The Performance of Food Manufacturing in Kansas

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Abstract

Over the past decades, the U.S. food manufacturing industry has experienced substantial changes in its structure and performance. This study uses the US Census Bureau's Annual Survey of Manufacturers from 1998 to 2021 to evaluate the changes in the structure and performance of the food manufacturing industry in Kansas. The study is important because the food manufacturing industry accounts for 21% of Kansas' manufacturing sector, and its structural and performance changes can have significant upstream and downstream effects in the agricultural sector as well as across Kansas's economy. Findings indicate that while the animal slaughtering and processing sector is the largest employer within Kansas's food manufacturing industry, it has experienced a decline in employment and records the lowest gross margin at 0.23. However, animal food manufacturing is a growing sector in Kansas.

Keywords: Food Manufacturing, Performance, Gross Margin

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Introduction

The food manufacturing industry is pivotal to Kansas's economy. The sector plays an important role in the state's food system, which extends from farms and ranches to the retail food market. The food manufacturing sector is the largest employment sector in Kansas manufacturing employment (Kansas Department of Commerce, 2020). According to the Annual Survey of Manufacturers, the industry employed more than 32,000 employees and paid about $1.9 billion in wages in 2021. With about 319 firms in 2021, the sector accounted for a value-added of about $10.3 billion in 2021 (US Census Bureau, 2021). The food manufacturing industry provides an annual revenue of about $5.2 billion to the Kansas economy (Kansas Department of Commerce, 2020).

Kansas has a diverse geographic region which contributes to its varied agricultural landscape. The state is agriculturally dominated and located in the U.S. Central Great Plains with about 85% (44.7 million acres) of its total area dedicated to agricultural production (Kansas Department of Agriculture, 2022). Kansas produces more than 120 different agricultural commodities including grains and livestock. The state ranks among the top 10 states in acreage and production for major crops. Kansas has on average ranked seventh nationally by the value of production (Kansas Department of Agriculture, 2024). Kansas' agriculture constitutes about 4.4 percent of the U.S. sales (USDA NASS, 2024). This incentivizes food manufacturing companies to establish operations in the area, taking advantage of proximity to suppliers of agricultural raw materials. According to (Bolotova, 2008) diverse agricultural environment provides a favorable market for agricultural producers and food companies to engage in various food manufacturing activities. There is an increasing consumer trend towards foods that offer convenience and taste and cater to health-conscious and quality-seeking buyers. This shift drives the need for ongoing innovations in food processing such as packaging methods, and increasing shelf life, to align with the changing consumer preferences (Adelaja et al., 2000).

Amid the importance of food manufacturing to the state, structural and performance changes can have significant upstream and downstream effects on the agricultural sector as well as the Kansas economy. Studies (Bolotova, 2008; Bolotova, 2016; Schmit et al., 2012) have assessed the structure and performance of the food manufacturing industries. (Bolotova, 2008) focused on the economic performance of the food manufacturing industries in Idaho. (Schmit et al., 2012) assessed the food and beverage manufacturing in New York State to understand the firm and market factors affecting the industry growth and competitiveness. (Collins & Preston, 1966) evaluated the significance of structural variables in explaining variations in market performances. These studies collectively highlight the importance of structural variables in shaping food manufacturing industries' economic performance and competitiveness.

This study measures the performance of the food manufacturing sector in Kansas between 1998 to 2021 using several key indicators by the U.S. Census Bureau. It also explores the factors that influence the performance in the industries during this period. The findings showed there had been

a changing employment structure in the food manufacturing sector in Kansas. The animal slaughtering sector is the largest employer in Kansas, though employment has declined over the years. The sector records a low gross margin of 0.23 compared to 0.26 and 0.31in the grains and oilseed milling and animal food manufacturing sectors respectively.

The rest of the paper is organized as follows. Section II presents the methods and data used for the study. Section III discusses the results of the study and section IV concludes and offers recommendations.

