1	30.0	52.0
Other Retailer	22.1	29.6	0.0	0.0	13.0	22.5
Wholesaler	33.2	35.5	19.6	43.8	53.3	50.3
Other	2.5	4.6	0.0	0.0	0.0	0.0

Conclusions and Implications

The data from this study are quite detailed and were collected and checked with care, but the sample size is small. As a result, caution must be exercised in drawing broad conclusions from this work. This research should be thought of as an initial foray designed to highlight certain issues and pave the way for necessary more comprehensive research projects on value-added dairy processing and value-added agriculture more generally. The key messages from this research include:

- Value-added dairy processing is not a panacea for struggling dairy farms or those interested in making a living from agricultural production and marketing. It appears quite possible to lose money by processing farm milk into dairy products. Many processing enterprises and overall businesses in our study were not profitable, but this may be due in part to the fact that many of them were relatively new to the processing business. A corollary to this observation is that existing ex ante feasibility studies often have underestimated the costs of milk production and processing, leading to overly optimistic predictions of financial performance.

- There are a variety of reasons that milk producers might give for wanting to consider value-added dairy processing. However, inadequate income from the dairy farm probably should not be one of them. On-farm processing adds layers of complexity to the business and demands time and management skills that may not be in abundance. This is consistent with the caveats discussed in Streeter and Bills (2003a, 2003b). For current dairy producers considering a transition to value-added activities, it appears that a financially successful farm business is a prerequisite.

- Operating a business in which both the milk production and the milk processing businesses are profitable appears to be a challenge. Only one of the 27 surveyed businesses made money in both the farm and processing businesses. This may suggest that specialization in one or the other of the enterprises (e.g., focusing on processing with purchased milk) is an appropriate production strategy if both enterprises are not essential to the marketing of the product.

- Previous experience and skills, not surprisingly, appear to influence financial performance. On average, individuals entering into processing from a dairy farm background tended to

have relatively low costs of milk production but high processing and marketing costs. Those entering into milk production and processing at the same time from a non-farm background tended to have relatively low processing and marketing costs but high milk production costs.

- There seems to be a strong learning effect for value-added processors. Those with more years experience in the business demonstrated more profitable businesses. However, there also is likely to be a selection process generating observations about business performance as those who are unsuccessful in the first few years have ceased operation and thus are not available to be survey participants later on. This phenomenon should be addressed in future research on value-added dairy processing.

- Potential value-added dairy processors should carefully consider capital purchases. Based on a simple regression analysis, it appears that many of the processors in this study had invested more in plant and equipment than could be supported by product sales. This may also be related to previous experience. Most dairy farmers would have a good idea of the capital expenditure necessary to expand the herd. However, relatively few are likely to have a good understanding of the capital needs to build and operate a small processing plant.

- Processing should be scaled to operate the processing equipment somewhat intensively. Some operations were processing for several hours a day, but only a few days a week. This schedule may suggest an excess investment in processing equipment relative to product sales. Careful planning will help to make the decision as to whether this is a good strategy or if substituting additional labor for capital would be more cost effective.

- Product pricing seems to be an issue for many on-farm processors. Our results suggest that on average, regardless of the product produced (bottled milk, yogurt, ice cream or cheese), value-added processors need to receive about $100 per hundredweight of milk used to cover milk production and processing costs. Using approximate milk-to-product conversions, this is about $10 per pound of cheese or $8.60 per gallon of fluid milk.

- Selling finished product for $100 per hundredweight of milk used is well above retail prices for most commercial products. This implies that value-added processors should not consider producing and competing against low cost commodity products. For example, it will be difficult to make another outstanding cheddar cheese and compete in an already crowded market for that product. As noted in Gloy and Stephenson (2006), there is a segment of consumers who are looking for a closer connection to their food. Selling the "farm story" with the product is an important part of marketing value-added dairy. There is also a segment consumers who are looking for new and unusual taste experiences. Grass fed milk and(or) well-made, unusual products have a better chance of commanding the higher price in a market niche.

- There are profitable value-added business models to pursue, but care must be taken to construct and execute a well-prepared business plan. There are legitimate motivations for value-added processing today. It could be a lifestyle choice but also a desire to capture some additional portion of the consumer dollar. There was a good reason that producer-processors specialized into either milk production *or* product processing more than 100 years ago—it made economic sense to focus management time and talent on a more streamlined business model and to explore the returns to scale that both segments of the industry continue to find.

- There is a need to better understand the factors that contribute to the financial success (or failure) and performance dynamics of value-added dairy processing businesses. Research to address this issue would require a larger sample of panel data over a number of years. The information provided by this research could be invaluable for the development of better ex ante estimates of likely profitability of value-added dairy processing and for the design of educational programs that seek to improve the financial performance of current value-added dairy processors.

- Projects that fund value-added activities could perform a major service by requiring those businesses to participate in formal assessments of their financial performance, and making summaries of those results publicly available for research and extension programs.

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APPENDIX A: SAMPLE INPUT SCREENS FROM STAND-ALONE DATA ENTRY PROGRAM FOR VALUE-ADDED DAIRY FINANCIAL ANALYSIS

General Instructions

Print Instructions

General Instructions for the Benchmark Instrument

This is a benchmark instrument to determine the financial performance of value-added dairy businesses by separating milk production from processing enterprises. The project is supported in part by a grant from the Risk Management Agency, a division of the U.S. Department of Agriculture and Cornell University. Project collaborators include the states of Wisconsin, Vermont and Massachusetts.

