LABOR STANDARDS AND EFFICIENCY ESTIMATION OF FARMS IN THE KANSAS FARM MANAGEMENT ASSOCIATION

by

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B. S., Kansas State University, 2010

A THESIS

submitted in partial fulfillment of the requirements for the degree

MASTER OF SCIENCE

Department of Agricultural Economics
College of Agriculture

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2012

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Abstract

The objectives of this thesis are to examine the labor requirements of Kansas crop and livestock enterprises and farms and the connection between labor efficiency and productivity, and other important farm characteristics including farm size and type. The derived labor requirements are compared to current KFMA labor requirements.

Enterprise summary reports and a five year whole-farm panel data set from 1,016 Kansas Farm Management Association (KFMA) farms are used in the analysis. Whole-farm labor requirements are computed with and without an adjustment for managerial and overhead cost. Individual regressions will be estimated to determine the effects that farm size, type, region and profit margin have on labor requirements.

The estimation results suggest that many of the current labor requirements still in use are accurate. However, there are enterprises with labor requirements that need updating. When the newly estimated requirements are compared to the previous KFMA requirements, 14 enterprises have lower labor requirements. Irrigated alfalfa showed the greatest decrease in labor required when compared to the previous standard, decreasing from 3.85 hrs/acre to 1.70 hrs/acre. Regression estimation results indicated that whole farm labor standards that were corrected for un-allocated overhead and managerial costs appear to be a more accurate representation of farm labor requirements.

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Chapter 1 - Introduction

1.1 Thesis Objectives

The objectives of this thesis are to develop labor requirements for crop and livestock enterprises, and to examine the how changes in value of farm production and percent livestock income effect labor efficiency and productivity. Enterprise and whole-farm Kansas Farm Management Association (KFMA) panel data are used to explore these objectives.

1.2 Background

In agricultural production today, many operations are comprised of smaller individual enterprises. These enterprises may consist of similar production processes such as the production of wheat and grain sorghum, however they can also be as different as dairy and soybean production. This variation in production activities results in substantially different labor requirements across enterprises and farms.

To determine farm types and to evaluate the efficiency of labor use it is important to derive labor standards for various enterprises. Also, with a greater emphasis being placed on farm financial performance, due to increased volatility in farm profitability, accurate estimation of labor requirements for enterprises is important. One of the challenges related to the development of labor standards involves the evolution in technologies which continually change the labor requirements of a farm manager. Another challenge is that a greater amount of the total labor has moved towards increased management time in areas such as marketing, tax planning, and input procurement. Therefore, determining how to allocate managerial labor costs not directly related to field operators or livestock management is becoming more important. Labor standards can be used to help allocate these managerial expenses. Labor standards have been

estimated in the past to determine the correct allocation, however due to the shift in farm size, changing technology, farming practices, and input costs, re-evaluation of these standards is appropriate.

Labor usage estimation at the whole-farm level is also an appropriate component in this work. As Miller (2007) has shown, various farm demographics can have dramatic effects on how labor is utilized on a particular operation. Therefore, an analysis of how whole-farm labor standards vary by farm type, size, and region will allow for adjustments to be made to the previously derived enterprise labor standards that have been and will continue to be used to create enterprise budgets.

1.3 Literature Review

Langemeier and Dhuyvetter (2005) estimated labor standards across three regions, Western, Central and Eastern Kansas for non-irrigated crops. When data were available, each crop's labor requirements were examined to access the impact that farm size had on labor. Farm size was classified into three categories based on their enterprise acreage or livestock production: small, medium, and large. Where data were limited, labor standards, reported as hourly labor requirements per acre, were reported for the average farm size. State level livestock labor standards were also estimated. For a medium size farm in Eastern Kansas the lowest crop labor required was for non-irrigated brome with a labor standard of 1.55 hrs/acre. In Central Kansas, non-irrigated soybeans had the lowest labor required at 1.95 hrs/acre. In Western Kansas, labor standards for medium size farms were 1.55 hrs/acre for non-irrigated grain sorghum and wheat and 2.30 hrs/acre for irrigated corn. Over all crop regions, as farm size increased the labor required for each enterprise decreased. When comparing crops across regions, trends were not

consistent. However, non-irrigated grain sorghum in western Kansas had lower labor requirements than the eastern and central regions in each of the farm size categories.

Villatoro and Langemeier (2006) examined factors impacting farm growth rates on Kansas farms. Specifically, their study examined how farm size, farm type, managerial ability, capital structure, operator age, family size, and off-farm income impacted the ability of an operation to grow. The results show that farms with a greater amount of their operation focused on crops had a larger growth rate, younger operators, and a lower level of off-farm income. Increasing the amount of crop income by one standard deviation from the mean resulted in a growth rate that increased from 2.1 to 2.8 percent. The economic total expense ratio was also found to have a significant effect on farm growth rates. A one standard deviation increase in the expense ratio resulted in a decrease in the predicted growth rate from 2.1 to 1.1 percent.