Methods and Data

The data used are from the Annual Survey of Manufacturers by the U.S. Census Bureau economic survey compiled by Stats Indiana. The Census uses the North American Industry Classification System (NAICS), which provides common industry definitions for Canada, Mexico, and the United States. The NAICS was adopted in 1997 to replace the SIC (Standard Industrial Classification) code system (US Census Bureau, 2021). There may be some differences in the data coverage due to the changes in classification. The major difference is that SIC 20 Food and Kindred Products, included beverages whereas the NAICS classifies food (NAICS 311) separately from beverages (NAICS 3121) (Salin et. al. 2002). This study focused on the NAICS four-digit and three-digit classification for the food manufacturing sector. The food manufacturing subsector consists of nine (9) industry groups based on the NAICS four-digit classification. These include animal food manufacturing (NAICS 3111), Grain and Oilseed milling (NAICS 3112), Sugar and confectionary products manufacturing (NAICS 3113), fruits and vegetable preserving and specialty food manufacturing (NAICS 3114), dairy product manufacturing (NAICS 3115), animal slaughtering and processing (NAICS 3116), Seafood product preparation and packaging (NAICS 3117), Bakeries and tortilla manufacturing (NAICS 3118), and other food manufacturing (NAICS 3119). The other food manufacturing comprises establishments with different production processes such as snack food manufacturing, coffee and tea manufacturing, concentrate, syrup, condiment, and spice manufacturing, and generally an entire range of other miscellaneous food product manufacturing. NAICS 3111, NAICS 3112, NAICS 3116, and NAICS 311 were considered in this study. The remaining industries within the four-digit sector were omitted due to unavailability of data. The Census does not disclose values when there are only a few firms in the industry to avoid disclosing the data of individual companies. The following indicators were analyzed: the number of employees, number of production workers, number of production workers hours, annual payroll, value of shipments, value-added, cost of materials, capital expenditure, and the number of establishments. The number of establishments data was also collected from the county business patterns.

These indicators are defined by the U.S. Census Bureau as: An establishment is a single physical location at which business is conducted, it may or may not be identical with a company (firm or enterprises). The number of employees consists of all full and part-time employees. Payroll

includes all forms of compensation paid during the reporting year to all employees. The employment data in the census consists of two categories of workers: production workers and non-production workers. Production workers refer to workers up through the line-supervisor level engaged in fabricating, processing, assembling, inspecting, receiving, packing, warehousing, shipping (but not delivering) maintenance, repair, janitorial, guard services, product development, auxiliary production for the plant's own use (e.g., power plant), recordkeeping, and other services closely associated with these production operations at the establishment covered by the report. Production workers' hours cover all hours worked or paid for at the manufacturing plant. The value of shipments includes the net selling values (exclusive of freight and excise taxes) of all products shipped including installation and repair, sales of scrap, and sales of products bought and sold without further processing. The value added is the measure of manufacturing activities to avoid the duplication of the figure for sales, value of shipments, or revenue. The value-added figure represents a subtraction of costs incurred for materials, supplies and containers, fuel, purchased electric energy, and contract work from the value of shipments. Value added is considered the best value measure for comparing the relative economic importance of manufacturing among industries and geographic regions. The total cost of materials includes freight charges and other direct charges incurred by the establishment in acquiring these supplies and/or materials used throughout the year. Capital expenditure refers to the total capital expenditure for buildings, structures, machinery, and equipment including new and used. It covers current spending on property, equipment, and capital improvements that are recorded as fixed assets and typically depreciated or amortized.

The study analyzed some economic indicators and the changes in the indicators to measure the performance of the industry. These changes indicate the analyzed industries' economic development trends (growth or decline). These indicators are value-added margin and gross margin. The value-added margin is a ratio that indicates how many dollars of value added are produced for each dollar of food processed (Salin et al., 2002). The margin reflects the percentage of sales that exceeds the cost of external inputs, illustrating how much value the company's internal activities add to its products. It is crucial for understanding the efficiency of a company in generating revenue from its direct operations, beyond the cost of raw materials. This is calculated as:

$$Value\ Added\ Margin = \frac{Value\ Added}{Value\ of\ Shipment/Sales} * 100$$

Gross Margin is a simple model used to estimate the financial returns of a production process, mostly used as a proxy for profitability. Gross margin is the percentage of the company's revenue that's retained after direct expenses such as labor and materials are subtracted. The gross margin indicates that, for every dollar of revenue generated, how much the company retains after accounting for the direct costs of production. It is essential for assessing a company's production and distribution efficiency relative to its revenue

$$Gross\ margin = \frac{Revenue - Variable\ costs}{Revenue}$$

Variable costs were measured as the sum of the production worker's wages, and the total cost of materials. Revenue is the value of output from the processing industries. It is the value of shipment in the food manufacturing sector. All values are measured in nominal prices.

