The economic contribution of farmer cooperatives for the state of Kansas

by

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Abstract

Farmer cooperatives have contributed to the vitality and sustainability of many communities across rural America. Since the passage of the Capper-Volstead Act in 1922, cooperatives have not only served the needs of members, but also provided economic support, employment, and wages in rural communities. The objective of this research is to measure the total economic contribution of grain and farm supply cooperatives to the Kansas economy.

Economic contribution results are often calculated utilizing the Input-Output and/or Social Accounting Matrix framework. IMPLAN, an economic analysis software, provides necessary data and the framework to quantify economic and employment contributions. The software enables total contribution to include the direct effects of farmer cooperatives, the indirect effect of the industry's economic relationships, and the additional spending of wages and income by households and governments. This analysis utilized survey results of Kansas cooperatives, the CoBank Risk Analyst database, and the Kansas Department of Labor's quarterly census of employment and wages.

Modeling considered both local ownership and single-level taxation, two characteristics of cooperative businesses. Two economic contribution analyses depict industry variation based on degree of local ownership. The sample of cooperative survey respondents confirm a relatively high level of Kansas ownership. The actual contribution of the Kansas cooperative sector is likely closer to the upper bound total contribution results. The total direct, indirect, and induced results for the Kansas cooperative sector assuming completely localized ownership includes 9,940 jobs, $631.7 million in labor income, $1.1 billion in total income and $1.8 billion in output.

Valuing the economic contribution of cooperatives to the Kansas economy can provide useful insights into the industry and its contribution to rural economic welfare. As consolidation and rapid growth has characterized the grain marketing and farm supply cooperative landscape, the results can inform discussion related to market influence, community support, and public policy.

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Chapter 1: Introduction

Cooperatives provide an opportunity for farmers and ranchers to collectively come together to gain bargaining power in purchasing and selling products. These businesses employ individuals and pay taxes in rural areas. Unlike other businesses, additional benefit comes in the form of cash patronage paid back to members. Cooperatives also provide societal support such as encouraging member leadership and participating in community philanthropic and education efforts. This list of activities, although not comprehensive, typically contribute to the impact farmer cooperatives have on communities across rural America while meeting the needs of their members.

As longstanding businesses in communities across Kansas, the value of cooperatives can be easily overlooked due to limited understanding of their purpose and the actual contribution they provide. A cooperative's ability to correct market inefficiencies and provide products or services that would otherwise be unavailable is important, but not easily understood. Using contribution analysis, the economic value of an industry can be presented in relatively straight forward terms. This information can be communicated in newspaper publications or government testimonies (Zeuli and Deller, 2007).

The focus of this research is to estimate the total economic contribution that grain and farm supply cooperatives provide for the Kansas economy. Economic contribution analysis allows for understanding both the direct activity of the cooperative sector, and the value of economic linkages with other businesses, households and the government in the study area. The greater impacts are measured utilizing the Input-Output and Social Accounting Matrix framework. IMPLAN, an economic analysis software, provides a simplified method for deploying this framework and quantifying economic and employment contribution of a specific sector.

This research about Kansas's 77 cooperatives utilized a variety of data sources. A survey of Kansas cooperatives was completed to gather data relating to employment, wages, patronage and sales. Respondents were also asked about their membership including size and percentage residing in Kansas. Additional 2017 data was gathered from the CoBank Risk Analysis database and the Kansas Department of Labor's quarterly census of employment and wages.

Results of this analysis can be presented in terms of the value of industry production, wages, and employment. Due to the unique business structure of cooperatives, results can also be derived from the income or patronage paid out to owners. In order to account for the value of patronage, two models were created to represent a range of contribution results. The upper bound represents one hundred percent local ownership and local spending. The lower bound relaxes this assumption. Given the survey responses, localized ownership of cooperatives in Kansas is relatively high. This indicates that the true economic contribution of the Kansas grain marketing and farm supply cooperative industry are closer to the upper bound. The combined direct, indirect and induced effects of cooperatives was estimated to be about 9,940 jobs, $632 million in labor income, $1.1 billion in total income and $1.8 billion in output.

Measuring the economic contribution of cooperatives helps to indicate the vital role cooperatives serve. These results are a part of communicating the industry's story. Cooperative management, boards of directors and industry advocates can utilize this information to communicate the value of the sector. Enhancing awareness of the value of Kansas cooperatives highlights the value of cooperative education, research and supportive policies. Kansas cooperatives can then continue supporting farmer-members and rural communities.

Chapter 2: Literature Review

Cooperatives exist to correct market failures such as monopolistic power and missing goods or services (Zeuli and Cropp, 2004). Much research examines the effectiveness of these businesses through the lens of business function and cooperative theory. Assessing the economic value of cooperative businesses yields notably less research. What follows is a review of articles and publications on the purpose of cooperatives and the current grain and farm supply cooperative landscape. Discussion also includes evaluation of studies on economic impact modeling for cooperatives businesses. A gap in the literature provides the opportunity to complete research evaluating and formalizing the economic impact of grain and farm supply cooperatives doing business in Kansas.

2.1 Foundations of Cooperative Business

Traditional firm theory states that firms seek to maximize profits. This was derived through the study of the behavior of consumers and firms. The economic behavior of cooperatives as the firm quickly debunks this theory (Royer, 2014). Cooperative theory is much more complex due in part to the inherent definition of a cooperative, the functions performed, and how the cooperative model has been applied.

The United State Department of Agriculture (USDA) (1994) defines a cooperative as a user-owned, user-controlled business where benefits are distributed equally based on use. Zeuli and Cropp (2004) note that collectively these three parts of user-ownership, user-control, and proportional benefit distribution define the business operations of a cooperative. User-ownership represents the capital contribution a member makes in proportion to use of the cooperative (Zeuli and Cropp, 2004). User-control gives a member the right to be actively involved in long-term business decisions through direct voting rights or indirectly through voting for representatives that serve on a board of directors (Zeuli and Cropp, 2004). Lastly, proportional benefit is the means by which a member is compensated for financial ownership or volume of cooperative business (USDA, 1994). Benefits are commonly dispersed in the form of patronage or net income paid out to members in proportion to use (Zeuli and Cropp, 2004).

The International Co-operative Alliance (ICA) expands in a broader manner on the business principals of cooperatives. Deller et al. (2009) allude to ICA adopting the historic Rochdale Principles. The business practices date back to 1844 and are the foundation of one of the earliest cooperative businesses in England, Rochdale Equitable Pioneers's Society (USDA, 1994). The seven widely accepted ICA principles for cooperative business include: voluntary and open membership; democratic member control; member economic participation; autonomy and independence; education, training and information; cooperation among cooperatives, and concern for the community (Deller et al., 2009).

The means in which agricultural cooperatives express these principles are through their various functions. Agricultural cooperatives are often grouped into the areas of marketing, supply, and service. Marketing cooperatives function for the purpose of marketing the products of their members. Zeuli and Cropp (2004) note that some marketing cooperatives function as bargaining entities by negotiating price and terms of trade for members without taking the physical possession or title of the commodity. Alternatively, some can function in a processing manner by taking in raw commodities, producing processed goods and marketing them for sale.

Alternatively, supply cooperatives focus on the sale of farm inputs and supplies. Typical supplies include animal feed, fertilizer, crop protection, seed and fuel. Product variety can become more expansive in order to provide items that are not easily obtainable in a rural area. Finally, service cooperatives are classified by the related marketing or purchasing services provided to members. These cooperatives perform services such as grain storage and drying, trucking or custom application of crop protectant (USDA, 2017).

These types of cooperatives all have a specific scope, but each also aligns closely with one of the two major purposes of cooperative businesses. One of the objectives of cooperatives is to correct market failures by ensuring economical and efficient marketing or sourcing channels (Nourse, 1942/1992). The competitive yardstick theory explains this purpose in further detail. The other important purpose is to provide goods and services that would otherwise be unavailable in a local community (Zeuli and Deller, 2007).

The cooperative definitions, principles, and purposes all contribute to the foundation of cooperative business. By fulfilling these principles and purposes, cooperatives are a business model that can capture a greater share of revenue in a local economy. Cooperatives are also owned by the users of the business and these users typically are local residents. In the case of grain and farm supply cooperative in Kansas, the majority of their membership reside in an area near the business. So, the revenue generated by the cooperative and the profit distributions to the membership likely stay within the local economy. This provides justification for modeling and measuring the economic contribution of grain and farm supply cooperatives in Kansas.

2.2 Cooperative Competitive Yardstick Theory

Although a foundation of understanding cooperatives is laid by its definitions, principles and functions, the business rationale in relation to the broader society is much more complicated. Edwin G. Nourse offered a philosophy of cooperation in 1942 that remains cogent today. It continues to serve as a guideline for agricultural cooperatives in competition with other forms of business. Nourse's work, "The Place of the Cooperative in Our National Economy," defines the objective of cooperatives in two parts. The first objective is to develop efficient and effective processes to market the collective volume of farmer products to those who have the need and power to purchase. The second objective is to utilize the revealed supply and demand relationship to fully inform producers in an expedited manner. An informed producer then may shift production, use alternative methods, or enter and exit the market.

The power of capitalizing on these objectives goes beyond the individual farmer. In his work, Nourse (1942/1992) alluded to cooperatives as the economic architect, functioning to improve the efficiency of the economy through strategically setting pace for competition. He describes cooperatives not necessarily growing to displace large businesses, but rather growing to establish a “yardstick” position in the market. The purpose of this position is to weaken monopolistic behavior by taking enough market share to force competition. The functioning of the free market is then improved, in part, by cooperative businesses acting in the economy.

Hogeland (2007) notes that the yardstick position could be limiting the potential for cooperatives, but it might also be the thing that is saving cooperatives. Intentional focus on serving members and holding true to the purpose of cooperatives can enable an organization to adapt to change and thrive in a more expedient manner. This ability allows the yardstick position to maintain relevance in the market. Furthermore, Hogeland (2007) utilized text analysis to show that Nourse advocated that the welfare of the farmer remain the primary objective during periods of change. The ability for cooperatives to adapt in a changing market while maintaining focus on its membership provides further justification to think beyond the business financials to understand the value of cooperatives.

2.3 Cooperative and Agribusiness Landscape

Early U.S. agricultural cooperatives had to overcome challenges and embrace new opportunities. Historically, three main groups of factors led to the development and expansion of the cooperative model across the United States. The types of motivation included economic conditions, farmer organizations and public policy (Cropp, 2002). These factors lead to cooperation in the beginning are still pertinent today.

The first formal farmer cooperatives in the United States were created in 1810 for dairy and cheese manufacturing (Zeuli and Cropp, 2004). Early organization then continued across the country in an informal effort, but many cooperatives ultimately failed. During the late 1870s and into the mid-1920s agricultural groups such as Grange, American Farm Bureau and the National Farmers Union stepped in to provide technical assistance to foster the development of cooperatives rooted in sound principles (Zeuli and Cropp, 2004).

Although cooperatives gained popularity during this period, the growth and development of the cooperative infrastructure was limited at times by political matters. Various state and national political actions, such as the Sherman Antitrust Act of 1890, plagued cooperatives doing business. The passage and implementation of the Capper-Volstead Act in 1922 was the final action that gave agricultural producers clarifying and legal limited exemption to anti-trust laws to act in the collective fashion that optimizes the definition of a cooperative (Zeuli and Cropp, 2004).

Historically, the number of cooperatives, farms, and members peaked in the early to mid-1900s. Zeuli and Cropp (2004) document some of the evolution of the cooperative landscape from USDA data. The number of cooperatives in the United States peaked in 1930. Five years later, the number of farms also reached a high point. It was not until 1955 that agricultural cooperative membership reached its peak. More current statistics in the 2016 USDA Rural Development Agricultural Cooperative Statistics Information Report (2017) recorded 1,953 agricultural cooperatives in the United States with membership just above 1.9 million individuals.

Although there has been a continual decrease in agricultural and cooperative numbers, the relative size of these businesses has changed. Nourse's (1942/1992) work points to the need for cooperatives to become "sufficiently large," continuing to force competition in the market. The increase in the relative size of cooperatives has been encouraged, in part, by the size growth and continued evolution of competing investor-owned firms. The various forces that originally led the way for cooperative development are also factors for today's consolidation. Economic conditions such as technology advancement force change in how cooperatives operate, encouraging a greater scale and increasing efficiency. Financial and operational pressures are also motivators of consolidation among agricultural cooperatives. Current agricultural economics conditions will only bring more pressure, leading consolidation to continue into the future (Briggeman, 2016).