Miller (2007) examined the effects that farm characteristics, financial performance, and specialization had on Kansas farms' labor productivity and efficiency. Labor productivity was calculated by dividing the value of farm production by a farm's total number of workers. Labor efficiency was computed by dividing the total cost of labor by value of farm production. Results show that value of farm production, operator age, and managerial ability had the greatest influence on labor productivity. Managerial ability was measured with the economic total expense ratio which was calculated by dividing economic total expense by the value of farm production. It was explained that farms with a higher value of farm production tend to have a higher level of technology adoption which typically increases labor productivity. Operator age and managerial ability influenced labor productivity due to differing financial goals and use of technology. The demographics that had the greatest impact on labor efficiency were value of farm production, managerial ability, and land tenure. As with labor productivity, value of farm

production and managerial ability had a significant impact on labor efficiency. Land tenure was shown to have a positive relationship with labor efficiency, that is when land ownership increased, labor efficiency increased as well.

Chapter 2 - Methods

This chapter presents the estimation process for the labor requirements or standards. Section 2.1 provides an explanation of enterprise level estimation with details on which enterprises that will be used and a sample calculation. Section 2.2 reviews the regression analysis used to elicit whole-farm labor standards. Section 2.3 presents the regression procedure used to explore the relationships between labor efficiency and productivity, farm size, farm type, and farm region.

2.1 Enterprise Labor Standards

Enterprise labor standards are calculated using Kansas Farm Management Association (KFMA) enterprise reports from 2006-2010. Standards are calculated for each non-irrigated, irrigated, no-till, and double crop enterprise as well as for each livestock enterprise. A labor standard for each enterprise is calculated for three regions; Eastern, Central, and Western Kansas, as well as at the state level for those enterprises that have continuous 5-year data available. Table 2.1 lists the crop enterprises that are calculated for each cropping practice. Livestock standards are calculated for the enterprises listed in Table 2. 2.

Table 2.3 provides an example of the calculations used to develop the enterprise labor standards. Both hired labor and unpaid labor are obtained from the enterprise analysis summaries from the Kansas Farm Management Association and a five-year average is calculated (items a and b in Table 2.3). The summation of the two labor expense items represents the total enterprise labor expense. The hourly rate chosen to use for the labor standard calculations is from the KFMA databank. Operator labor charges estimated by the association from 2006 through 2010 are divided 2500 hours; this is a standard measure of annual hours, 50 hours per

Table 2.1 Crop Enterprises by Cropping Practice

Non-Irrigated	Irrigated	No-Till	Double Crop
Corn	Corn	Corn	Grain Sorghum
Grain Sorghum	Grain Sorghum	Grain Sorghum	Soybeans
Wheat	Wheat	Wheat	
C.R.P.	Soybeans	Soybeans	
Soybeans	Alfalfa	Corn Silage	
Alfalfa	Sunflowers	Cane Hay-Sudan	
Brome Hay		Sorghum Silage	
Corn Silage		Sunflowers	
Sudan-Cane Hay			
Sorghum Silage			
Cotton			
Sunflowers			

Table 2.2 Livestock Enterprises

Livestock
Beef Cows, Sell Calves
Beef Cows, Sell Feeders
Beef Backgrounding
Beef Backgrounding-Finishing
Beef Grazing
Dairy
Sow and Litter/Sell Market Hogs
Contract Turkeys

Table 2.3 State Level Non-Irrigated Corn Per Acre Labor Standard

a	Hired Labor	$ 8.86
b	Unpaid Family and Operator Labor	$ 28.69
c	Total Labor (a + b)	$ 37.55
d	Hourly Labor Rate	$ 17.82
	Labor Standard (c ÷ d)	2.11 hrs /acre

Note: All values are 5-year averages

week for 50 weeks. These hourly rates are then averaged to arrive at the $17.82/hr. The labor standard is then derived by dividing the total labor expense (c) by the assumed hourly rate (d).

2.2 Whole-Farm Labor Standards

Linear regression model is used to estimate the whole-farm labor requirements for irrigated, non-irrigated, and livestock enterprises:

(2.1) $(MLABOR)_i = a_0 + a_1\ MDACRES_i + a_2\ MIACRES_i + a_3\ MLIVEI_i + e_i$

Equation 2.1 regresses MDACRES, (planted non-irrigated crop acreage), MIACRES, (planted irrigated crop acreage), and MLIVEI, (livestock income, measured in value of farm production) against MLABOR which is the total labor expense for the total farm operation (i.e., the sum of hired labor, unpaid family and operator labor expense).

The expected signs for a_1, a_2, and a_3 are positive, that is, as the number of planted acres, and as livestock income increases, total labor expense increases. Coefficients from this regression are used to estimate a labor standard for each type of producer activity (non-irrigated acres, irrigated acres, and livestock). A labor standard for each production activity will be calculated by dividing each coefficient by the estimated hourly rate of $17.82. One issue that arises with this estimation is how the allocation of overhead and managerial costs should be accomplished. When operators are asked to report labor usage, these particular costs are often underestimated due to the less transparent role they play in production decisions. Many of these costs are represented in the intercept coefficient, a_0, therefore a second labor standard is calculated by multiplying the previously calculated labor standard by a percentage weight of the intercept relative to the average estimated production requirements.