The study analyzed the factors that influenced gross margin using the multiple regression model. Gross margin (GM) was expressed as a function of the year, capital-to-output ratio, production workers' hours per output, industry growth rate, and recession indicators. The empirical model was specified as

$$GM_j = \alpha_{ij} + \sum_{i=1}^{n} \beta_{ij} x_{ij} + \varepsilon$$

GM_j – the dependent variable: Gross Margin, with j representing a sector in the food manufacturing industry in Kansas.
α_i – the constant term, representing the expected response of gross margin when the independent variables are zero.
β_{ij} – the coefficients of each independent variable for each industry.
x_i – the independent variables
ε - the error term, representing the effect of omitted variables from the equation.

Results and Discussion

Table 1. provides an overview of the Kansas food manufacturing industries in 2021, detailing the number of establishments, number of production workers, percent of production workers to all employees, annual payroll, value-added, and value of shipment. In 2021, the food processing industry in Kansas employed nearly 27,545 production workers, thus, about 85% of all employees. The animal slaughtering and processing sector was the largest employer, accounting for 60% of all production workers in the state's food manufacturing industry. The animal food manufacturing sector accounted for 10% and the grains and oilseed manufacturing accounted for 4% of the production workers in the state. The annual production worker's payroll generated in these sectors was $974 million, $66 million, and $151 million (Table 1.) respectively.

Table 1. Food Manufacturing Economic Activity in Kansas by Subsector, 2021

NAICS	Industry	Establishments	Production workers	Annual Payroll ($- mill)	Value of Shipment ($-mill)	Value Added ($-mill)
311	Food manufacturing	319	27,545 (85%)	$1,570	$29,220	$10,328
3111	Animal food manufacturing	61	2662 (81%)	$150.8	$2,891	$1,091

3112	Grain & oilseed milling	27	1143 (81%)	$66.3	$2,250	$661.6
3116	Animal slaughtering and processing	88	16,470 (86%)	$973.9	$18,845	$5,454

Other industries were omitted due to unavailability of data or data disclosure issues. Values in bracket () are the production worker's percentage (%) of all employees.
Source: U.S. Census Bureau

According to the annual survey of manufacturers, the number of employees in the food manufacturing industry in Kansas increased by 5% between 1998 to 2021. The animal food manufacturing industry experienced the highest increase in the number of employees, about 75% between 1998 and 2021. The animal slaughtering and processing sector also experienced an increase of about 8% while the grains and oilseed milling sector experienced a decline of about 29% between 1998 and 2021. Animal slaughtering and processing is the largest employment sector in the food manufacturing industry in Kansas. A study by (Wilkerson & Williams, 2012) noted that demand for domestic labor in the manufacturing sector is due to several key factors including the close proximity to natural resources, the reliance on highly skilled factory workers, and the location near other manufacturing sectors that require timely deliveries of specialized components.

The Kansas food manufacturing sector employed a yearly average of 30 thousand between 1998-2009, gradually decreasing to about 28 thousand in 2010-2021 (table 2). The animal food manufacturing sector is the only industry that increased employment by about 30% over the period. The number of employees in the grains and oilseed milling and animal slaughtering and processing industries decreased by about 30% and 4% respectively.

Table 2. All employees in the Food Manufacturing Industry in Kansas

Industry	All Employees	
	1998 -2009	2010-2021
Food Manufacturing	30718	28806
Animal Food Manufacturing	1998	2674
Grains and Oil Seed Milling	1759	1224
Animal Slaughtering & Processing	17925	17273

Food manufacturing firms benefit from the proximity to raw commodities. Producers also benefit from proximity to processors. The number of food processing establishments/ plants in Kansas rose about 13% from 282 in 2012 to 319 in 2021(Table 1). This increase is reflected in a few selected industries like dairy product manufacturing which increased from 3 in 2012 to 7 in 2021 (US Census Bureau, 2021). Additionally, the animal slaughtering and processing industry saw a 10% growth in the number of establishments between 2012 and 2021, while the animal food manufacturing and grains and oilseed milling sectors maintained consistent levels during the same period. Despite this stability, the sector experienced some turnover, with certain establishments

opening and closing over the years. Supply-side factors are one reason why manufacturing plants relocate to the state (Schmit et. al. 2012).