Mirroring national trends, the Kansas grain marketing and farm supply cooperative landscape has evolved. Historic information by the United States Department of Agriculture indicated that there were approximately 350 agricultural cooperatives operating in Kansas in 1950 (USDA National Agricultural Statistics Service, 2018). The most recent statistics indicate 84 marketing, supply and service co-ops operate in Kansas as of 2016 (USDA, 2017). Although declining, the pattern between 1950 and 2016 indicated short times of stabilization in the number of cooperatives. The cycle closely followed agricultural economic conditions, declining at a greater pace during periods of low commodity prices.

Further research by Briggeman (2016) layed out in detail the presence of agricultural cooperatives across Kansas that have upright grain storage. The development of Kansas grain marketing and farm supply cooperative maps provide a visual representation of this landscape. In 2017 a total of 77 agricultural cooperatives operated in Kansas with over 550 locations with grain storage. The maps also detailed all non-cooperative grain storage locations across the state. There were nearly twice as many cooperative grain storage locations in comparison. This market presence is further evidence of the extent of the Kansas cooperative landscape. The prevalence of this industry indicates greater opportunity these businesses have to provide value to the economy.

2.4 Value of Cooperatives

Nourse (1942/1992) emphasized the economic value agricultural cooperatives can provide farmers, however, the businesses and members can have a much larger impact on rural communities and consumers. Societal benefits include fostering leadership, supporting education, and promoting a sense of community (Dudensing and Park, 2013). This type of value is much harder to quantify, but nonetheless contributes to social welfare.

The broad value of cooperatives can sometimes be ambiguous. Coffey's (1992) review of Nourse's work years later revealed hardship associated with maintaining the yardstick position in the market, but noted that some level of public good continues to be generated for society and cooperative members. As explained in further detail by a USDA Cooperative Information Report (1980), the value of a cooperative is most easily seen shortly after organization. When years pass, the value becomes more obscure due to the faded memory of the economy prior to cooperative formation.

Value is also revealed when agriculture undergoes periods of rapid evolution, rural populations decline, and the number of cooperatives decrease. During these times of change, one of the seven ICA principles of cooperative business, concern for the community, increases in relevancy (Folsom, 2003). Cooperatives can act as agents of local economic support, providing a level of stability and improved market efficiency in a local economy (Zeuli and Deller, 2007). By holding this type of position in a local community, long after investor-owned firms leave, highlights the contribution of cooperatives to a community's resiliency over the long term (Fairbairn et al., 1995).

The economic value cooperatives provide directly to members can be readily observed in financial information, but the broader impact of the industry is much harder to quantify. Nonetheless, seeking to document a broader value of cooperatives validates the contributions of these types of businesses in a community. It showcases the relevance of cooperatives as not just businesses, but as models for community support.

2.5 Analyzing the Importance of Cooperatives

Various levels of analysis and methodology have been utilized to document the contribution or impact of cooperatives. Fairly comprehensive reviews are found in Folsom (2003) and Zeuli and Deller (2007). Additional research has occurred since these publications that refines the methodology and overcome various research limitations. Quantifying and communicating the importance of cooperatives is valuable for members, communities, and policy makers.

Folsom (2003) points to a case study approach to share information about the value of cooperatives. With limited financial and employment data, a case study can be more descriptive in nature, focusing on the societal benefits in greater detail. The less tangible impacts evaluated can include changes in community leadership capacity, access to information, or the availability of goods (Folsom, 2003).

Zeuli and Deller (2007) argue that even when using an objective empirical approach, subjective analysis is a valuable first step. Drawing on cooperative theory, Zeuli and Deller (2007) suggest that researchers should first consider a cooperative's ability to correct market performance due to various failures and provide products or services that would otherwise be unavailable in the community. Remembering the multifaceted purposes of the cooperative structure provides a foundation for measuring and quantifying the economic impact of cooperatives.

One way of quantifying the economic importance of a cooperative or the industry is through a contribution analysis. Watson et al. (2007) define this type of analysis as measuring the extent gross economic activity for a specific business or industry cycles within the specified industry and the linking industries. This type of analysis focuses on where businesses and individuals spend money. A contribution analysis quantifies the relative size of an industry in an existing economy (Watson et al., 2007).

Economic importance can also be revealed for a specific industry, event, or policy through economic impact analysis. The appropriateness of this type of analysis is much more narrow as it is specifically for an industry, event, or policy that keeps or brings in new revenue, and if lost would change the region's economic base. This type of analysis is more complicated as it seeks to measure the net change of the economy had the associated activity of the industry, event or policy not occurred (Watson et al., 2007). "Impact" is the incremental difference between what exists and what would exist in the alternative (Watson et. al, 2007). This requires the researcher to quantify the alternative reality that would exist in the absence of the existing industry, event, or policy.

The methodology commonly utilized to assess the economic contribution and impact of a business, industry or sector to a local economy is input-output (I-O) and social accounting matrix (SAM) analyses (Miller and Blair, 2009). These types of analyses seek to describe and quantify the economic linkages of various industries and institutions in an economy for a given period (Deller et al., 2009). An abstraction of the real-world relationships is formulated by specific assumptions and data. The resulting framework is likened to the "spreadsheet of the economy," identifying the interdependencies between industries, households, and the rest of the economy (Deller et al., 2009).

Input-output analysis is an attractive way to calculate and present quantifiable value of a business or industry. The results are relatively straightforward for communicating with various constituencies (Zeuli and Deller, 2007). Economic contribution results are also often sought out by organizations working on behalf of an industry, policy makers, and community development supporters (Dudensing and Park, 2013).

It is imperative that the results of cooperative economic contribution studies be evaluated with the understanding that input-output analysis will never fully measure the total value of cooperatives to the local economy or members. Cooperatives have unique economic relationships due to its purpose and principles as a member-owned organization. The actual relationship of cooperatives with its local economy is much harder to quantify (Zeuli and Deller, 2007).

2.6 Cooperative Economic Impact Modeling

A common economic analysis system, IMPLAN (IMpact Analysis for PLANning), employs the I-O and SAM framework for research related to understanding economic impact or contribution. The model can measure the jobs, wages, income, and taxes generated by a business or industry. Several research projects have utilized this modeling system to measure the economic importance of cooperatives to a regional economy (Zeuli and Deller, 2007).

A study by Deller et al. (2009) at the University of Wisconsin Center for Cooperatives sought to measure the impact of cooperative business in the United States. As a national-level economic impact analysis, the project examined the comprehensive activity and impacts of various cooperative business sectors. The economic sectors of interest included Commercial Sales and Marketing; Social and Public Services; Financial Services; and Utilities. Sectors were disaggregated to include farm supply and marketing, grocery, healthcare, housing, childcare and rural electric cooperatives. The researchers identified 29,284 cooperatives and surveyed 16,151 firms within the targeted sectors. The extrapolated results for the entire population was estimated to be nearly $654 billion in revenue, $133.5 billion in value-added income, almost $75 billion in wages and over 2.1 million jobs. The subset of activity derived for the entire population of farm supply and marketing cooperatives (2,547 firms) totaled nearly $128.3 billion in revenue, $8.9 billion in wages, over 200,000 jobs and almost $11.3 billion in value-added income to the economy. This study was the first and only to provide national-level economic impact results of businesses organized as cooperatives.

A majority of economic contribution studies for the cooperative sector have been conducted at the state level. The efforts seeking to model the economic contribution of cooperatives became popular back in the early 2000s. The results continue to be valuable information when communicating the contribution cooperatives make to economic and social welfare. A non-exhaustive list of studies includes Bangsund and Leistritz (1998), Coon and Leistritz (2001) and McKee (2011) for North Dakota; Folsom’s (2003) analysis for Minnesota; Zeuli et. al (2003) for Wisconsin; Park et. al (2009) for Texas; and Herian and Thompson (2016) for Nebraska. It should be noted that each of these researches sought to model the economic contribution of the cooperative sector utilizing similar, but differing methodology.

The approach Bangsund and Leistritz (1998) and Coon and Leistritz (2001) utilized to complete an economic contribution analysis for the North Dakota cooperative sector was notable because of the "bottom-up" modeling approach. This approach is considered superior as primary data was collected by surveying firms, farmers, non-farming households and government organizations (Zeuli and Deller, 2007). The survey results informed the unique multipliers built in the North Dakota Input-Output Model. Zeuli and Deller (2007) noted that because of the presence of cooperatives in many sectors across North Dakota's economy, this model more accurately represented the actual spending patterns of cooperatives and the members. Such models utilizing this approach though can be time consuming and expensive to build and maintain (Zeuli and Deller, 2007). It may be, in part, why the 2011 update for North Dakota used the standardized data gathered by IMPLAN. Results from this most recent research modeling a variety of cooperative businesses estimated 8,000 direct employment, $3.5 billion in gross business volume, and $1.1 billion in labor income. Total contribution includes an output multiplier of 1.61 or $5.6 billion in gross business volume and an employment multiplier over 3.

Other work measuring the economic contribution of cooperatives of various types were completed by Zeuli et al. (2003) and Folsom (2003) for Wisconsin and Minnesota, respectively. Both analyses employed IMPLAN to generate results. The Zeuli et al. (2003) study estimated employment, wage income, total income and tax revenue generated from various cooperative businesses in the state. Results from Wisconsin's cooperative businesses included 20,424 direct jobs and $582.9 million in direct wages. Total effects account for 28,945 jobs and $795.2 million in labor income. Multiplier results for all Wisconsin cooperatives were 1.42 for employment and 1.60 for patronage income. Folsom (2003) estimated output impacts of sales revenue generated, employment and tax revenue. For all cooperative businesses, total impact results included 79,363 jobs and $10.89 billion in total income. Resulting multipliers include an employment multiplier of 1.72 and income multiplier of 2.62.

Research focused on only the economic contribution of grain and farm supply cooperatives was completed by Park et al. (2009) for Texas and Herian and Thompson (2016) for Nebraska. Both analyses utilized IMPLAN. Park et al. built several models with results reported in terms of the effects of sales, value added, income, and employment. They considered the linkage between members and cooperatives, choosing to include the value of grain production as part of the cooperative contribution results. Herian and Thompson (2016) chose to consider the value of marginal sales output, labor income, member patronage, and employment utilizing a three-year average. Analysis was segmented to understand the impact of cooperative operations and capital investments in equipment or facilities by cooperatives across Nebraska. Further models considered the impact of farm cooperatives for the urban versus rural areas of the state. Results for the agricultural cooperative sector and the sector's construction investment include a direct three-year average employment of 7,1580 jobs and output of $1.3 billion. Associated total effects were 13,944 jobs and $2.2 billion in output. The multipliers were 1.94 for employment and 1.65 for output.

The number of state-level economic contribution studies for cooperatives further exemplifies the attention placed on these types of analyses. Each of these studies chose different approaches to addressing the challenge of representing the contribution of cooperatives. This highlights the need for careful consideration of the industry landscape, the data required for analysis, methodology, and results interpretation.

2.7 Model Considerations for Cooperatives

While each of these previous studies provides useful information about the potential value of cooperatives, specific limitations and considerations are brought to light. Zeuli and Deller (2007) argue that when modeling cooperative businesses, it is imperative to consider the uniqueness of the businesses structure and how patronage refunds are returned to members. Considering these two dynamics, provides a foundation for measuring the economic importance of cooperatives in Kansas.

Input-output modeling utilizes multipliers to represent the relationship of one industry's economic activity to gross sales in other sectors of the economy (Watson et al., 2007). As mentioned, the inability to account for the unique relationship of cooperatives with the economy can limit the results (Zeuli and Deller, 2007). IMPLAN groups firms into industrial sectors based on the North American Industrial Classification System (NAICS). Within this system, individual businesses are grouped by production processes and are not differentiated by business structure. Unique industry sectors can be built within the IMPLAN system to overcome this limitation. Constructing a new sector requires primary research to increase the accuracy of regional economic linkages or purchasing patterns (Zeuli and Deller, 2007). This approach is similar to the "bottom-up" model completed by Bangsund and Leistritz (1998) and Coon and Leistritz (2001).