Data contained in this survey will be held in strictest confidence. We will return a report to you comparing your farm business and processing business against other benchmark participants. Data ranges will be scrutinized to ensure that no individual operation can be identified in the reports.

Data is stored on your computer in a text file for each business that you have named (use the business name as the file name). This text file is a column of data that can be opened in a spreadsheet or text editor. When finished with the questions, you can send the data to Cornell where individual reports will be assembled. This is done by choosing "Mail Survey" from the File menu.

Responses for each reporting business are to be on a consolidated financial statement basis. For example, the total dairy and crop production business are to be combined into one business with transfer payments and loans between entities removed. The exception will be the processing business. Please make every attempt to partition combined costs for such things as utilities, hired labor, etc. between milk production and dairy product processing. Any other businesses not associated with the dairy are to be removed from the record. That is all receipts, expenses, labor and investments are not to be included in this benchmark.

In order for an income statement to accurately measure income, it must include cash transactions and accrual adjustments (changes in accounts payable, accounts receivable, inventories, and prepaid expenses). When your cursor is in a databox in a receipt or expense field, an accrual calculator is available to help you from the Pages menu (ctrl-A). A few guidelines follow:

Cash paid is the actual cash outlay during the year and does not necessarily represent the cost of goods and services actually used in 2003.

Change in inventory of expense items: Increases in inventories of supplies and other purchased inputs are subtracted in computing accrual expenses because they represent purchased inputs not actually used during the year. Decreases in purchased inventories are added to expenses because they represent inputs purchased in a prior year and used this year.

Change in prepaid expenses is a net change in non-inventory expenses that have been paid in advance of their use. For example, prepaid lease expense on the beginning of year balance sheet represents last year's payment for use of the asset during this year. End-of-year prepaid expense represents payments made this year for next year's use of the asset. Adding payments made last year for this year's use of the asset, and subtracting payments made this year for next year's use of the asset is accomplished by subtracting the difference.

Change in accounts payable: An increase in accounts payable from beginning to end of year is added when calculating accrual expenses because these expenses were incurred (resources used) in 2003 but not paid for. A decrease is subtracted because it represents payment for resources used before 2003.

Accrual expenses are an estimate of the costs of inputs actually used in this year's production. They are the cash paid, less changes in inventory and prepaid expenses, plus accounts payable.

Cash receipts include the gross value of milk checks received during the year plus all other payments received from the sale of farm products, services, and government programs. Non-farm income (selling seed or services performed off of the farm, etc.) is not included in calculating business profitability.

Changes in inventory of farm commodities produced by the business are calculated by subtracting beginning of year values from end of year values excluding appreciation. Increases in livestock inventory caused by herd growth and/ or quality are added, and decreases caused by herd reduction and/or quality are subtracted. Changes in inventories of crops grown are also included. An increase in advanced government receipts is subtracted from cash income because it represents income received in 2003 for the next crop year in excess of funds earned for 2003. Likewise, a decrease is added to cash government receipts because it represents funds earned for 2003 but received in the previous year. Similar changes in the value of processed commodities should be accounted for in the processing business (eg, change in the value of cheese held in inventory).

Changes in accounts receivable are calculated by subtracting beginning year balances from end year balances. Payments in January for milk produced and sold in December 2003 compared to January 2003 payments for milk produced in previous year are included as a change in accounts receivable.

Accrual receipts represent the value of all farm commodities produced and services actually generated by the farm business during the year.

Basic Information

Edit Notes

	Farm	*Person Filling Out Survey*
Name:	Ron Cheddar	Mark Stephenson
Farm/Business Name:	Example Cheese Maker	Cornell University
Address:	112 Stilton Road	316 Warren Hall-AEM
City:	Little Curd	Ithaca
State:	NY	NY
Zip:	12345	14853-7801
Phone Number:	518-555-1212	607-255-0324
Email Address:	Ron@CheeseCurd.com	mws5@cornell.edu

2003 Calendar year of fiscal data.

Cows Type of animals milked.

10 Average number of mature livestock owned, rented and leased (both milking and dry) during 2003

7 Average number of youngstock owned, rented and leased during 2003

100000 Total pounds of milk produced in 2003

90000 Total pounds of farm milk used in dairy processing

Pounds of milk purchased off the farm for dairy processing.

9800 Total pounds of milk sold (not used in processing)

20 cwt. All of your milk was used in processing. If you had sold some or all of it, what kind of price would you have expected to receive per unit?

100 Total tillable acres (owned and rented)

54 Acres of crops grown for use by the dairy herd (exclude permanent pasture)

44 Acres of pasture (tillable and permanent)

2000 What year did you begin the farming enterprise?

2002 What year did you begin the processing enterprise?

☑ Are you a certified organic producer?