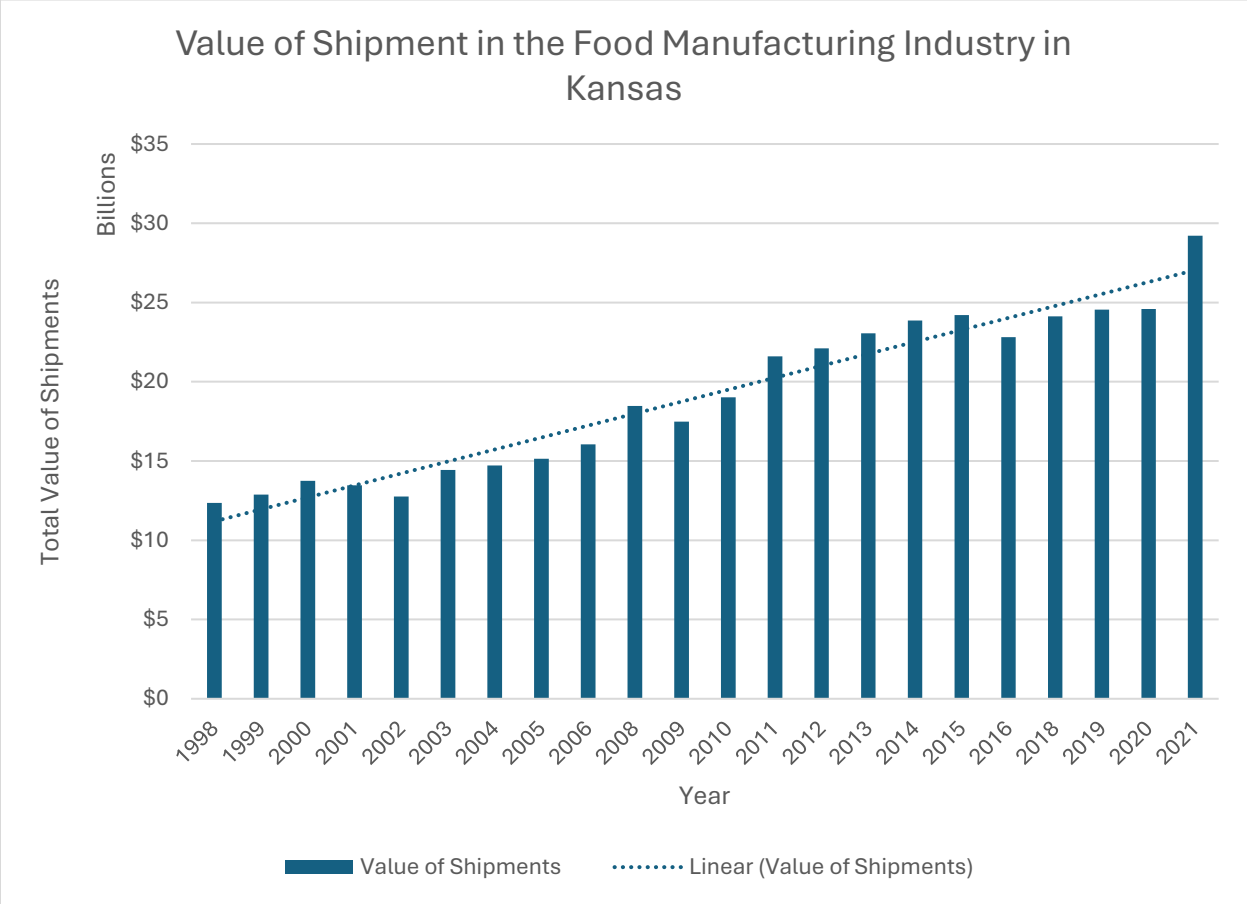


Figure 1. Value of Shipment in the Kansas Food Manufacturing Industry, 1998-2021
Source: U.S. Census Bureau