Another means of distinguishing the impact of the cooperative structure from other forms of business is to consider the value of cash patronage (Zeuli and Deller, 2007). This payment is a means for cooperatives to share profits with members. Unlike dividends paid by publicly traded companies, these payments most likely have a higher value-added impact since membership is more locally concentrated, allowing less money to seep out of the economy of interest (Zeuli and Deller, 2007). The associated taxation of cooperatives and cash patronage should also be considered. Income taxes on member-derived business income is paid at the ownership level (Folsom, 2003). This exemplifies the single-level taxation associated with cooperative businesses.

The methods utilized to model cash patronage in IMPLAN do differ due to the uniqueness of these payments. Folsom (2003) and Zeuli et al. (2003) provided alternative approaches for addressing patronage within modeling. Folsom (2003) chose to treat patronage in a similar manner as profits from a sole proprietorship rather than as a dividend. This allocation approach sought to represent the localized ownership and spending, as well as the single-level taxation. Their study compared allocating patronage as "proprietary income" and then as "other property income," the traditional allocation of dividends in IMPLAN. Alternatively, Zeuli et al. (2003) chose to treat patronage refunds as a separate activity in their model. This meant that patronage-only contribution results were available for this income shock on the final demand in the economy.

Park et al. (2009) chose to consider the economic contribution of Texas agricultural cooperatives in various combinations. Models included consideration of the value of commodities produced and localized ownership, as well as the reverse. The initial results were only modeling the contribution of the gross margin of sales and revenue from warehousing. Park et al. (2009) argued that the value of a cooperative cannot be fully separated from the value of the commodities produced by members and marketed by the business. A second set of results are presented taking into account the value of the commodities passing through the cooperative sector. The final model completed by Park et al. removed consideration of business structure and treated patronage again as a dividend and attributed it to "other property income."

These analyses of state-level economic impacts of cooperative businesses illustrate the need for careful specification in the IMPLAN model. Realizing the full impact of cooperatives and the business structure cannot be fully quantified, but adapting to increase the accuracy of estimation increases the validity of the results. Furthermore, understanding the limitations and model considerations provides a valuable foundation from which to interpret contribution results. By utilizing these state-level cooperative contribution analyses and understanding general input-output methodology, a more appropriate approach can be taken to model and identify the economic contribution of grain and farm supply cooperatives operating in Kansas.

2.8 Conclusion

Kansas grain and farm supply cooperatives provide business activity, local employment, and income. This activity contributes to the vitality and sustainability of the agricultural economy and communities across rural America. Research literature supports this notion through cooperative theory and various analysis approaches. A study seeking to quantify the impact of these businesses will provide a view into the value of Kansas cooperatives. This analysis will provide evidence of the value of the cooperative model to the state. The results can be shared by those advocating on behalf of the cooperative community serving agriculture and rural America.

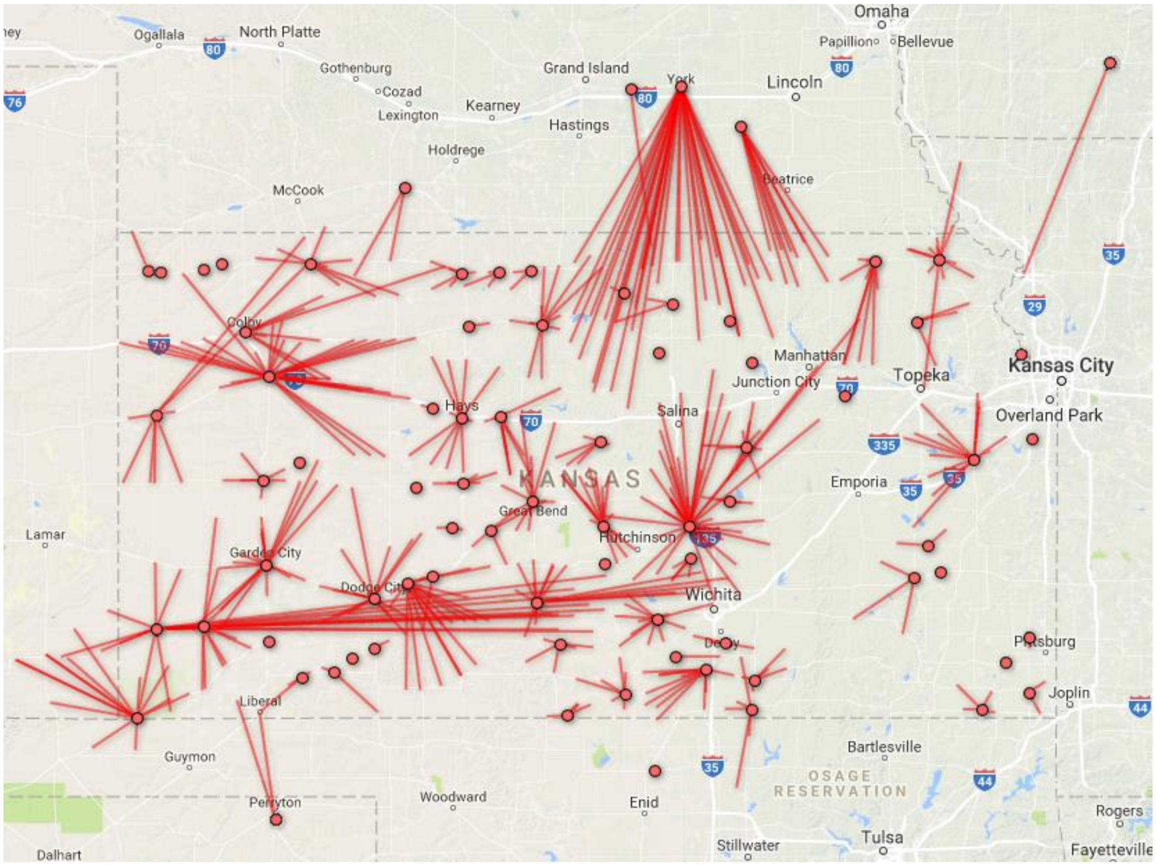
Chapter 3: Data Discussion

Indicators of economic activity include jobs, wages, income, and taxes generated by a business or industry. These details about the Kansas grain and farm supply cooperative sector were gathered from an industry survey, the CoBank Risk Analyst database, and the Kansas Department of Labor's quarterly census of employment and wages. All of these data have merits and limitations. Therefore, when evaluating the value of the data and the associated assumptions it is imperative to remember that the information is being utilized to formulate an abstraction of the real world. The purpose of this chapter is to present the details of each data source and how they collectively complement one another.

3.1 Identifying KS Cooperatives

Before gathering the details of economic activity, it is important to define the region of study. This is necessary to have all the information that appropriately reflects the area of interest (Zeuli and Deller, 2007). Figure 3.1 represents the Kansas grain marketing and farm supply cooperatives landscape. The map indicates 77 farmer cooperatives that had grain locations in Kansas as of the end of 2017. The red dots represent the cooperative headquarters with the lines going out to the cooperative upright grain storage locations (Briggeman, 2016). These cooperatives are headquartered in Kansas, Nebraska, Oklahoma and Texas. Selecting cooperatives that are only headquartered in Kansas would greatly underrepresent the cooperative landscape. Thus, the map provides an accurate list of the grain marketing and farm supply cooperatives operating in Kansas.

Figure 3.1 Starburst Map of All Cooperative Grain Locations in Kansas



Source: Arthur Capper Cooperative Center, accc.k-state.edu/map, (September, 2017)

Within the study region there are specialized grain marketing limited liability companies owned by cooperatives and their members. These entities can handle merchandising, risk management, and grain handling logistics for cooperatives and producers. Although these businesses work closely with the cooperatives operating in Kansas and provide economic activity, they were excluded from this analysis. Choosing to include activity from these businesses in the model would increase the potential for double counting activity and overstating value. It would be difficult to separate the marginal economic activity of these types of businesses from the activity of their cooperative owners.

3.2 Surveying Kansas Cooperatives

A survey was developed to gather information from general managers, chief financial officers, and controllers of the 77 Kansas cooperatives. The survey asked for information necessary for use in IMPLAN and information easily accessible from the most recent fiscal year-end financial and payroll documents. Due to the nature of the requested information, a survey proposal was sent to the Kansas State University Institutional Review Board. A copy of the survey and IRB approval are included in Appendix A.

For survey formulation, previous work valuing the economic activity of cooperatives was reviewed. The sections of the survey included general cooperative information, employment, financial information, taxation details, and organizational structure including equity redemption plans. The questions sought to parallel the needed information for IMPLAN including entity employment, wages and salaries paid to all employees, taxes and other income such as patronage.

To gather information, the survey and cover letter were mailed to the 77 cooperatives during March 2018. After two weeks, a follow-up email was sent to general managers. To increase the response rate, phone calls were also made. In total, 47 of the 77 cooperatives returned a completed survey.

The 47 survey respondents present a starting point for understanding the membership and financial activity of the Kansas cooperative sector. Table 3.1 details average values from survey respondents and a representative total of Kansas cooperative industry activity. Each cooperative was asked about their overall activity and a percentage estimation of that activity that occurred in the state. A Kansas activity value was then found for each line item. The results were summed across all 47 respondents. Averages for these 47 cooperatives were also calculated. It is unclear whether those involved in a specialized grain marketing limited liability company claimed grain sales revenue on their survey responses.

Table 3.1 Kansas Cooperative Survey Summary Statistics

Variables[a]	**Sample Average**[b] **($ in Thousands)**	**Total in Kansas**[c] **($ in Thousands)**
Cooperative Membership	1,653	77,675
Jobs	81.87	3,848
Total Assets	$59,821	$2,811,610
Capital Investments	$2,324	$109,247
Sales Revenue	$72,216	$3,394,154
Property Taxes Paid	$353	$16,602
Patronage Paid	$1,082	$50,871

Note: [a] **47 farm supply and grain marketing cooperatives operating in Kansas responded to the Kansas farmer cooperative economic impact survey**
[b] **Sample Averages (2017 $) are calculated based on Kansas farmer cooperative economic impact survey respondents' portion of business in Kansas.**
[c] **Totals (2017 $) are derived from Kansas farmer cooperative economic impact survey respondents' portion of business in Kansas.**
Source: Kansas farmer cooperative economic impact survey

3.3 Finalized Data

The information available for this research included the survey, the CoBank Risk Analyst database and the Kansas Department of Labor (DOL) quarterly census of employment and wages. Each of the data has its respective merits and limitations, but collectively the information validates research assumptions and provides the necessary details for an informed analysis. The CoBank data are the primary data source with other information supplementing the analysis. The survey data and labor information were the basis for extrapolating the data to appropriately model the whole cooperative sector. The survey also validated assumptions associated with modeling cooperatives. What follows are details of the final dataset that represent the Kansas cooperative landscape.

The CoBank Risk Analyst database provided data for 60 Kansas cooperatives for 2017. In comparison to our defined population, 11 Kansas cooperatives and the 6 cooperatives that are headquartered out of state are absent from the data. A sample of 60 cooperatives is much greater than the 47 entities responding to the survey. The larger sample also limits the level of extrapolation and increases the accuracy of the aggregate numbers that are input into IMPLAN for analysis. Furthermore, given that the data were gathered and generated by a financial institution, a level of accuracy and consistency is assumed to be associated with the original information.

Although individual cooperatives are not distinguishable in the dataset, the detailed financial information allows for a dynamic analysis. In the context of impact analysis, the financial data provide information relating to the financial transactions by a specific enterprise. The detail shows how sales revenue, costs, and other income and expenses are distributed. Revenue and cost of the goods sold are split into categories including commodities, feed, fertilizer, chemical, seed, fuel and other sales. Expense line items include employee wage and benefit payments, lease or rent expenses, utilities, repairs and maintenance expenses, insurance costs, trucking expenses, interest, income taxes and property taxes. Additional business income includes storage revenue, other operating revenue, income from patronage or joint ventures. Cash patronage payments and net earnings retained by the business are also recorded. This level of comprehensive financial data allows for an aggregate sector income statement to be built.

A major limitation of the CoBank dataset is that it represents only a subset of all Kansas cooperatives. To overcome this and represent the full cooperative sector, it was necessary to consider how the financial information from 60 Kansas cooperatives could be extrapolated to be an estimation for the entire sector. Identifying the specific names of the missing cooperatives is not possible as the entities are anonymous. Furthermore, the cooperatives that have Kansas grain locations, but are headquartered out of state, cannot be identified within their state from the database. What can be identified is the number of cooperatives missing. It was concluded that of the 77 cooperatives, 11 Kansas cooperatives and six cooperatives headquartered out of state were absent from the dataset.