Yes Do you currently, or have you previously operated other businesses

What type of other business and how many years were you involved

		Years
Business 1)	Dairy farm	12
Business 2)		
Business 3)		

Farm Receipts and Expenses

Receipts

1960	Raw milk sales (to commercial processors or handlers)
2000	Sale of dairy cattle, calves, goats/sheep
0	Other livestock
750	Crops
0	Custom machine work
1500	Government receipts
0	Other (indicate)
$6210	Total Receipts

Expenses

850	Hired labor for farm enterprise (include all payroll taxes, fringe benefits and profit sharing, but exclude the value of housing, milk , meat, etc.)

Feed purcased

3100	Dairy grain and concentrate
0	Dairy roughage
0	Non-dairy feed

Machinery

1250	Machinery hire, rent and lease
2600	Machinery repairs and farm vehicle expense
200	Fuel, oil and grease

Livestock

0	Replacement livestock
500	Breeding
1100	Milking supplies
450	Veterinary and medicine
0	Cattle rent and lease
0	Custom boarding
0	Other livestock expense (including bedding, bST, milk marketing, etc.)

Crop production

0	Fertilizer and lime
475	Seeds and plants
0	Spray and other crop expense

Real estate

525	Land, building and fence repair
2500	Real estate taxes
0	Rent and lease

Other

750	Insurance
225	Utilities (farm share)
3125	Interest
475	Miscellaneous
$18125	*TOTAL OPERATING EXPENSES*
1000	Expansion livestock
2300	Depreciation (machinery and real estate)

Processing Enterprise Receipts and Expenses

Receipts

69750	Cheese sold
0	Bottled Milk sold
0	Yogurt sold
0	Ice Cream sold
	Other Dairy Products (indicate)
	Other Receipts (indicate)
$69750	Total Receipts

Expenses

Labor — *Hired labor for dairy processing enterprise (include all payroll taxes, fringe benefits and profit sharing, but exclude the value of housing, milk , meat, etc.)*

3500	Processsing/marketing labor Tip

Materials and supplies

	Milk purchased and not produced on the farm.
2525	Processing materials and supplies (example: cultures, salt, etc.)
625	Packaging materials and supplies
125	Other materials and supplies (include cleaning chemicals, etc.)

Machinery and equipment

0	Machinery or equipment hire, rent and lease Tip
2600	Machinery and equipment repairs and business vehicle expense Tip

Marketing expenses

3250	Transportation (travel to selling points, distribution routes, etc.)
325	Value of product samples
750	Advertising
0	Fees paid to retailers
125	Fees paid to other market outlets (farmer's markets, etc.)
	Other (indicate)

Real estate

725	Processing building maintenance and repair Tip
1225	Real estate taxes (on processing business--if separable from farm) Tip
0	Rent and lease Tip

Other

250	Insurance (processing related) Tip
491	Utilities (processing share) Tip
1120	Interest Tip
110	Licensing and regulatory fees
0	Custom processing fees or expenses paid
0	Miscellaneous Tip
$17746	*TOTAL OPERATING EXPENSES*
1200	Depreciation (machinery and real estate) Tip

Assets and Liabilities

Edit Notes

Assets are to be valued at market value as of December 31, 2003, less sale expenses. Liabilities include remaining balance on all loans and obligations. Deferred taxes are not included as a liability. Where possible, assets and liabilities should be separated into farm and processing enterprises. Dwelling and other personal assets and liabilities should not be included.

Assets

Farm	*Processing*	
325	325	Business cash, checking and savings
0	0	Accounts receivable
0	0	Pre-paid expenses
6250		Feed and Supplies
12000		Mature dairy animals
4800		Dairy youngstock
125		Other livestock
32550	25000	Machinery and equipment
0	0	Farm Credit and other stock
110000	0	Land and buildings
	22125	Processed dairy products and supplies
0	0	Other assets
$166050	$47450	Total Assets

Liabilities

Enterprise	*Type of Liability*	*Dollars per Payment*	*No. Payments per Year*	*Principal Remaining*	*Ann Percent Interest*	*Description*
Farm	Long-...	750	12	50000	6.25	Farm Bank Loan
Proce...	Long-...	400	12	16000	7	Loan for Cheese Making Equip
Proce...	Long-...	100	12	20000	0	Stockholder Loan for Cheese E

Farm	*Processing*	
$50000	$36000	Total Liabilities

Leases

Enterprise	*Dollars per Payment*	*No. Payments per Year*	*No. Payments Remaining*	*Description*
Proce...	120	12	12	Leased lab equipment