Food manufacturers continue their attempt to increase sales, profits, and market share through restructuring, expanding foreign market opportunities, reducing costs, and introducing new products. The value of the Kansas food shipment grew from a total shipment of over $12 billion in 1998 to $29.2 billion in 2021 (Figure 1). The animal slaughtering and processing sector is the leading industry in terms of sales or value of shipment in Kansas which is similar to the structure of South Carolina food manufacturing (Bolotova, 2016). The sector in Kansas accounted for approximately 64% of the total shipments in Kansas in 2021. However, South Carolina animal slaughtering and processing accounted for approximately 33% of the total value of shipments within the state's food manufacturing sector (Bolotova, 2016). Considering Kansas's significant cattle and calf production sector, it is unsurprising that animal slaughtering and processing not only dominate in terms of economic activity but also lead in employment figures. Animal food manufacturing holds the second largest share of shipment value, accounting for approximately

10%, and grain and oilseed milling at 8% in 2021. The total purchase of materials for the food manufacturing industries in Kansas totaled over $19 billion in 2021. Capital requirements differ among industries. Capital expenditures increased from $218 million in 1998 to $374 million in 2021 with about 71% growth in the Kansas food manufacturing industries (US Census Bureau, 2021). The animal slaughtering sector had the highest capital expenditure of $204.9 million in 2021. This is likely attributable to the presence of multiple establishments in the state. The share of the production workers' wages to the value of shipment in the food manufacturing sector in Kansas is an average of 4% annually. The total cost of materials averages 74% annually of the value of shipment in the Kansas food manufacturing sector.