What is known about all of these cooperatives is employment. This was the tool utilized to extrapolate the CoBank financial information to have an aggregate sector income statement representative of all 77 grain marketing and farm supply cooperative operating in Kansas. Furthermore, a major economic component in IMPLAN is the count of employment for a sector. Employment was taken from 47 cooperatives via the survey. Respondents recorded full- and part-time Kansas jobs. The employment numbers for the remaining 30 cooperatives were found from the Kansas Department of Labor quarterly census of employment and wages. Each business reports full- and part-time Kansas jobs monthly, so a 12-month average was utilized for each cooperative. Collectively, this information provided a complete profile of employment for the industry. Table 3.2 details the breakdown of Kansas cooperative employment data by where the cooperatives were headquartered.

Table 3.2 Kansas Cooperative Employment

Employment Detail	Total Jobs in Kansas
KS Jobs of cooperative headquartered in KS (n=71)	4,159
KS Jobs of cooperatives headquartered outside of KS (n=6)	493
Total KS agriculture cooperative jobs (n=77)	4,652

Sources: Kansas grain cooperative economic impact survey; Kansas Department of Labor (DOL) quarterly census of employment and wages

To be begin, deriving a number to increase the data it was easiest to begin considering the six cooperative headquartered outside of Kansas. As Table 3.2 indicates, the Kansas jobs from the missing cooperatives headquartered outside of the state is 493. The remaining 11 Kansas cooperatives must also be accounted. There is no information relating to the size and scope of these operations, except for employment. Nonetheless, not extrapolating the data to account for these 11 cooperatives would underestimate results. Utilizing the information in Table 3.2, the total employment for Kansas-headquartered cooperatives was 4,159 jobs. The resulting average employment by cooperatives headquarted in Kansas was then determined to be 58.58 jobs. So the 11 missing Kansas cooperatives were then estimated to account for 644.4 jobs. The missing Kansas employment from the 17 cooperatives was then 1,136.4 jobs.

This missing employment was then utilized to quantify a coefficient, based on employment, to increase the financial data not present in the CoBank dataset. The 1,136.4 jobs was compared to the 4,159 jobs recorded for Kansas headquartered cooperatives. The Kansas headquartered cooperative total was utilized as the financial data was only recorded for the cooperatives headquartered in Kansas. This result is a coefficient value of 0.273. This is an estimate that approximately 27.3 percent of the sector's financial value was absent from the CoBank dataset. All aggregate values recorded in the sector income statement were increased by 27.3 percent. Increasing the data contributes to a more complete representation of the sector. The post-extrapolation data therefore is utilized for the IMPLAN analysis. Table 3.3 indicates resulting summary statistics about the cooperative industry after extrapolating the data.

Table 3.3 Extrapolated Kansas Cooperative Summary Statistics

Variables[a]	Cooperative Average[b] ($ in Thousands)	Total in Kansas[c] ($ in Thousands)
Grain Sales Revenue	$104,556	$8,050,854
Inputs Sales Revenue	$19,183	$1,477,054
Total Sales Revenue and Income	$128,133	$9,866,237
Cash Patronage Paid	$923	$71,080
Net Profit after Patronage	$2,676	$206,040

Note: [a] The CoBank financial information was increased by 27.3 percent (based on employment) to depict an estimated 2017 Kansas cooperative sector income statement representative of all 77 cooperative operating in the state.
[b] Cooperative Average is calculated from the extrapolated 2017 CoBank Kansas cooperative sector income statement.
[c] Total in Kansas is the sum of the respective variables from the extrapolated 2017 CoBank Kansas cooperative sector income statement.
Source: 2017 CoBank Kansas cooperative sector income statement

The data also helped validate the assumptions associated with modeling the economic contribution of cooperatives. As seen in chapter two, many previous analyses have assumed localized cooperative ownership. Survey respondents actually indicated what portion of their members reside in the region of interest. Kansas-headquartered cooperatives indicated on average that 87 percent of their members reside in Kansas. Although not all membership resides in the state, the ownership outside of the state could be comparable to non-Kansas cooperative ownership by residents, essentially negating any difference. Absentee landowners may also play a consideration in this percentage. Nonetheless, 87 percent residency is a relatively high number indicating that considering patronage as locally spent income is a reasonable assumption for the industry. Another detail that describes patronage payout is if it is paid to a living member. This can vary by a cooperative's equity redemption plan, but the survey results also indicate that approximately 20 percent of equity paid out is to estates. Although this number is not negligible, it supports the notion that treating patronage as more localized spending is appropriate.

Utilizing the combination of data sources allow for an informed model or abstraction of the real world. The data incorporate consideration of every cooperative operating in Kansas and confirm assumptions associated with modeling cooperatives within IMPLAN. The finalized data can be utilized within IMPLAN to understand the overall economic contribution of the Kansas grain marketing and farm supply cooperative sector.

Chapter 4: Model Framework

The analytical framework for this research is the Input-Output (I-O) and Social Accounting Matrix (SAM) system. Utilizing a system of linear equations, the I-O framework can map the interdependence of industries in an economy. SAM analysis is an extension of I-O that includes institutions (households, government, investment and trade). Together this accounting system comprehensively tracks all financial transactions occurring in a regional (global, state, sub-state) economy. The IMPLAN system contains the necessary data and framework to easily construct a SAM and regional economic multipliers. What follows is an explanation of the theoretical framework for Input-Output and Social Accounting Matrix analysis and a simplified example of the framework.

4.1 Input-Output Analysis

In the late 1930s, Wassily Leontief, a Harvard professor, developed a general theory of production based on the idea of industrial interdependency in an economy. Building on his theory, Leontief developed the first input-output table for the American economy (Miernyk, 1965). These tables are the basis for Input-Output analysis, representing a large “spreadsheet” of the economy (Deller et al., 2009).

The framework begins with the producing sectors. These sectors are industries completing resource-based production, manufacturing, or providing services (Miller, 1998). Industries buy and sell goods and services to each other in the process of production. The intermediate demand is the exchange of output from one sector being used as an input by another sector. Final demand is created when products or services are consumed by local households and governments. Final demand also includes the consumption of products produced within the region by industries, households and governments outside of the region (Deller et al., 2009). The collection of goods and services transactions at all levels and between all of these agents is recorded in an input-output table. The resulting table represents the total exchanges in a specified economy.

These relationships of the economy can be explained in a statistical framework. Miller and Blair (2009) provided a detailed explanation of modeling such relationships for regional analysis. The framework begins with the assumption that a regional economy consists of many producing or selling industries denoted by $i = 1, 2, \ldots n$ and many purchasing sectors denoted by $j = 1, 2, \ldots n$. The economic relationships of one sector can first be explained by vector notation. From the perspective of a producing industry the total value of goods produced by industry i during the year is denoted by x_i. The total value of sales to the final consumer by industry i is represented by y_i. The intermediate demand or sales by industry i to industry j during the year is represented by z_{ij}. The relationship of sector i can then be written as a combination of n buying sectors and the final demand such that:

$$x_i = z_{i1} + z_{i2} + \ldots + z_{in} + y_i$$

These equations are then created for every other selling sector ($i = 1, 2, \ldots n$).

Alternatively, the purchasing sectors ($j = 1, 2, \ldots n$) have associated economic relationships. The demand by industry j for goods produced by industry i is again explained by z_{ij}. Purchasing sectors must also pay for other factors of production ranging from labor, capital and taxes. These value added payments are indicated by va_j. Additionally, purchasing sectors may import needed goods and services represented by m_j. Thus, the relation of sector j can be written as:

$$x_j = z_{1j} + z_{2j} + \ldots + z_{nj} + va_i + m_i$$

These equations then exist for each other sector ($j = 1, 2, \ldots n$). The values in these two equations make an input-output transaction table.

In order to move to a model, the individual industry or sector equations can be utilized to to define a relationship of the value of goods produced and purchased by two different sectors. Technical coefficients of production represent such connection and is represented by $a_{ij} = z_{ij}/x_j$. The coefficient, a_{ij}, is representative of the value of good *i* that is used in producing a dollar's worth of output *j* (Blair, 1998).

From the technical coefficient, the interrelationship can be written as $z_{ij} = a_{ij}x_j$. This allows the previous equation for sector *i* to be rewritten as:

$$x_i = a_{i1}x_1 + a_{i2}x_2 + \dots + a_{in}x_n + y_i$$

A system of equations for *n* industries is then represented by:

$$\begin{aligned} x_1 &= a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n + y_1 \\ x_2 &= a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n + y_2 \\ &\vdots \\ x_n &= a_{n1}x_1 + a_{n2}x_2 + \dots + a_{nn}x_n + y_n \end{aligned}$$

The coefficients from the system of equations can then be arranged in what is known as the technical coefficient or direct requirement matrix. Matrix **A** is formed from all the fixed ratios of a_{ij}. This matrix represents the proportional values of inputs regionally supplied for every dollar of regionally produced output (Blair, 1998). Matrix **A** arranges the coefficients as such:

$$\mathbf{A} = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix}$$

The sum down the column represents the total amount sector *j* spent on inputs from the region for a dollar's worth of output. Although this is not comprehensive of all input purchases by sector *j*, it indicates the intraregional input requirements.

From the system of equations, the total output and final demand can then be written as column vectors. For n sectors the total output is represented by $\mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix}$. The n final demand is written such that $\mathbf{y} = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix}$. Utilizing these column vectors and matrix **A**, the system of equations can then be written as:

$$\mathbf{x}=\mathbf{A}\mathbf{x} + \mathbf{y}$$

This dynamic model can be utilized to understand a change in demand in an economy driven by things such as changes in tax policies or foreign export orders (Blair, 1998). This change is demand is indicated by the **y** column vector. As a "demand driven" model, the level of goods produced, **x**, is determined by the new level of demand (Blair, 1998). This is solved utilizing the matrix **I,** an (n x n) identity matrix made up of ones across the diagonal and the remaining values as zeroes. The equation of matrices can then be written as:

$$\mathbf{I}\mathbf{x} - \mathbf{A}\mathbf{x} = \mathbf{y}$$

or

$$(\mathbf{I} - \mathbf{A})\, \mathbf{x} = \mathbf{y}$$

The *Leontief Inverse* is then necessary for the equation to capture the response of **x** due to the change in demand **y**. The resulting equation can be written as:

$$\mathbf{x}= (\mathbf{I}\text{-}\mathbf{A})^{-1}\mathbf{y}$$

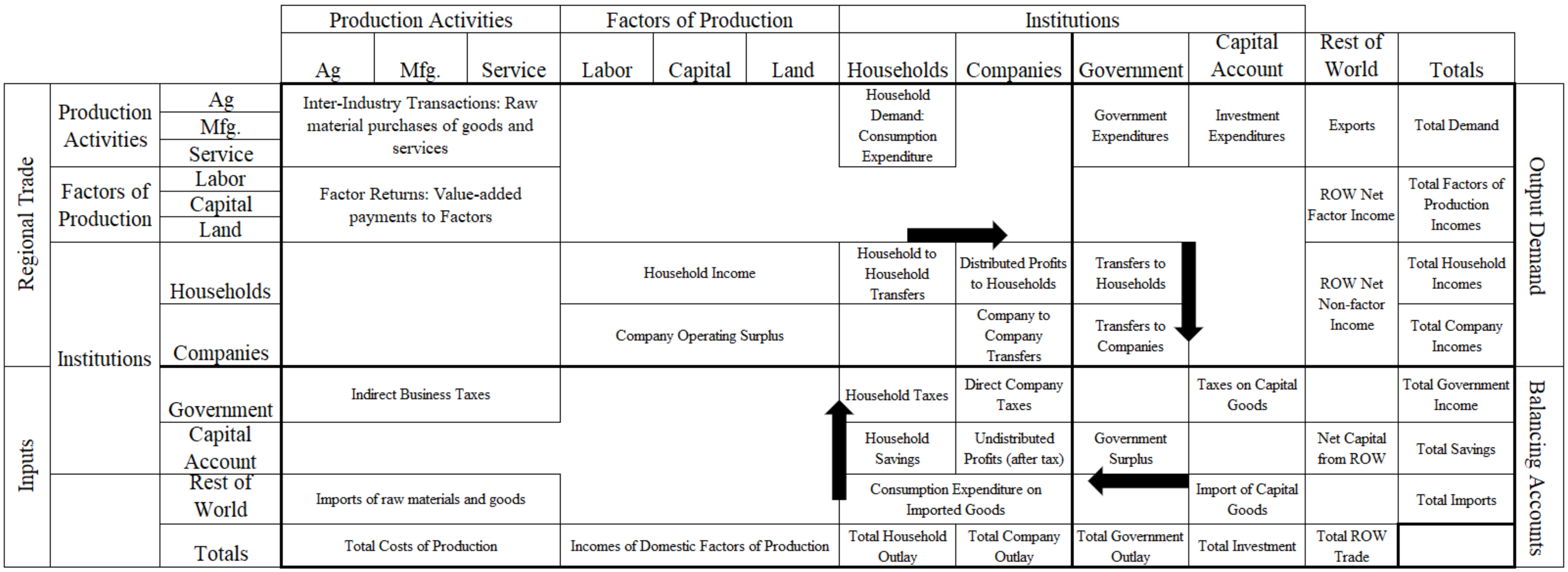
The matrix $(\mathbf{I}\text{-}\mathbf{A})^{-1}$ is known as the total requirements table or matrix of multipliers (Blair, 1998). The sum of a column within this inverse matrix is the multiplier for a particular industry (Zeuli and Deller, 2007). The multipliers represent the degree of interdependency between a specific industry and the rest of the industries in a region (Deller et al., 2009). The multipliers signal the amount that the initial effect grows (multiplies) to fully represent the total effect of an exogenous change, such as a change in final demand (Blair, 1998).