Work Force and Time Allocation

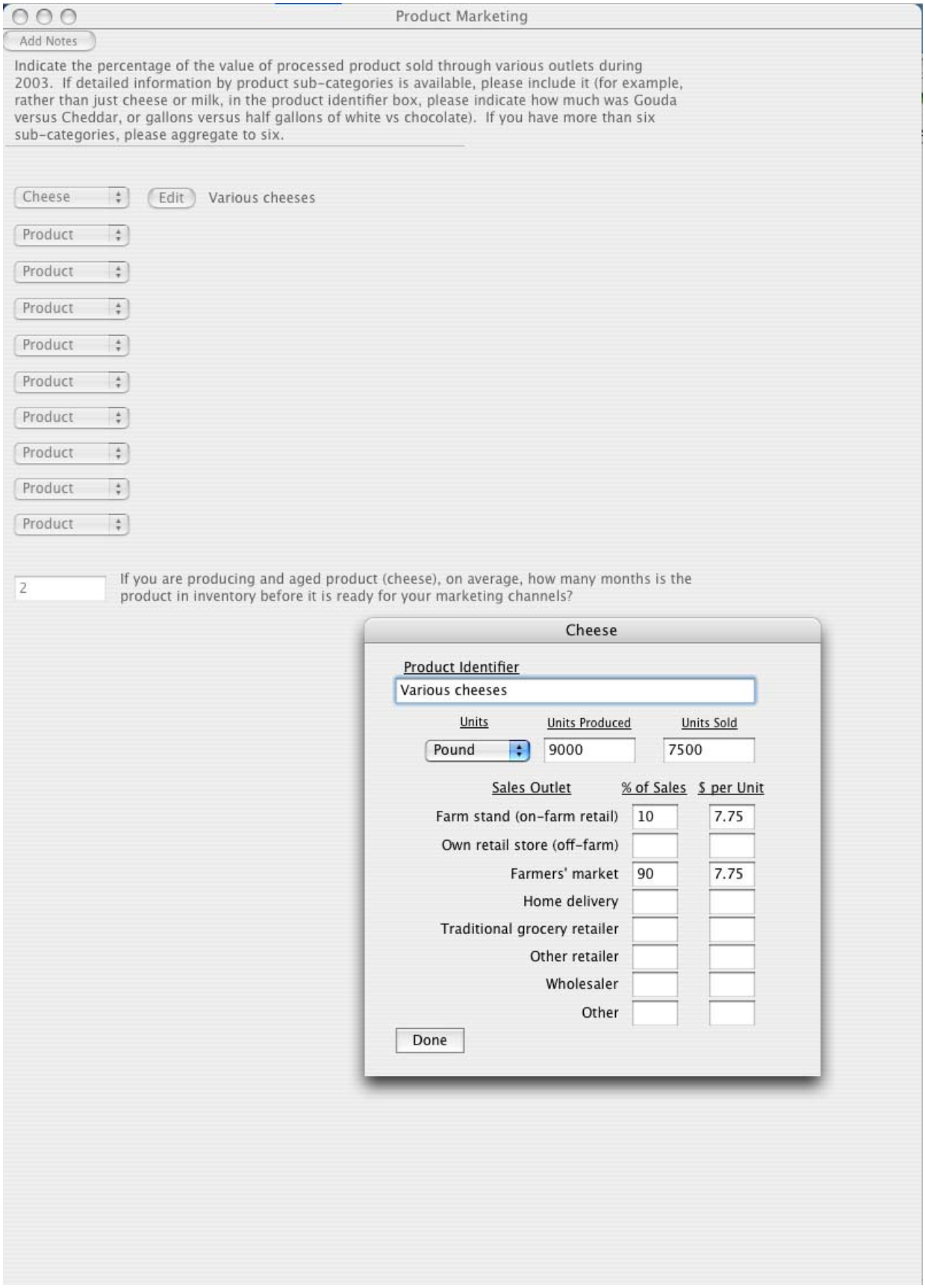
Edit Notes

Labor is reported here in months of full-time equivalent (FTE) for the farm, processing and product sales during 2003. One month of full-time equivalent of labor is considered to be 230 hours per month. Please make your best partitioned estimate of monthly FTEs in 2003.

	Farm	Processing	Selling	
Owner(s) / operator(s):	6	7	3	16 Months
Unpaid family labor:	2	0	3	5 Months
Paid family labor:	0	0	0	0 Months
Other hired labor:	4	1	2	7 Months
	12 Months	8 Months	8 Months	28 Months

Please answer the following question for each owner / operator: What annual salary would you expect to be paid if you were employed by someone else to do all of the tasks (labor and management) that you currently do in your own farm and processing business.

Owner / operator #1:	25000
Owner / operator #2:	
Owner / operator #3:	
Owner / operator #4:	
Owner / operator #5:	


Product Marketing
Add Notes
Indicate the percentage of the value of processed product sold through various outlets during 2003. If detailed information by product sub-categories is available, please include it (for example, rather than just cheese or milk, in the product identifier box, please indicate how much was Gouda versus Cheddar, or gallons versus half gallons of white vs chocolate). If you have more than six sub-categories, please aggregate to six.
Cheese
Edit
Various cheeses
Product
Product
Product
Product
Product
Product
Product
Product
Product
2
If you are producing and aged product (cheese), on average, how many months is the product in inventory before it is ready for your marketing channels?
Cheese
Product Identifier
Various cheeses
Units
Units Produced
Units Sold
Pound
9000
7500
Sales Outlet
% of Sales
$ per Unit
Farm stand (on-farm retail)
10
7.75
Own retail store (off-farm)
Farmers' market
90
7.75
Home delivery
Traditional grocery retailer
Other retailer
Wholesaler
Other
Done

Miscellaneous Questions

Add Notes

Increased income com...