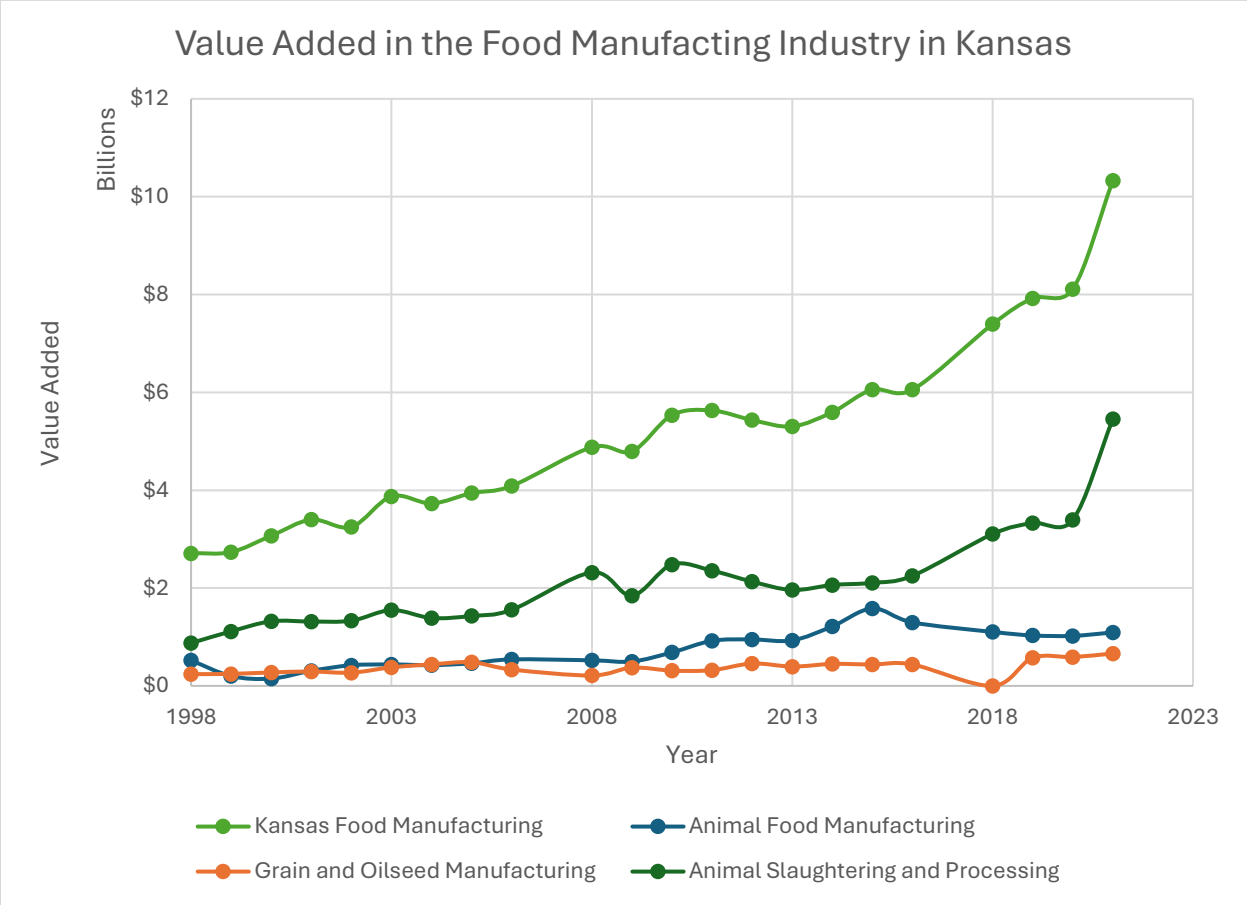


Figure 2. Value-added in the Kansas Food Manufacturing Industry, 1998-2021
Source: US Census Bureau

Manufacturers are consistently enhancing the value added to food products. However, value-added exists if consumers want the products and are willing to buy them. In 2021, the value added by Kansas food manufacturing totaled $10.3 billion compared to $2.7 billion in 1998. Of this, animal slaughtering and processing contributed $5.5 billion, animal food manufacturing added $1.09 billion, and the grain and oilseed milling sector also contributed $661 million. Over the years, the food industries in this study have experienced a significant growth rate of more than 100%.