4.2 Social Accounting Matrix

The Social Accounting Matrix (SAM) is a comprehensive system that when incorporated with the input-output framework provides a complete depiction of the interdependencies and circular flow in an economy (Adelman and Robinson, 1986). Every transaction including interindustry purchases, interregional monetary flow, income distribution, and the relationship of a specific region with other external economies are just some of the connections that the SAM incorporates (Thorbecke, 1998). The relationships modeled include those in the original I-O framework, but also institution accounts including households, government, savings or investment, and financial transfers. Figure 4.1 as represented by Thorbecke (1998) depicts all transactions that must be accounted for in the circular monetary flow between the various industries and institutions.

Figure 4.1 Sample SAM Transaction Table

Source: Thorbecke, 1998



One of the key assumptions of both I-O and SAM analyses is that supply must equal demand (Deller et al., 2009). In order to ensure this, all transactions among the various accounts, as depicted in Figure 4.1, must be recorded. In matrix form, the SAM is a square with the row and column sums balancing to one. When changes such as an increase in final demand occurs, the balance is disrupted. That is, one of the accounts within the matrix becomes exogenous. Common exogenous accounts are considered to be the government, the rest-of-the-world, and capital accounts. Endogenous accounts include households, companies and production activities. Like in the I-O framework, exogenous changes drive endogenous responses (Thorbecke, 1998).

The matrix of equations for various accounts is presented by Adelman and Robinson (1986) and Thorbecke (1998). The SAM coefficients is represented by the matrix $\mathbf{A^*}$**:**

$$\mathbf{A}^* = \begin{bmatrix} \mathbf{A0C} \\ \mathbf{V00} \\ \mathbf{0Y0} \\ \mathbf{00T} \end{bmatrix}$$

Where $\mathbf{A^*}$ is the SAM matrix of the direct coefficients (*n + m + k, n + m + k)*. The other matrices that make up $\mathbf{A^*}$ include:

A, matrix of input-output direct coefficients for production activities (*n, n)*

V, matrix of value-added coefficients (*m, n)*

Y, matrix of income distribution coefficients (*k, n*)

C, the matrix of household expenditure coefficients (*n, k)*

T, matrix of inter-institutional transfer coefficients (*k, k)*

n, number of sectors

m, number of value-added categories

k, number of endogenous institutions

Matrix $\mathbf{A^*}$ indicates the monetary linkages and flow within a modeled economy. The value-added coefficients (**V**) represent the flow of income from activities to factors of production including labor, land and capital. These coefficients are also sometimes known as factor income coefficients. The income distribution coefficients (**Y**) map the flow from factors to institutions including households, companies and the government. The household expenditure coefficients (**C**) finish the loop by mapping institutional income back to producing sectors (Adelman and Robinson, 1986). The input-output direct coefficients for production activities (**A**) and the inter-institutional transfer coefficients (**T**) represent the intraregional interdependencies.

Expanding further on the underlying input-output framework, the social accounting matrix is really a data system that links all monetary flows within and outside a specified economy. With the expanded list of relationships, the new model can be written as:

$$\begin{bmatrix} x \\ v \\ y \end{bmatrix} = \mathbf{A}^* \begin{bmatrix} x \\ v \\ y \end{bmatrix} + \begin{bmatrix} e^x \\ e^v \\ e^y \end{bmatrix}$$

Where *x* is the vector of sectoral supply (*n*, 1);

v, vector of value added by categories (*m*, 1);

y, vector of institutional incomes, (*m*, 1);

e^x, vector of exogenous sectoral demand (*n*, 1);

e^v, vector of exogenous value added (*m*, 1);

e^y, vector of exogenous institutional income (*k*, 1);

Again, utilizing the identity matrix **I** and the inverse of matrix $\mathbf{A^*}$**,** the SAM inverse multiplier matrix $(\mathbf{I} - \mathbf{A^*})^{-1}$ can be applied. More succinctly, **M** is equal to $(\mathbf{I} - \mathbf{A^*})^{-1}$. The model can now be written as:

$$\begin{bmatrix} x \\ v \\ y \end{bmatrix} = \mathbf{M} \begin{bmatrix} e^x \\ e^v \\ e^y \end{bmatrix}$$

The *Leontief Inverse*, in this case represented by **M**, again denotes the total requirements table or matrix of multipliers. The economic impact of any exogenous change in sector supply (*x)*, value added *(v)*, and institutional incomes *(y)* can be measured by utilizing the multipliers to derive initial changes and the successive ripple of change in sectoral supply, value added, and incomes (Adelman and Robinson, 1986).

Some of the exogenous vectors each have their own set of multipliers that provide insight into economic relationships. An output multiplier, as represented by e^x in the framework, indicates the total regional increase in output from a $1 increase in demand. The income multiplier represented by e^y signifies the change in income through an economy's institutions due to a $1 increase in demand for a sector. An employment multiplier can also be calculated through a similar process utilizing employment information rather than financial data. This multiplier indicates the total employment change due to a change in employment in a specified sector (Deller, 2009). Collectively, output, income, and employment multipliers represent the relationship of initial business activity and successive activity generated in an economy.

4.3 Simplified Framework Example

A social accounting matrix system that that would represent today's economy would be quite large as there are many industries in the economy and each would have its respective coefficients and matrices. Computers greatly expedite the process of model construction. To understand what is occurring in IMPLAN, the conceptual framework is used for a small, non-technical example. This example closely follows the Deller et al. (2009) and Deller (2014) explanations presented in the national cooperative impact study and the Wisconsin agriculture economic contribution study, respectively.

The simplified example begins with a transaction table that expresses the exchange of goods and services between production and consumption sectors. The sample purchasing sectors within the model economy include agriculture, manufacturing and services. The final demand sectors include households (HH) and rest-of-the-world accounts known as exports and imports. Reading a transaction table such as Table 4.1 can reveal the purchasing pattern of a specific producing sector (reading down the column) or the sales of goods and services to demanding sectors (reading across the row).

Table 4.1 Example Transaction Table

Processing Sectors	Purchasing Sector Demand			Final Demand		
	Agriculture	**Manufacturing**	**Service**	**Households**	**Exports**	**Output**
Agriculture	$10	$6	$2	$20	$12	$50
Manufacturing	$4	$4	$3	$24	$14	$49
Service	$6	$2	$1	$34	$10	$53
Households	$16	$25	$38	$1	$52	$132
Imports	$14	$12	$9	$53	$0	$88
Input	$50	$49	$53	$132	$88	$372

Source: Deller (2014)

Values down the columns indicate interindustry purchases, purchases from other producers, labor supplied to the sector (by households), and imports of goods and services. The coefficients in the table can be interpreted such that agriculture purchases $10 worth of other agricultural goods, $4 worth of goods from the manufacturing sector and $6 worth of services. Labor supplied by households to the sector is worth $16, and goods and services imported into the sector is worth $14. This purchasing sector's total spending for inputs is $50 for one unit of output.

Reading across the rows indicates the demand from other sectors. Specifically, agriculture sells $10 worth of products to others in agriculture, $6 to manufacturing and $2 to the service sector. Households purchase $20 worth of product and $12 leaves in the form of exports. The output or total industry revenue for agriculture is $50.

As indicated in the outer edges of the table, this transaction table is balanced, meaning supply (rows) equals demand (columns). Imports and exports represent some of this balancing. These values also indicate the degree of openness of the economy. As demand increases, open economies will see greater demand from exports and a larger share of expenditures from imports.

As explained in the conceptual framework, relationships can be explained utilizing the transaction table. Proportions of inputs needed to produce one dollar of output can be calculated (Deller, 2014). Simply, the recorded input dollar amount in the transaction table is divided by the column total to provide what is known as technical coefficients. These coefficients are then recorded in what is known as the direct requirements table. Table 4.2 is the direct requirements table for the example economy.

Table 4.2 Example Direct Requirements Table

Processing Sectors	Purchasing Sectors		
	Agriculture	**Manufacturing**	**Service**
Agriculture	0.2	0.12	0.04
Manufacturing	0.08	0.08	0.06
Service	0.12	0.04	0.02
Households	0.32	0.51	0.72
Imports	0.28	0.24	0.17
Input	1	1	1

Source: Deller (2014)

Reading down the columns, the production function, or ‘recipe’ of purchases, can be understood. For each dollar of sales to the agriculture purchasing sector, 20 cents is required from other agriculture businesses, 8 cents from manufacturing, 12 cents from the services sector and 32 cents from households as labor to fulfill the output demanded. Furthermore, for each dollar of output, 28 cents worth of goods and services must be imported. Collectively, these coefficients represent the interdependency of the economy.

The effect of a change in final demand can then be determined. Utilizing the Leontief Inverse and the direct requirements table, the change in goods produced is the result of a change in final demand. The change associated with the producing sector occurs proportionally across other sectors providing inputs and households providing labor. The impact of these changes are summarized in a total requirements table. The total requirements table represents the amount a one dollar increase in final demand for a purchasing sector will require, in total, of a particular processing sector. The total requirement takes consideration for the direct effects such as the increase in inputs purchased, but also additional activity such as the increase in wages paid to those working at the industries providing the inputs. Table 4.3 is the resulting total requirements table for the same example economy.

Table 4.3 Example Total Requirements Table

Processing Sectors	Purchasing Sectors		
	Agriculture	**Manufacturing**	**Service**
Agriculture	1.28	0.17	0.06
Manufacturing	0.12	1.11	0.07
Service	0.16	0.07	1.03
Total	1.56	1.35	1.16

Source: Deller (2014)

The total requirements table is made up of coefficients known as multipliers. Starting in the upper left, the multiplier 1.28 indicates that for a $1 increase in final demand for the agriculture sector an additional $0.28 is generated in agriculture industry sales. Broken down, a dollar of sales is the direct effect of the increase in demand and 28 cents is the indirect economic activity from the increase. This value is derived from the Leontief Inverse as explained in the conceptual framework section. Continuing down the column, the coefficient for manufacturing indicates that for a dollar increase in the demand of agriculture there is a 12 cents worth increase in manufacturing output. When the values of the column are summed, the result is known as the output multiplier. The output multiplier for the agriculture purchasing sector is 1.56, indicating a total region increase of $0.56 in output from a $1 increase in demand.

Chapter 5: IMPLAN Modeling

5.1 IMPLAN Modeling System

As part of the 1972 Rural Development Act, the USDA Forest Service developed Impact Analysis for Planning or IMPLAN. The economic analysis software was utilized to project the economic impact of alternative uses of public forest resources (Deller et al, 2009). Although the software has now been privatized, the program is still a widely used and accepted tool to estimate job creation, tax implications, and the total effects of an economic industry or shock.

IMPLAN creates an abstraction of the world by employing the input-output (I-O) and social accounting matrix (SAM) framework. The standardized data necessary to build the various tables are gathered by IMPLAN from the U.S. Bureau of Economic Analysis, the U.S. Bureau of Labor Statistics, and U.S. Census Bureau. As explained in chapter four, the underlying tables represent the structure of the economy. The framework relationships are fully updated about every five years. Data releases occur more frequently to update the size and scope of the industries in the model.