What is your primary reason for undertaking small scale dairy processing? (choose one)

What were your principal sources of information for starting the farm business? (Indicate as many as apply)

- [x] Written materials (books, newsletters, web sites, etc.)
- [ ] Course taught by private consultant
- [ ] Course taught through university or school
- [x] Course taught through non-profit organization or project
- [ ] Cooperative extension
- [ ] Other (specify)

What are the key challenges facing your business over the next year? (Indicate as many as apply)

- [ ] Milk production (herd feeding, breeding, health, etc.)
- [x] Product quality
- [ ] Financing expansion
- [x] Marketing efforts to increase sales
- [ ] Expanding production to meet increased demand
- [x] Compliance with (or understanding of) regulations
- [ ] Other (specify)

Do you currently cooperate with other value-added processors in the following ways? (Indicate as many as apply)

- [ ] Purchasing supplies or other inputs
- [ ] Purchasing equipment
- [ ] Purchasing other products or services (insurance, etc.)
- [ ] Jointly aging cheese
- [ ] Co-packaging products
- [ ] Distributing products to customers
- [ ] Joint promotion and advertising
- [ ] Marketing products

Wrap Up

This is the last page of the survey. The area below is provided to let us know anything that you might want to about your business. It would also be a good place to let us know if you have had any unusual disruptions to your business in 2003. Such things as major expansions or contractions of the farm or processing enterprises could make a difference in the interpretation of your financial success.

This is an example for report-generation purposes only. It shouldn't be used as any kind of indicator of the profitability of value-added cheese businesses.

If you are satisfied that your survey responses are complete, please go the the "File" menu and select the "Mail Survey" option.

APPENDIX B: SAMPLE INDIVIDUAL BUSINESS FINANCIAL PERFORMANCE REPORT

Individual Financial Performance Report for Example Cheese Maker
The U.S. Value-Added Dairy Project
Calendar Year, 2003

Wednesday, June 08, 2005

Cooperator Contact Info
Ron Cheddar
Example Cheese Maker
112 Stilton Road
Little Curd, NY 12345
518-555-1212
Ron@CheeseCurd.com

Enumerator Contact Info
Mark Stephenson
Cornell University
316 Warren Hall-AEM
Ithaca, NY 14853-7801
607-255-0324
mws5@cornell.edu

Table 1. Descriptive Statistics

Animals		
Cows		10
Heifers		7
Milk Production		
Total milk produced, lbs.		100,000
Milk production per Cow, lbs/yr		10,000
Raw milk sold, lbs.		9,800
Farm milk used in processing, lbs.		90,000
Milk purchased and used in processing, lbs.		0
Total milk used in processing, lbs.		90,000
Milk not accounted for (farm use, loss, etc.), lbs.		200
Crops		
Total crop acres per Cow		5
Total pasture acres per Cow		4
Products	Produced	Sold
Total pounds cheese	9,000	7,500
Total gallons beverage milk	0	0
Total gallons yogurt	0	0
Total gallons ice cream	0	0
Total other products	0	0

The U.S. Value-Added Dairy Project is supported in part by a grant from the Risk Management Agency, a branch of the U.S. Department of Agriculture and by the Cornell Program on Dairy Markets and Policy. Any questions regarding benchmark results may be directed to the enumerator listed above or to Cornell University (607) 255-0324.

Businesses from many states are participating in the benchmarks. The confidentiality of all data will be maintained at the highest level. Once there are enough completed benchmarks, a comparison report will be generated and sent to you at the address above. This report will allow you to compare your operation with similar businesses.

Individual Financial Performance Report for Example Cheese Maker
The U.S. Value-Added Dairy Project
Calendar Year, 2003

Table 2. Income Statement for the Business

Receipts	**Farm**	**Processing**	**Total**
Raw milk sales	$1,960		$1,960
Transfer to processing*	$18,000		$18,000
Dairy product sales		$69,750	$69,750
Livestock sales	$2,000		$2,000
Crops & other farm sales	$750		$750
Government & other receipts	$1,500	$0	$1,500
Total Receipts	$24,210	$69,750	$93,960
Expenses			
Hired labor	$850	$3,500	$4,350
Feed purchased	$3,100		$3,100
Transfer to processing*		$18,000	$18,000
Materials & supplies		$3,275	$3,275
Machinery & equipment	$4,050	$2,600	$6,650
Livestock	$2,050		$2,050
Crops	$475		$475
Real estate & buildings	$3,025	$1,950	$4,975
Utilities	$225	$491	$716
Interest	$3,125	$1,120	$4,245
Marketing		$4,450	$4,450
Miscellaneous	$1,225	$360	$1,585
Total Operating Expense	$18,125	$35,746	$53,871
Expansion livestock	$1,000		$1,000
Depreciation	$2,300	$1,200	$3,500
Net Income	$2,785	$32,804	$35,589
Unpaid family labor**	$4,400	$6,600	$11,000
Real interest on equity***	$5,500	$322	$5,823
Labor & mgt income	($7,115)	$25,882	$18,766
Value of operator's labor	$9,375	$15,625	$25,000
Rate of Return on Assets	(4.7%)	23.9%	1.8%

* "Transfer to processing" represents an opportunity cost for the farm to sell milk and an expense to the processing enterprise to buy milk. The value used is based on the actual dollar value of milk sold off the farm or from your assessment of that value.