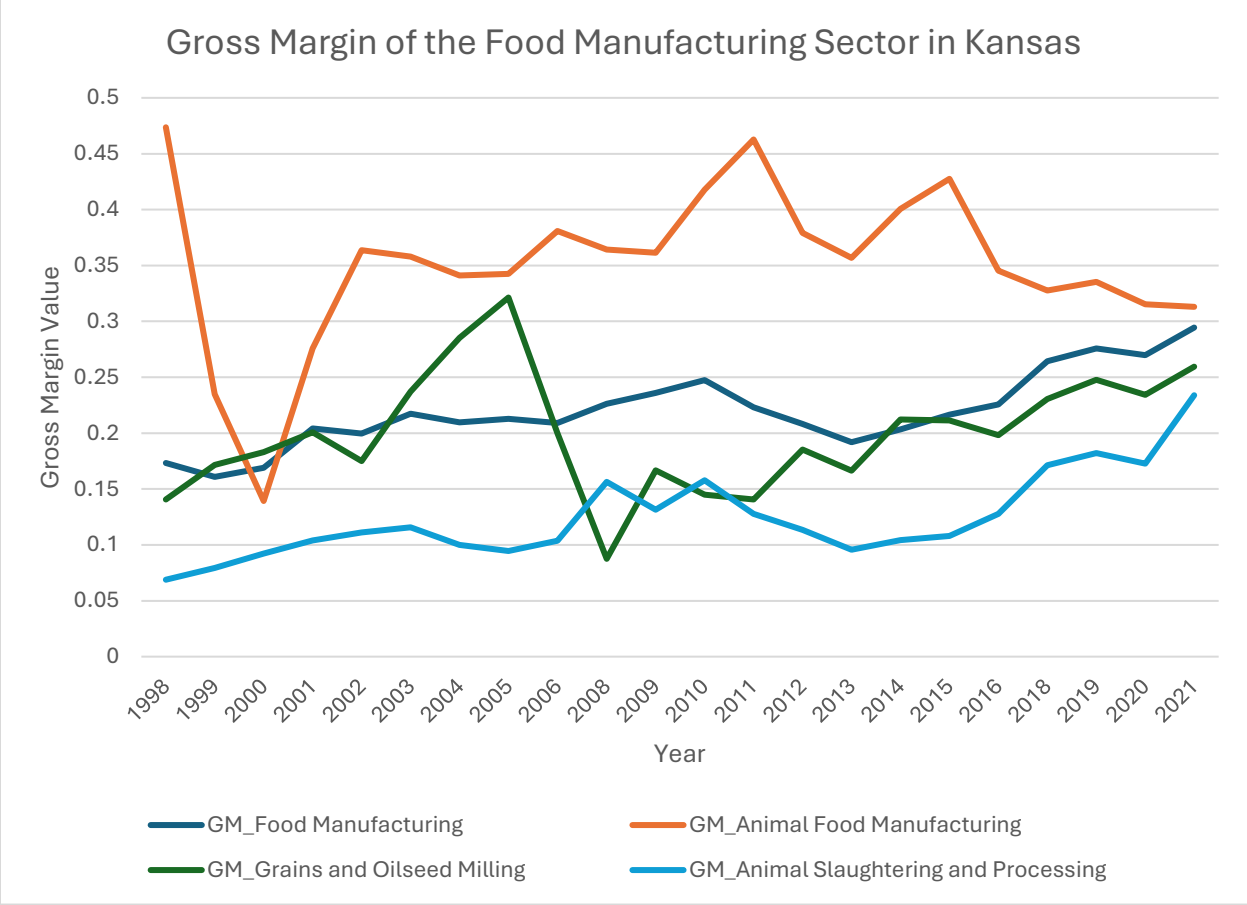


Figure 3. Gross Margin of the Kansas Food Manufacturing Industry by Subsectors, 1998-2021
Source: U.S. Census Bureau, 2021

The Kansas food manufacturing industry reported a gross margin of 29% in 2021. The sector has increased its gross margin from 17% in 1998 to 29% in 2021. The animal food manufacturing sector consistently achieved the highest gross margin within the Kansas food manufacturing industry, reaching 31% in 2021. In contrast, the animal slaughtering sector reported the lowest gross margin, coming in at 23%. This disparity highlights the varying levels of profitability across different segments of the industry. The grains and oilseed milling sector recorded a gross margin of 26% in 2021.

Table 3. The Value-Added Margin in the Food Manufacturing Industry in Kansas, 1998 -20009 and 2010 - 2021

NAICS	Industry	Value-Added Margin	
		1998 - 2009	2010 - 2021
311	Food Manufacturing	0.25	0.28
3111	Animal Food Manufacturing	0.38	0.41
3112	Grains and oilseed Manufacturing	0.23	0.21
3116	Animal Slaughtering and Processing	0.15	0.19

Source: U.S. Census Bureau

The value-added margin characterizes the overall effectiveness of production and marketing activities. In 2021, the state's value-added margin for all food manufacturing as a group was about 35%. The yearly average value-added margin for the sector between 1998 to 2009 was 25%, which increased to about 28% from 2010 to 2021. The animal food manufacturing sector had the highest value-added margin of 38% in 2021, and grains and oilseed milling, and animal slaughtering and processing had 29% each. While animal food manufacturing and animal slaughtering and processing increased in 2010 -2021, the grains and oilseed milling value-added margin decreased within the same period (Table 3).

Gross margin is influenced by different factors in different sectors. According to (Collins & Preston, 1966) both economic theory and industrial experience suggest that the structural features of an industry strongly influence the competitiveness of firms and the performance outcomes.

Conclusion

Food manufacturing is a key driver of economic development in Kansas. By establishing operations in the state, these industries create employment opportunities, stimulate local economies, and increase the demand for agricultural commodities produced in the area (Bolotova, 2016). Their presence not only supports farmers by purchasing raw materials but also contributes to the overall growth and diversification of the rural economy. The food manufacturing sector is the highest employer in the manufacturing industry in Kansas. Employment in the industry has declined over the years in the food manufacturing industry as a group in Kansas, however, the animal food manufacturing sector has increased.

(Salin et al., 2002) identified three types of food manufacturing industries based on their location preference: agricultural-related companies, demand-driven companies, and footloose industries. Agriculturally related industries are located near major agricultural production zones either because their principal food ingredients are bulky or perishable or because farmers are their customers. Demand-driven industries are located near their customers, especially in highly

populated areas, while footloose firms usually satisfy a wide geographic area with one plant regardless of its location. Kansas is an agricultural-dominated state that ranks among the top 10 states in both acreage and production, it is easier for agriculturally related industries to establish operations in the state. The state ranks highly in the market value of cattle and calves ranching, so it is no surprise that animal slaughtering and processing have the largest share in terms of value-added, value of shipment, employees, etc. among the other food manufacturing industries. Kansas has a central location where food products produced can be shipped. It will be easier for footloose food manufacturing to locate and ship their produce around the country. Regional and state governments and policymakers should consider these when attracting food manufacturers into the state.

This paper presents a preliminary study of the Kansas food manufacturing sector. Further studies will focus on the structure and performance of the food industry at the national level with firm-level data.

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