Within IMPLAN the sectors or industries are organized according to the North American Industrial Classification System (NAICS). Within this system, individual businesses are grouped by production processes (IMPLAN, 2018). Much of the standardized data gathered by IMPLAN follows this type of organization. Currently 536 NAICS sectors are represented within IMPLAN. These include producing and manufacturing sectors, retail and wholesale trade, service sectors, transportation, government, households, and rest-of-the-world accounts.

Each of the 536 industries in the model are distributed to states, counties, and zip codes providing flexibility in geographic representation. For example, within the Kansas model, the tobacco farming sector has no information recorded indicating no production in the state. Alternatively, large values appear for the beef cattle farming and ranching sector. Industry size details include output or value of industry production, employee compensation, proprietor income, other property income and taxes on production and imports. Each industry also has a set of multipliers that represent the industry's monetary linkage with other industries.

The underlying framework presents all of the industry multipliers together in the total requirements table. This table represents the complete monetary flow of an economy. The multipliers within the table enable the model to calculate various levels of effects or changes in output given the change in final demand (Folsom, 2003). The impact is broken down into three areas known as direct, indirect and induced effects. The direct effects are the value of production or change in demand for production. It includes the revenue gained from the actions of the industry including selling goods or services, income paid to workers and owners, and the number of jobs (Deller et al., 2009). These serve as the initial stimulus used to calculate broader economic changes in the economy.

The multipliers within the framework then simulate successive rounds of spending that resulted from the initial activity in the economy. This "ripple effect" spreads the impact to other industries and institutions within the economy and accounts for monetary leakage out of the economy (Deller et al., 2009). The result of this successive spending is defined as indirect and induced effects. Indirect effects are the revenue generated in the economy due to the purchase of inputs, other goods or services from various industries in order to meet the new final demand (Folsom, 2003). Induced effects are then the changes in spending by institutions such as households and the government due to the income change (via wages, dividends or patronage) that resulted from the direct and indirect effects (Folsom, 2003).

When the model is complete, the economic contribution of an industry or the impact of an exogenous change can be determined. As will be seen in the following chapter, the results provide a broader understanding beyond just quantifying jobs, sales, wages and salaries for a particular industry. The broader economic contributions made by an industry sector can be seen utilizing this tool.

5.2 IMPLAN Methodology

By utilizing the aggregate cooperative income statement and IMPLAN, the economic contribution of grain and farm supply cooperatives in Kansas can be computed. The study utilized a 460-industry Kansas economy model calibrated by 2016 data in IMPLAN. What follows are the details of utilizing the financial and employment information within the IMPLAN model. This effort was completed twice in order to produce two sets of results that could be compared to consider the range of effects of the cooperative business structure on the economic contribution of an industry. This allows for a more dynamic and complete discussion about the contribution of the sector.

Categorizing financial data

The income statement for the industry and the employment data include all the necessary sector information that must be input into the IMPLAN model. It is required to organize this information in a manner that aligns with how IMPLAN categorizes industry economic activity. Understanding the description of each of the categories assists in appropriately allocating the financial information. Table 5.1 presents these definitions and how the financial information about the Kansas cooperative sector was organized.

Table 5.1 Organizing financial information for use in IMPLAN

Economic Category and Definition	Data Organization for Model 1	Data Organization for Model 2
Output		
▪ Annual value of industry production expressed in producer prices ▪ Retail and wholesale trade output, such as for cooperatives, is represented by gross margin	▪ Gross margins for grain, feed, fertilizer, chemical, fuel and other sales. ▪ Other business revenue including storage and other operating revenue; income from joint ventures; cash patronage income; and miscellaneous income	▪ Gross margins for grain, feed, fertilizer, chemical, fuel and other sales. ▪ Other business revenue including storage and other operating revenue; income from joint ventures; cash patronage income; and miscellaneous income
Employee Compensation		
▪ Value of wages, salary, all benefits and payroll taxes paid by the employer	▪ Employee compensation	▪ Employee compensation
Proprietor Income		
▪ Income of self-employed individuals or unincorporated business owners in the industry	▪ Portion of income taxes ▪ Cash patronage paid	▪ Portion of income taxes
Other Property Type Income (Other Property Income)		
▪ Corporate profit distributions such as dividends, business profits, business transfer payments and net interest	▪ Net interest ▪ Net earnings after patronage ▪ Portion of income taxes	▪ Net interest ▪ Net earnings after patronage ▪ Portion of income taxes ▪ Cash patronage paid
Taxes on Production and Imports		
▪ Sales and excise taxes, duty payments, property taxes, and licensing fees. Recorded as less subsidies	▪ Property taxes	▪ Property taxes
Employment		
▪ Full- and part-time workers in the industry	▪ Annual average of jobs for the industry	▪ Annual average of jobs for the industry

Source: IMPLAN Group, 2018 implanhelp.zendesk.com/; CoBank Kansas cooperative sector income statement

Table 5.1 can also be categorized into output, value added and employment. Output is figuratively the amount available for paying operating expenses, distributing patronage, and retaining business profits. The other four categories, or employee compensation, proprietor income, other property type income, and taxes on production and imports, are known as value added. Individually, each category represents a means in which output is distributed or how funds are spent in the economy by the sector. Employment is the last area, accounting for the industry's jobs. Income taxes are split between other property type income and the proprietor income as it is a value recorded, but businesses act more as a vehicle for this tax to be passed from consumer to the government.

The difference between columns two and three of Table 5.1 is where cash patronage is aggregated. In the first IMPLAN model, patronage is recorded as proprietor income. Following the work of Folsom (2003) and Park et al. (2009), this was done to consider the nature of cooperative businesses. One consideration is the localized ownership. As patronage is paid on level of use, it is assumed that those members receiving the largest portions of patronage reside locally. Furthermore, it is assumed the payout is spent locally with normal leakage for local imports. These assumptions of localized spending are confirmed by the survey data and was discussed in chapter three. This localized spending is similar to how profits from a sole proprietor is modeled in IMPLAN. The last consideration is the income taxation structure for cooperative businesses. Member-derived income is subject to single-level taxation paid by owners, similar to the tax structure for sole proprietorships or other unincorporated businesses. For these reasons, patronage is recorded as proprietor income.

Within the second model the localized ownership assumption is relaxed. Cash patronage is still included in the second model, but is instead treated as a corporate dividend and aggregated under other property type income. This second model includes all other financial information being recorded in the same manner. It is assumed that the results for the second model will be smaller due to how IMPLAN treats dividends in the economy. The leakage of money out of the economy will be greater, so the effects will be smaller. This information comes from the employment data gathered and the aggregate income statement.

After aggregating the data, the following steps were taken to set up the model. The steps were the same for both efforts. The dollar amounts entered into the model were the only difference.

Customization of industry sectors

The next step for modeling was to consider the operations of grain and farm supply cooperatives across Kansas. It is seen in the detailed CoBank sales data and is well known that a majority of Kansas cooperatives operate as both a grain marketing entity and as a supply distributor or wholesaler. In the context of economic analysis, these types of businesses should have different purchasing or direct requirement needs. Choosing to model farmer cooperatives as one sector could create a level of aggregation bias. Therefore, the cooperative industry activity was split into grain storage operations and input sales. Input sales activity was also considered to be a wholesale activity rather than retail due to the backward supply chain linkages and the nature of sales to members. Limited information about what cooperatives purchase, who the purchases are from, and for what specific business activity prevents us from further breaking down sales.

Although separating activities of cooperatives is appropriate, it was necessary to devise a decision rule to do so. Again, output is the amount available for paying operating expenses, distributing patronage, and retaining business profits. From this total, an understanding of the contribution of the business activity can be considered. Storage revenue accounts for 14 percent of output or value of production. Although storage revenue is about two percent of total industry revenue, it represents 14 percent of the income available for business operations. The gross margin from the commodities, feed, fertilizer, chemical and fuel and other sales accounts for 69 percent of output. The remaining 17 percent of output is other business income. Much of this other business income would have been derived from the primary business activity of sales, so it closely aligns to the input supply or wholesale sector. The output split is a logical way to separate the aggregate categories. Business employment, output and value added is split with 14 percent of the total recorded to the new grain storage sector and 86 percent to the new cooperative wholesale sector.

Table 5.2 breaks down the financial information into these two sectors for each of the models. Choosing to breakdown the financial activity allows for greater accuracy in modeling the actual relationships of the cooperative sector with the greater Kansas economy. The variation in the total aggregate categories represent the differences in patronage allocation.

This separation of cooperative industry activity into grain storage operations and input sales were modeled in IMPLAN as two new sectors. Although these two cooperative sectors closely align with the operations of the warehousing and storage sector and the wholesale sector within the North American Industry Classification System, it was necessary to separate the information. The separation was necessary to understand the contribution of just the cooperative activity, not the total warehousing and wholesale sector activity in Kansas.

Table 5.2 Aggregated cooperative financial values by sector and model (2017 $)

Economic Category	Cooperative Wholesale Sector[a]	Cooperative Storage Sector[b]	Total Aggregate Category
Model One[c]			
Employment	4,001	651	4,652
Output	$918,236,443	$149,480,351	$1,067,716,794
Employee Compensation	$265,332,152	$43,193,606	$308,525,758
Proprietor Income	$61,705,388	$10,045,063	$71,750,451
Other Property Type Income	$238,184,280	$38,774,185	$276,958,465
Taxes on Production and Imports	$18,829,108	$3,065,204	$21,894,312

Model Two[d]			
Employment	4,001	651	4,652
Output	$918,236,443	$149,480,351	$ 1,067,716,794
Employee Compensation	$265,332,152	$43,193,606	$308,525,758
Proprietor Income	$576,387	$93,830	$670,218
Other Property Type Income	$299,313,281	$48,725,418	$348,038,698
Taxes on Production and Imports	$18,829,108	$3,065,204	$21,894,312

Note: [a] Cooperative Wholesale Sector activity represents an estimated 86 percent of cooperative business activity in Kansas.
[b] Cooperative Storage Sector activity represents an estimated 14 percent of cooperative business activity in Kansas.
[c] Model one aggregated cooperative cash patronage as proprietor income.
[d] Model two aggregated cooperative cash patronage as other property type income.
Source: 2017 CoBank Kansas cooperative sector income statement

To create the new sectors within the Kansas economy, industries with no business activity in Kansas were identified. Modifying these sectors ensures that any changes made to them will not affect other industries in the model. Tobacco farming was one of the empty sectors due to no Kansas production. Once identified, the name of the industry was changed to the cooperative wholesale sector. The zeros that originally appeared in the sector were replaced with 86 percent of the respective aggregated categories or those values found in Table 5.2 for the cooperative wholesale sector. The remaining 14 percent of Kansas cooperative sector activity was inputted into an empty sugarcane sector. The industry was renamed cooperative grain storage and the zeros were replaced with the Kansas cooperative employment, output, employee compensation, proprietor income, other property type income, and taxes on production and imports values for the cooperative wholesale sector.

The new sectors are created to identify the contribution of a specific group of businesses or a subsection of an industry. This process is a reorganization of a balanced model rather than a new economic shock. For this reason, it is necessary to subtract the values input into these new sectors from broader industries. The industries that must be reduced would be those where cooperative business activities would most likely would be recorded. The values representing 86 percent of cooperative business activity attributed to the cooperative wholesale sector was subtracted from the general wholesale sector in IMPLAN. The values recorded in the cooperative grain storage sector was deducted from the existing warehousing and storage sector in IMPLAN. This process was completed to avoid double counting of the value of activity in the model.

For the second model, the same process was followed. New sectors were created and the detailed information entered into each new sector is from Table 5.2. These values were also deducted from the broader general wholesale and existing warehousing and storage sectors in IMPLAN.

Customization of production functions

After entering the details of cooperative employment, output, employee compensation, proprietor income, other property type income, and taxes on production and imports, it was necessary to model the linkages these new sectors have with other industries. These linkages represent monetary flows. Some of the linkages for production including labor payments and business taxes are accounted for as value added, but other business expenses or purchases must be added to the model. The other business expenses are found in the aggregate income statement. The categorized expenses of the industry recorded by CoBank include lease/rent expense, utilities, repairs and maintenance, insurance expense, trucking expense and other operating expenses.

The economic relationships for these business purchases are known as technical coefficients. These are ratios calculated as the value of the good or service purchased divided by output. The coefficients are assigned to the respective NAICs sector, to indicate the purchasing relationships of the cooperative sector. Table 5.3 indicates the coefficients for the known cooperative sector business expenses and the associated sector.