** Unpaid family labor valued at $2,200 per month.

***The equity in your business is charged a 5.0% rate of return.

Individual Financial Performance Report for Example Cheese Maker
The U.S. Value-Added Dairy Project
Calendar Year, 2003

Table 3. Income Statement per Hundredweight^

Receipts	**Farm**	**Processing**
Raw milk sales	$1.96	
Transfer to processing*	$18.00	
Dairy product sales		$77.50
Livestock sales	$2.00	
Crops & other farm sales	$0.75	
Government & other receipts	$1.50	$0.00
Total Receipts	$24.21	$77.50
Expenses		
Hired labor	$0.85	$3.89
Feed purchased	$3.10	
Transfer to processing*		$20.00
Materials & supplies		$3.64
Machinery & equipment	$4.05	$2.89
Livestock	$2.05	
Crops	$0.47	
Real estate & buildings	$3.02	$2.17
Utilities	$0.23	$0.55
Interest	$3.12	$1.24
Marketing		$4.94
Miscellaneous	$1.23	$0.40
Total Operating Expense	$18.12	$39.72
Expansion livestock	$1.00	
Depreciation	$2.30	$1.33
Net Income	$2.79	$36.45
Unpaid family labor**	$4.40	$7.33
Real interest on equity***	$5.50	$0.36
Labor & mgt income	($7.12)	$28.76
Value of operator's labor	$9.38	$17.36
Rate of Return on Assets	(4.7%)	23.9%

^ The "Farm" values are per cwt. of milk produced while the "Processing" values are for cwt. of milk used in processing.
* "Transfer to processing" represents an opportunity cost for the farm to sell milk and an expense to the processing enterprise to buy milk. The value used is based on the actual dollar value of milk sold off the farm or from your assessment of that value.
** Unpaid family labor valued at $2,200 per month.
***The equity in your business is charged a 5.0% rate of return.

Individual Financial Performance Report for Example Cheese Maker
The U.S. Value-Added Dairy Project
Calendar Year, 2003

Table 4. Balance Sheet

Current Assets	**Farm**	**Processing**	**Total**
Cash, checking & savings	$325	$325	$650
Accounts receivable	$0	$0	$0
Prepaid expenses	$0	$0	$0
Farm feed & supplies	$6,250		$6,250
Processed products & supplies		$22,125	$22,125
Total Current	$6,575	$22,450	$29,025
Intermediate Assets			
Livestock	$16,925		$16,925
Machinery & equipment	$32,550	$25,000	$57,550
Farm Credit & other stock	$0	$0	$0
Total Intermediate	$49,475	$25,000	$74,475
Land & buildings	$110,000	$0	$110,000
Other assets	$0	$0	$0
NPV of Leases	$0	$1,398	$1,398
Total Assets	$166,050	$48,848	$214,898
Current Debt			
Operating & short-term	$0	$0	$0
Accounts payable	$0	$0	$0
Current portion of inter. & long debt	$6,046	$5,000	$11,046
Total Current Debt	$6,046	$5,000	$11,046
Intermediate Debt	$0	$0	$0
Long-term Debt	$50,000	$36,000	$86,000
NPV of Leases	$0	$1,398	$1,398
Total Liabilities	$56,046	$42,398	$98,444
Net Worth	$110,004	$6,450	$116,454
Debt/Asset Ratio	33.8%	86.8%	45.8%
Current Ratio	108.7%	449.0%	262.8%

Individual Financial Performance Report for Example Cheese Maker
The U.S. Value-Added Dairy Project
Calendar Year, 2003

Table 5. Buildup of Costs and Returns per Hundredweight

Milk production		
Net feed & crop		$1.33
Hired labor	$0.85	
Operator's & unpaid family labor	$13.78	
Total labor		$14.62
Net farm machinery		$4.05
Net livestock purchases		($2.00)
Marketing & livestock expense		$2.05
Farm utilities & other farm expenses		$0.23
Farm real estate repair, taxes & rent		$3.02
Farm depreciation		$2.30
Interest paid	$3.12	
Interest on equity	$5.50	
Total Interest		$8.63
Net miscellaneous expense		$1.23
Cost per cwt. of milk production		$35.45
Product processing		
Hired labor	$3.89	
Operator's & unpaid family labor	$24.69	
Total labor		$28.58
Materials & supplies		$3.64
Processing equipment repair/expense		$2.89
Processing real estate repair, taxes & rent		$2.17
Processing utilities		$0.55
Processing depreciation		$1.33
Interest paid	$1.24	
Interest on equity	$0.36	
Total Interest		$1.60
Marketing		$4.94
Net miscellaneous & other expenses		$0.40
Cost per cwt. of milk processed		$46.10
Average per cwt. revenue on product sales		$77.50
Net return per cwt. over costs (5.0%)		($4.05)

Explanation of Key Financial Performance Measures

Income Statement

The income statement is a summary of all receipts and gains during a specified period of time (usually one year), less all expenses and losses during the same period. Because it includes a calculation of net income (or loss), it is also known as a *profit and loss statement*. The income statement is a measure of output and input in value terms. It provides one measure of liquidity, the ability of the business to meet its financial obligations, including family living expenses. Income statements are most appropriately calculated on an *accrual basis*, which makes adjustments to cash receipts and expenditures for such items as changes in accounts payable and receivable, prepaid expenses, and values of inventories of assets and materials used in milk production or dairy processing. Accrual accounting more accurately reflects the business' performance than cash accounting because it better matches receipts and expenditures in a given year. Although your business probably depends on both production and processing, separating them for the purposes of the income statement can provide useful information about which enterprise contributes what to overall financial performance.

Your report provides an income statement for the farm (milk production) enterprise (if applicable), the processing enterprise, and the combined total. *Table 2* provides the standard income statement that includes the total receipts, expenses and net income for both the farm and the processing enterprises. This provides an indication of the income-generating capacity of farm and processing enterprises. *Table 3* reports these same values per hundredweight of milk produced (for the farm) and milk processed (for the processing enterprise). The per-hundredweight calculations allow better comparisons across farms and processing enterprises of different sizes, because the values are standardized by the amount of milk produced or processed. It is also often easier to examine areas in which receipts may be increased or expenditures reduced when values are expressed in this manner.

Net Income is the total combined return to the farm/business operator and other unpaid family members for working, managing, financing and owning the farm business. It is calculated as the difference between accrual receipts and accrual expenses, expansion livestock (for the farm) and depreciation.

Labor and Management Income is the return generated by the business to the labor and management of the operator(s). It is calculated starting with *Net Income* and subtracting the value of any *Unpaid family labor* and the opportunity cost of farm equity (*Real interest on equity*). This opportunity cost assumes that if the current equity were not invested in the farm, a 5% return (that is, interest, say from a bank account) could be earned.

The *Rate of Return on Assets* is calculated by taking *Net Income*, subtracting the value of *Operator's & unpaid family labor*, adding back the *Interest* paid and dividing by the total assets owned by the enterprise. This indicates the percentage rate of return on assets owned by the enterprise, assuming that the operator and family labor are compensated at a level they indicate is acceptable.

Balance Sheet

The balance sheet is a summary of the assets and liabilities of the business, together with a statement of the owner's *equity* or *net worth*. The primary purpose of the balance sheet is to indicate financial solvency of the business, because it shows the margin by which debt obligations would be covered if the business were terminated and all assets were sold. A balance sheet refers to a specific point in time (not a period of time).

Your report provides an balance sheet for the farm (milk production) enterprise (if applicable), the processing enterprise, and the combined total. *Table 4* indicates the values of assets,

liabilities and net worth. *Net worth*, or *equity*, is the difference between the value of assets and liabilities in the balance sheet.

The *debt-to-asset ratio* is calculated by dividing the total liabilities by the total assets. It is a summary measure for the solvency of the business, and reflects the capacity of for borrowing.

The *current ratio* is calculated by dividing current liabilities by current assets. If current assets are sufficient to cover current liabilities, this ratio will be greater than 100%.

Accounting of Costs and Returns

Table 5 provides an additional way of viewing the financial performance of the farm and dairy processing enterprises. It includes a calculation of the full *cost of milk production per hundredweight*, including the value of operators' labor and unpaid family labor, and the opportunity cost of farm equity ("interest on equity"). The cost per hundredweight also assumes that the costs of producing crops and livestock sold are equal to the revenues generated. This may be a poor assumption if crop sales or other forms of income are a substantial portion of total income. A similar calculation is made for the full *cost of dairy processing per hundredweight of milk processed*, again accounting for the value of operators' and unpaid family labor and the opportunity cost of equity. The *average revenue per hundredweight of product sales* is calculated as the accrual revenues for dairy product sales divided by the amount of milk processed. The *net return per hundredweight* begins with the average revenue per hundredweight of product sales, then subtracts the costs of processing and the costs of milk production. This net return is reported per hundredweight, and as a percentage of the costs of milk production and processing. Because the full costs of operator's labor and opportunity costs are included, it is possible for the net returns to be negative, even if the farm and dairy processing enterprises together generate a net income greater than zero.

APPENDIX C: SAMPLE BENCHMARK PERFORMANCE REPORT

Benchmark Performance Report for
Example Cheese Maker
The U.S. Value-Added Dairy Project
Calendar Year, 2003

Monday, September 25, 2006

Table 1. Comparisons of the Farm Operation

	By Size^	By Product*	Your Operation
Total milk produced, lbs.	118,442	1,254,844	100,000
Total receipts	$39,201	$333,286	$24,210
Total operating expenses	$40,282	$157,809	$18,125
Net Income	($9,110)	$160,687	$2,785
Labor & management income	($17,460)	$144,816	($7,115)
Return on assets	(33.6%)	(16.0%)	(4.7%)
Receipts per cwt milk produced	$44.90	$42.19	$24.21
Hired labor expenses per cwt	$4.76	$6.36	$0.85
Feed costs per cwt	$20.23	$16.84	$3.10
Operating expenses per cwt	$50.04	$44.15	$18.12
Net income per cwt	($18.93)	($13.48)	$2.79
Labor & mangt income per cwt	($35.82)	($29.66)	($7.12)
Assets	$258,079	$547,488	$166,050
Liabilities	$56,016	$287,890	$56,046
Net worth	$202,063	$259,598	$110,004
Debt/Asset ratio	19.5%	21.6%	33.8%
Full-time equivalent labor (months)	13.0	23.6	12.0
Number of years farming	7.2	8.8	3.0

^ Size categories are based on annual pounds of milk used to produce finished products. You are in the 0 to 99,999 lbs. of milk category.