Table 5.3 Technical coefficients for known cooperative expense categories

Expense	NAICS Sector[a]	Values[b] ($ 2017)	Coefficients[c]
Output		$ 1,067,716,794	
Lease/Rent Expense	440- Real Estate	$ 19,996,268	0.018728
Utilities	49- Electric and Power Transmission	$ 42,679,997	0.039973
Repairs and Maintenance	62- Repairs and Maintenance for Non-residential Property	$ 40,443,448	0.037878
Insurance Expense	437- Insurance Carrier	$ 26,981,927	0.025271
Trucking Expense	411- Truck Transportation	$ 18,857,876	0.017662
Other Operating Expenses	Balance[d]	$ 239,628,292	0.224431

Note: [a] North American Classification System sector number and name
[b] Values are the aggregate sector expenses from the 2017 CoBank Kansas cooperative sector income statement.
[c] Coefficients are calculated as the expense value divided by output.
[d] The remaining .224421 of coefficient values is allowed to balance in the model or distribute to 200-plus industries.
Sources: IMPLAN Group; 2017 CoBank Kansas cooperative sector income statement

The technical coefficients can be interpreted to understand average economic relationships of businesses in an industry and the purchases that are necessary for operation. Even very small expenses can have an identified coefficient and linking industry in the production function. Collectively, the technical coefficients for one industry are like the recipe indicating the direct requirement of an industry for operation. Pulling from Table 5.3, the lease and rent expense coefficient of 0.0187 indicates that 1.8 percent of output on average is spent on leases and rent expense by the cooperative sector. This portion of output would be sent to the real estate sector. It is these coefficients that create a dynamic model.

As indicated in Table 5.3, the other operating expenses do not have an associated NAICS sector. This is because the type and value of remaining inputs were unknown. The financial data do not indicate whom these purchases were made from and the specific amount. It is possible to anecdotally consider a list of products purchased from another sector, but the magnitude of purchase would not be known. Additionally, the list may not be comprehensive of the average farmer cooperative business purchases. For this reason, the remaining 22.44 percent of output was distributed across the sector production function.

To determine the various industries to balance to, production functions, or the list of technical coefficients, of similar industries were imported into each of the respective sectors. The production function of the existing general wholesale sector was copied to be the production function for the new cooperative wholesale sector. The production function of the existing warehousing and storage sector was copied to the cooperative grain storage sector.

These production functions can be edited with what information is known. The wholesale sector production function, that is now summarizing the cooperative wholesale sector, already had all five industries from which the known cooperative purchases were made. The coefficients for the real estate, electric and power transmission, repairs and maintenance for non-residential property, insurance carrier and truck transportation were edited using the numbers found in Table 5.3. These new coefficients now represent what was known about the actual monetary relationship between these industries and farmer cooperatives. These five coefficients were then locked within the list of technical coefficients. Other sectors were kept in the production function and no industry linkages were added or eliminated.

The IMPLAN model then rebalanced itself. The balancing process distributed the remaining coefficient value of 0.224431 to the other 200-plus industries listed. The five industries that represent the known expenses are locked and therefore do not change during this process. Rebalancing occurs in proportion to the industry relationships that were previously defined by IMPLAN.

The list of industries that appeared as part of the cooperative wholesale sector production function were determined by IMPLAN for the general wholesale sector. The precision of the coefficients is determined to the sixth decimal spot. When editing the production function, identifying known coefficients such as the five expenses from the aggregate income statement helps to increase the accuracy. The remaining 200 plus industries accounted for other purchases of the sector. All of these industries were retained in the production function as that level of detail about cooperative purchases is not available.

For the new cooperative grain storage sector, a very similar process was followed. After the production function of the existing warehousing and storage sector was copied to the cooperative grain storage sector, the edits were made. All five known expense industries were already in the production function of the existing warehousing and storage industry. The same coefficients found in Table 5.3 were utilized. The model was again balanced to distribute the remaining coefficient value of 0.224431 to various industries that IMPLAN has determined for warehousing and storage. Once re-balanced, a representative production function of the cooperative grain storage sector is in the model.

The sum of technical coefficients that make up a production function are known as the total absorption value. The portion of output that goes towards the other categories of employee compensation, proprietor income, other property type income, and taxes on production and imports is the value added coefficient. Together, the total absorption value and the value added coefficient must add to one. This indicates that all monetary relationships of an industry were considered.

Scenario Analysis

The next step in the modeling processes was to utilize the sector information that makes up the respective industry's direct requirements. This information is then utilized to build the multipliers for the region of interest. Although in IMPLAN this is a simple command selection, the software builds the total requirement tables, accounting for the newly introduced industries. After multipliers are built, a scenario can be specified and results observed.

A scenario begins with defining the new activity. The type of activity is defined as an industry change. It is at this point, both cooperative sectors are pulled together for a comprehensive analysis of the industry. Each sector characterizes a separate event occurring in 2017 as per the data year. The proportion of total industry output for each respective sector is again entered into the model. The associated employment, employee compensation and proprietor income will populate from the output value according to the proportions that were earlier specified. Due to this process, rounding was expected in the model. After the two cooperative industries were selected and the appropriate sector details input, the overall cooperative activity is analyzed for the single region. Results of the scenario indicate the contribution of the selected cooperative industries.

5.3 IMPLAN and Framework Limitations

Unique challenges exist when modeling cooperative businesses or sectors. Some of the assumptions of I-O and SAM analysis are known to be limiting. Some even violate key business characteristics of cooperatives. Understanding these associated assumptions and limitations is valuable when interpreting the contribution analysis results. Nonetheless, this type of analysis is a starting point to understanding the value of cooperative businesses.

One important assumption of linear accounting systems is constant returns to scale (Folsom, 2003). This assumption maintains the consistence of the input-output modeling framework. The direct requirement table is assumed to be the same for all businesses within a sector. This is known not to be true for many industries, including cooperatives, as scale efficiency remains an important driver of many industries.

Furthermore, the linkages in the input-output model are derived from national income and product accounts. These same relationships are applied at all geographic scales, adjusted only by income. This becomes a benchmark for building smaller, localized models (Zeuli and Deller, 2007). This “top-down” approach of narrowing data represents the assumption that spending patterns are consistent within a sector across any geographic scale. For this reason, consideration must be given to the nature of the business and its purchasing patterns to determine whether creating a custom spending pattern is necessary.

It is also important to disclose that many modeling assumptions are static or fixed (IMPLAN, 2018). When evaluating a change in the economy, adjustments will be made for output, but the combination of inputs will remain constant. The change in output will have an effect proportionally across the basket of all input purchases. The model also is static due to no substitution of inputs, forcing the product mix to remain fixed (Folsom, 2003). The accounting system does not accommodate price changes in the model. The time period modeled is also fixed. For these reasons, only current relationships can be evaluated and the effects of marginal changes must be evaluated with caution (Swenson, 2006).

Finally, there is the potential for aggregation bias. Aggregation bias is defined as the loss of detail when a region’s industries are aggregated before creating the multipliers (IMPLAN, 2018). The production function, or direct requirements, then becomes a combined average of individual sectors. The resulting pattern can be a grossly inaccurate representation of actual industry relationships. Generally, aggregation bias is accepted to an extent due to the detail level of NAICS codes (Zeuli and Deller, 2007). Like in this research, some aggregation bias can be minimized by retaining a fully disaggregated model through sector customization and building multipliers.

While there are these limitations, quantifying the value of cooperatives remains a worthwhile endeavor. The results from IMPLAN provide a straight forward valuation of an industry and associated economic relationships. The information can be easily shared with policy makers and other constituencies. As indicated by the results, a range of value can also be calculated to understand the impact of localized ownership and single level taxation. This type of research provides the starting point in the greater discussion of the value of cooperatives.

Chapter 6: Results Discussion

The data gathered for this analysis provide a variety of information about the Kansas grain marketing and farm supply cooperative industry. Following the modeling steps discussed in chapter five, the results provide a greater perspective by quantifying the total economic contribution of the industry. Additionally, consideration of the value of localized ownership of cooperatives can be examined. What follows is a discussion of results interpretation, a summary overview of the Kansas economy, and the IMPLAN contribution information for the two modeling efforts.

6.1 Results Interpretation

Although IMPLAN allows for a variety of customization, results are always presented in the same manner. The results are summarized in a way that closely aligns to the aggregated category information input into IMPLAN as detailed in Table 5.1. Contribution analysis results are broken down into the following categories:

- Employment: Annual average of jobs that the industry supports, including full- and part-time jobs;
- Labor Income: Annual employee compensation (wages and benefits) and proprietor income;
- Total Income: The difference between an industry's or an establishment's total output and the cost of its intermediate inputs. Consists of employee compensation, taxes on production, and gross operating surplus. Also known as value added income;
- Output: Representative of the value of industry production. Retail and wholesale trade output, such as for cooperatives, is represented by gross margin (IMPLAN, 2018).

Each of these four categories are also broken down into the type of effect, specifically direct, indirect and induced effects. Direct effects are the activity of the industry that is known from the primary data and are the inputs into the model. The successive rounds of spending that resulted from the initial activity are then defined by the indirect and induced effects. Indirect effects are the revenue generated in the economy due to the purchase of inputs of goods or services from various industries by the cooperative sector. Induced effects are the spending by institutions such as households and the government due to the income generated by the cooperative business activity.

These various effects can then be utilized to calculate multiplier results. The sum of the total effects of the category is divided by the direct effects to calculate a multiplier. Multipliers are commonly presented for output, income and employment. The output multiplier indicates the additional contribution from other sectors in the state's economy for each dollar of output by the cooperative sector. Likewise, the income multiplier signifies the income generated through an economy due to one dollar of cooperative income paid. The employment multiplier represents the jobs in the rest of the state's economy in relationship to one job provided by the cooperative industry. These single numbers are a straight forward summary of the economic benefit of an industry in a specified economy (Miller, 2017).

The size of the multiplier is also an indicator of model validity. Swenson (2006), argues that multiplier exaggeration occurs in a variety of industrials sectors due to double counting. An industry specific multiplier should only represent the marginal effects of the industry of interest. When completing a state-level analysis multiplier usually range between 1 and 3 (Miller, 2017). Multipliers are dependent on the geographic region as this is an indicator of the linkages between industries. Moving to a local economy, the multipliers would be expected to be lower as the number of industries available to do business is less (Miller, 2017). Furthermore, multipliers are dependent on the industry of interest and where they commonly purchase inputs (Miller, 2017). If purchases are made or the products are produced outside of the region, the multiplier would not be as large.

Contribution results are presented in the same manner for all industries modeled, but interpreting them should be done with consideration for the type of industry. It has been discussed, but contribution results will never depict the full value of the cooperative sector. Zeuli et. al (2003) allude to the need to also take consideration when evaluating results categories such as output. Output is calculated in different ways for various industries such as representing gross sales for service industries and gross margins for retail or wholesale sectors. It is necessary then to ensure that results are interpreted in the same manner. For this particular contribution analysis of Kansas farmer cooperatives, the close linkage to members producing crops can be a cause for misinterpretation of the value of output. This further signifies the need to present all economic categories as a means of describing an industry.

6.2 State Economic Summary

In order to understand the size and scope of the cooperative industry relative to the rest of the economy, examining economic activity for the state of Kansas is a starting point. The most recent year for which data were available was 2016. This information in Table 6.1 provides an overview of the Kansas economy. The Kansas economy produced $337.46 billion in sales in 2016. Service, the largest aggregate sector, makes up 41 percent of the state's total output. On a per worker basis, manufacturing is the leading industry at $575,211 in output per worker.

Table 6.1 Contributions to the 2016 Kansas economy by aggregate sector (2017 $)

Aggregate Sector	Employment	Total Output ($ Millions)	Labor Income ($ Millions)	Total Income ($ Millions)
Agriculture	77,553	16,313.70	2,955.23	3,939.67
Mining	42,132	5,111.59	2,134.71	876.86
Construction	95,542	14,539.96	4,892.13	6,575.23
Manufacturing	167,974	96,620.68	13,484.28	23,972.06
TIPU[a]	96,535	32,004.65	6,786.29	14,182.91
Trade	247,280	30,158.55	10,215.28	19,362.65
Service	911,118	119,090.46	41,000.66	72,100.25
Government	287,254	23,617.19	17,551.37	21,629.10
Total	1,925,388	$ 337,456.78	$ 99,019.94	$ 162,638.74

Note: [a] TIPU sector represents transportation, information, and public utilities.
Sources: IMPLAN Group

Within these aggregate sectors, cooperative business would fall under the trade and the transportation, information and public utilities sectors. Recalling the model customization procedures, the industries that farmer cooperative activity most likely falls under is wholesale trade and the warehousing and storage sectors. These were the industries from which cooperative activity was deducted to maintain a balanced model. Wholesale trade is classified as part of the trade aggregate sector. The warehousing and storage sector is considered to be a part of transportation and thus falls under TIPU (transportation, information, and public utilities). Trade and TIPU were decreased after separating cooperative activity and the new cooperative sectors were created.