* The product category is based on the primary product that you produced, which was cheese.

The U.S. Value-Added Dairy Project is supported in part by a grant from the Risk Management Agency, a branch of the U.S. Department of Agriculture and by the Cornell Program on Dairy Markets and Policy. Any questions regarding benchmark results may be directed to the enumerator listed above or to Cornell University (607) 255-0324.

Businesses from many states are participating in the benchmarks. The confidentiality of all data will be maintained at the highest level

Benchmark Performance Report for
Example Cheese Maker
The U.S. Value-Added Dairy Project
Calendar Year, 2003

Monday, September 25, 2006

Table 2. Comparisons of the Processing Operation

	By Size^	By Product*	Your Operation
Total milk used in processing, lbs.	30,131	485,269	90,000
Total receipts	$42,382	$154,082	$69,750
Total operating expenses	$34,857	$207,832	$35,746
Net Income	$1,891	($73,399)	$32,804
Labor & management income	($100)	($80,619)	$25,882
Return on assets	(27.6%)	(52.0%)	23.9%
Receipts per cwt milk processed	$93.93	$100.20	$77.50
Hired labor expenses per cwt	$9.95	$9.22	$3.89
Marketing expenses per cwt	$9.12	$8.83	$4.94
Operating expenses per cwt	$83.94	$79.58	$39.72
Net income per cwt	($1.87)	$15.01	$36.45
Labor & mangt income per cwt	($6.62)	$8.75	$28.76
Assets	$58,046	$140,133	$48,848
Liabilities	$45,713	$184,631	$42,398
Net worth	$12,333	($44,498)	$6,450
Debt/Asset ratio	48.5%	56.0%	86.8%
Processing full-time equivalent labor (months)	5.1	16.1	8.0
Marketing full-time equivalent labor (months)	2.4	4.2	8.0
Number of years processing	3.8	4.2	1.0

^ Size categories are based on annual pounds of milk used to produce finished products. You are in the 0 to 99,999 lbs. of milk category.

* The product category is based on the primary product that you produced, which was cheese.

Benchmark Performance Report for
Example Cheese Maker
The U.S. Value-Added Dairy Project
Calendar Year, 2003

Monday, September 25, 2006

Table 3. Comparisons of the Combined Farm and Processing Operations

	By Size^	By Product*	Your Operation
Total receipts	$81,583	$487,368	$93,960
Total operating expenses	$75,140	$365,642	$53,871
Net Income	($7,220)	$87,288	$35,589
Labor & management income	($17,560)	$64,197	$18,766
Return on assets	(27.2%)	(23.4%)	1.8%
Assets	$316,125	$687,621	$214,898
Liabilities	$101,729	$472,521	$98,444
Net worth	$214,396	$215,100	$116,454
Debt/Asset ratio	26.4%	30.3%	45.8%
Full-time equivalent labor (months)	20.6	43.9	28.0

Table 4. Buildup of Costs and Returns per Hundredweight

	By Size^	By Product*	Your Operation
Cost of milk production per cwt	$122.74	$110.31	$35.45
Cost of processing per cwt	$135.55	$112.95	$46.10
Ave revenue per cwt from product sales	$91.34	$98.63	$77.50
Net return per cwt over all costs	($152.57)	($124.63)	($4.05)

---

^ Size categories are based on annual pounds of milk used to produce finished products. You are in the 0 to 99,999 lbs. of milk category.

* The product category is based on the primary product that you produced, which was cheese.

OTHER A.E.M. RESEARCH BULLETINS

RB No	Title	Fee (if applicable)	Author(s)
2006-05	Measuring the impacts of generic fluid milk in dairy marketing		Kaiser, H. and D. Dong
2006-04	2007 Farm Bill: Policy Options and Consequences for Northeast Specialty Crops Industries, Small Farms, and Sustainability Programs		Bills, N., Gloy, B., Uva, W., White, G. and M. Cheng
2006-03	Farm Savings Accounts for Specialty Crop Growers		Cheng, M. and B. Gloy
2006-02	Ecosystem Values and Surface Water Protection: Basic Research on the Contingent Valuation Method		Messer, K., Platt, L., Poe, G., Rondeau, D., Schulze, W. and C. Vossler
2006-01	An Economic Analysis of Generic Fluid Milk Advertising in Ontario, Quebec, and the Maritime Provinces		Kaiser, H., Cranfield, J. and M. Doyon
2005-03	Dairy Farm Management Business Summary, New York State, 2004	($20.00)	Knoblauch, W., Putnam, L. and J. Karszes
2005-02	Survey of Hispanic Workers in New York State	($12.00)	Maloney, T. and D. Grusenmeyer
2005-01	The Profitability of Agricultural Lending Relationships		LaDue, E., Gloy, B. and C. Cuykendall
2004-13	Dairy Farm Management Business Summary, New York State, 2003	($20.00)	Knoblauch, W., Putnam, L. and J. Karszes
2004-12	Optimal Institutional Mechanisms for Funding Generic Advertising: An Experimental Analysis		Messer, K., Schmit, T. and H. Kaiser

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