6.3 Economic Contribution Results

Although cooperatives provide value in various ways, the results generated by this research begin to quantify their economic contribution to the Kansas economy. Steps were taken, as outlined, to extrapolate the data to represent the whole industry. The representative income statement is an initial summary estimate of the industry independent of IMPLAN modeling and was used to specify the direct economic effect. Modeling efforts then explain the greater economic contribution of the industry in terms of direct, indirect, and induced effects. The modeling process was completed twice in order to produce two sets of results that together indicate a range of contribution. The upper bound of the range is the result when assuming all cooperative ownership is local. These values represent members residing in Kansas and spending cash patronage locally. The lower bound was calculated by relaxing the localized ownership assumption in the model. This range as presented in Table 6.2 provides an estimate of what the actual contribution of the Kansas grain marketing and farm supply cooperative sector would be.

The upper bound results or those from the first model assume one hundred percent localized ownership by allocating patronage as proprietor income. These results include $678 million in total income derived directly from the cooperative sector and an additional $438 million in indirect and induced income. Total income accounts for the contribution of patronage in addition to other types of income. Employment for the cooperative industry is 4,622 jobs with 5,327 additional jobs closely related to the direct employment. Direct output reached just over $1 billion with an additional $797 million in indirect and induced effects.

Table 6.2 Cooperative sector contribution to Kansas (2017 $)

	Model One	Model Two	Difference
Employment			
Direct Effect	4,622	4,622	-
Indirect Effect	2,380	1,658	722
Induced Effect	2,947	2,268	679
Total Effect	9,940	8,548	1,401
Multipliers	2.15	1.85	0.30
Total Output[a] ($ Millions)			
Direct Effect	$1,067.72	$1,067.72	-
Indirect Effect	$398.97	$272.27	$126.7
Induced Effect	$398.79	$336.33	$62.46
Total Effect	$1,865.47	$1,676.32	$189.15
Multipliers	1.75	1.57	0.18
Labor Income ($ Millions)			
Direct Effect	$380.17	$380.17	-
Indirect Effect	$131.75	$52.77	$78.98
Induced Effect	$119.86	$57.52	$62.34
Total Effect	$631.78	$490.46	$141.32
Multiplier	1.66	1.29	0.37
Total Income[b] ($ Millions)			
Direct Effect	$678.93	$678.93	
Indirect Effect	$210.97	$129.29	$81.68
Induced Effect	$227.27	$176.23	$51.04
Total Effect	$1,117.17	$984.45	$132.72
Multipliers	1.64	1.45	0.19

Note: [a] Total output is the value of industry production.
[b] Total income is the difference between an industry's total output and the cost of its intermediate inputs.

The multiplier values as shown in Table 6.2 represent the interdependencies in the economy. The income multiplier, representing income from employee compensation, proprietary income (patronage), other property income and indirect business taxes is 1.64. This suggests that one dollar of income generated in the cooperative sector stimulates the generation of an additional

$0.64 in total income throughout the economy. The output multiplier is 1.75, indicating that for each dollar of output generated by the cooperative sector an additional $0.75 of output is generated in other sectors. The employment multiplier is 2.15. This signifies that for each job in the cooperative sector, another 1.15 jobs were closely tied to cooperative employment.

The second model relaxes the assumption of localized cooperative ownership. IMPLAN does not directly report the exact portion of patronage leaving the economy in the initial round of spending modeled, but it is known that the monetary leakage is higher when patronage is treated like a dividend. Due to income leaving the economy during the initial rounds of spending, these results show smaller levels of contribution. The results of this model include the same direct effects as the previous model. Both models are tied to the same business activity. The indirect, induced and total effects are the information of interest differing between the two models.

The differing results provide a range of indirect and induced effects generated by the cooperative sector in Kansas. The ranges for the two models vary by category. When comparing total effects, the output range spreads $189 million. A noticeable portion of this difference in output comes from the indirect effects. The indirect employment range is also noteworthy. The difference between the two models is 1,401 jobs. Localized ownership and localized spending capture a greater proportion of economic activity locally, leading to more jobs supported in Kansas. Total income, the category that includes patronage, has a range of over $132.72 million. The difference in indirect effects is the resulting impact that spending cash patronage locally can have. The first and second model differ by almost $81 million. In comparison to the estimated 2017 cooperative industry cash patronage value of $71 million, this impact is sizeable.

The multipliers also reflect a difference in the two models. The smaller multipliers from the second model indicate fewer interdependencies and a more open economy due to greater monetary leakage. The amount of monetary leakage is apparent by total income. The spread of the multipliers indicates that an additional $0.19 for every dollar of total income generated by cooperatives would leave the Kansas economy if ownership were not completely local. The employment multiplier also provides evidence that localized ownership and spending helps to retain jobs in Kansas.

Multipliers from this study are comparable to other economic contribution studies in other states. Comparing multipliers is one way to validate an economic contribution model. Although methodologies for calculating multipliers differ, the multiplier results from North Dakota, Wisconsin, Minnesota and Nebraska are comparable. Output multipliers for the states ranged from 1.61 to 1.72. The model one multiplier of 1.75 is still relatively comparable. Employment multipliers had a greater range including Wisconsin indicating the lowest employment multiplier just under 1.5 and North Dakota with a value over 3. The Nebraska employment multiplier was the most similar with a value of 1.94. Table 6.2 indicates a total income multiplier of 1.64 from model one. This value is very close to the separate contribution results for patronage completed in the Wisconsin analysis.

The range of results from the two models indicate a spectrum of the value of cooperatives, but also the value of local ownership. The economic contribution models indicate that localized ownership has a greater effect within the Kansas economy. Although an exact localized ownership percentage is not known for the whole industry, chapter three discussed details of the survey sample that validates a relatively high level of local ownership. For this reason, the actual economic contribution of the grain and farm supply cooperative sector is likely to be closer to the results of the first model. Those values serve as an upper bound.

Cooperatives provide an opportunity for farmers and ranchers to collectively gain bargaining power in purchasing and selling products. In so doing, the sector supports economic activity, employment, and wages in a community. This modeling effort quantifies the value of this industry. It also indicates that localized ownership, a characteristic of many agricultural cooperatives increases the contribution of the industry. Cooperatives provide value to their members, but also to communities across Kansas.

Chapter 7: Conclusions

Cooperatives provide value in many ways including holding the yardstick position in the market, providing services, supporting the community philanthropically and serving as a rural employer and tax payer. This research was conducted to identify the economic contribution of many of these activities completed by the Kansas grain marketing and farm supply cooperative sector. As agriculture continues to evolve, producers have alternatives of where to source their inputs or sell their grain. With the increased competition, measuring the economic contributions of cooperatives can be valuable for market influence, public policy, and community support.

This analysis utilized the 2017 CoBank Risk Analyst data as the primary data source. In order to fully account for the 77 cooperatives operating in the state, the data were extrapolated utilizing employment values. A sector income statement was then constructed to represent the industry and used in IMPLAN modeling efforts. Income statement information was aggregated into output, employee compensation, proprietor income, other property type income and taxes on production and imports.

Two models were utilized for this analysis. The first model represented the underlying assumption that cooperative ownership is local, meaning members live in the state of Kansas. The second model relaxed this assumption. The differences in the two models stem from how financial information was aggregated into the five categories. The first model included cash patronage as proprietor income. This treatment of patronage follows closely to the work by Folsom (2003) and Park et al. (2009) to indicate localized ownership and spending. The second model relaxed the assumption by allocating cash patronage like a dividend as other property type income. After allocating sector information, the details could be utilized in IMPLAN modeling.

Employing the I-O and SAM framework, IMPLAN creates an abstraction of the economy, representing economic relationships of various industries within a specified region. To estimate cooperatives' economic contribution, two sectors were created to represent cooperative wholesale and cooperative grain storage activity. Employee compensation, proprietor income, other property type income and taxes on production and imports were estimated for these sectors. Production functions were also modified to capture the economic relationships these businesses have with the rest of the economy. After model formulation, results could be interpreted.

The two models were constructed to estimate a range showing the value of local ownership. Survey respondents confirmed a relatively high level of Kansas ownership. The actual contribution of the Kansas cooperative sector is likely to be closer to the upper bound total contribution results. The total direct, indirect and induced results for the Kansas cooperative sector assuming completely localized ownership includes 9,940 jobs, $631 million in labor income, $1.1 billion in total income and $1.8 billion in output.

Cooperatives provide value to their members, but the results also indicate a greater contribution to communities across Kansas. As an industry operating in rural America and seeing increased consolidation, measuring the economic contributions of cooperatives helps illustrate the role cooperatives serve. Cooperative management, board of directors, and industry advocates can utilize these results to communicate the value of the Kansas cooperative sector to policy makers. Increasing the understanding of how cooperatives create economic value illustrates the value of cooperative education, research, and support policies.

These results are a useful starting point in communicating the value of cooperatives. A cooperative's ability to improve market performance and provide products or services that would otherwise be unavailable is important. Although this type of community support can be easily overlooked, and difficult to demonstrate, this research contributes to the story. This type of discussion will allow Kansas cooperatives to continue supporting farmer-members and the rural communities.

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Appendix A- Survey Instrument

Economic Impact of Grain Cooperatives for the state of Kansas

Your response is voluntary, and will be kept anonymous and confidential.

Please complete the survey below with your cooperative's most recently reported fiscal year. Provide answers in the boxes. Shaded boxes require no response.		
Name of Cooperative:		
Fiscal Year End (Month):		
Membership	Total	Best estimate of percent living in Kansas
Number of cooperative members:		%
Financial		
Patronage	Total	Best estimate of percent paid to members in Kansas
Cash patronage paid for the year	$	%
Retained patronage as member equity	$	%
Member equity redemptions paid to estates	$	%
All other member equity redemptions paid	$	%
Assets	Total	Best estimate of percent located/invested in Kansas
Total value of assets:	$	%
Capital investments in the past fiscal year *PP&E, acquisitions, investment in other entities, etc.*	$	%
Taxes	Total	Best estimate of percent paid in Kansas
Property taxes paid	$	%
Federal income taxes paid	$	
State income taxes paid	$	
Sales/Revenue	Total	Best estimate of percent earned in Kansas
Value of sales/revenue from all business activities:	$	%

Economic Impact of Grain Cooperatives for the state of Kansas Please provide data from your cooperative's most recently reported fiscal year. *Continued*		
Equity Redemption Plans		
	Please circle 'yes' or 'no' if your co-op retired this type of equity (retained patronage) last fiscal year:	Please answer the questions below about additional information on retired equities:
Retire to estate and/or special situations	YES NO	
Retire on patron's age *Equity redeemed when patron reaches a certain age*	YES NO	What is the age of patron?
Revolving fund *Equity redeemed when equity reaches a certain age*	YES NO	What is the age of the oldest, revolving equity?
Percentage of all equities *Equity redeemed based on percent of total outstanding equity*	YES NO	What percent?
Base capital plan *Equity investment of patrons maintained based on percent of patronage business*	YES NO	Would it be okay to contact you to discuss your base capital plan further? YES NO N/A
Other	YES NO	Please specify:
Employment		
Employees	Total	Percent living in Kansas
Number of full-time employees		%
Number of part-time employees		%
Wages and Salaries		
Wages and salaries paid to full-time employees	$	
Wages and salaries paid to part-time employees	$	

Thank you for completing the survey!

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Dr. Brian Briggeman
Agricultural Economics
305 C Waters Hall

Proposal Number: 9190

FROM: Rick Scheidt, Chair
Committee on Research Involving Human Subjects

DATE: 03/05/2018

RE: Proposal Entitled, "Economic Impact of Grain Cooperatives for the state of Kansas"

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written – and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, **45 CFR §46.101, paragraph b, category: 2, subsection: ii.**

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.

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