Table 2.4 and 2.5 provide examples of how the regression coefficients are used to develop the whole-farm labor standard. The same hourly rate for labor is used as the one already

Table 2.4 Whole-Farm Labor Standard Example Computation

Mlabor =	a_0 +	a_1 MDACRES +	a_2 MIACRES +	a_3 MLIVEI
Regression Coefficient	$25,375	$25.65	$63.18	$0.0886
Hourly Rate	(b)	$17.82 hrs/acre		
Labor Standard:				
Non-Irrigated Acres	(a_1 ÷ b)	1.44 hrs/acre		
Irrigated Acres	(a_2 ÷ b)	3.55 hrs/acre		
Livestock Income	(a_3 ÷ b)	0.0049 hrs/$ of VFP from livestock		

Table 2.5 Whole-Farm Adjusted Labor Standard Example Computation

	Mean Value x	Coefficient =	Labor Cost	
Non-Irrigated	1,065	25.65	27,330	(b)
Irrigated	29.52	63.18	1,865	(c)
Livestock Income	145,716	0.0886	12,925	(d)
Total Labor Cost			42,120	(b + c + d) = (e)
Intercept			25,375	($a_{0)}$
Labor Cost + Intercept			67,496	(a_0 + e)
Adjustment Multiplier	1.60	(a_0 + b + c + d) ÷ (b + c + d) = (f)		
Labor Standard (From Table 2.4) x Adjustment Multiplier				
Non-Irrigated	1.44 x 1.60 =	2.31		
Irrigated	3.55 x 1.60 =	5.68		
Livestock Income	0.0049 x 1.60 =	0.00798		

defined in the enterprise labor standard discussion. The regression coefficients in the whole-farm example can be interpreted as a marginal effect on total labor costs. For example, a_2 can be interpreted as follows; every acre of irrigated crops added to the operation will result in a $63.18 increase in total cost. The coefficient, a_3, which represents the additional cost incurred by one additional dollar added of livestock production (in value of farm production), is not directly used in this study. It is necessary to include this variable in the regression so that farm labor used for livestock production is accounted for. The interpretation of a_0 consists of all other overhead and managerial costs that are not included in the three other categories (i.e., non-irrigated crops, irrigated crops, and livestock). To calculate the non-irrigated crop production labor standard the coefficient for MDACRES, a_1, is divided by the hourly rate (b). This is repeated for both irrigated crops and livestock production.

Table 2.5 provides the calculations used to develop labor standards that are adjusted for overhead costs. An intercept weight is calculated to correct the previously estimated labor standard to include the additional costs associated with overhead. The mean values of the variables used in the regression; non-irrigated acres, irrigated acres, and livestock income are multiplied by the regression coefficients; a_1, a_2, and a_3, respectively. These labor costs (b, c, and d) are summed to calculate total labor cost (e). The adjustment multiplier is calculated by dividing the summation of the total labor cost (e) and the intercept value (a_0) by the total labor cost (e). The adjusted labor standards are then calculated by multiplying each previously calculated labor standard by this multiplier (f).

Regressions are estimated for all reported farm types, sizes, profit levels, and regions. Farm types are categorized according to Kansas Farm Management Association guidelines, type-

1 is comprised of non-irrigated crops, type-2 irrigated crops, type-3 crops and beef cows, type-4 crops and beef cattle backgrounding, type-5 crops and dairy production, and type-6 other.

Farm size is classified into 5 categories by value of farm (VFP) production. Size 1 includes farms with less than $100,000 VFP; size 2 includes farms with VFP between $100,000 and $250,000; size 3 includes farms with VFP between $250,00 and $500,000; size 4 includes farms with VFP between $500,000 and $1,000,000; and size 5 are operations with greater than $1,000,000 VFP. Profit levels are reported as lower quartile, middle quartiles (consisting of the 2nd and 3rd quartile), and upper quartile. The operating profit margin ratio is used to define the profit quartiles. Results are reported for Western, Central, and Eastern Kansas regions.

2.3 Value of Farm Production per Worker and Labor Efficiency

Regressions are also estimated to establish how the VFP per worker and labor efficiency varies by farm type, farm size, region, and profit margin quartile. These estimates assist in understanding labor trends given various farm characteristics.

2.3.1 Value of Farm Production per Worker

Equation 2.2 shows the regression used to estimate the impact of farm size and farm type on value of farm production per worker.

(2.2) $VFPW_i = a_0 + a_1\ MVFP_i + a_2 PLIVEI + e_i$

(2.3) VFPW= MVFP/NUMW

(2.4) PLIVEI = MLIVEI/MVFP

Value of farm production per worker, VFPW, is regressed against the value of farm production, MVFP, and the percent of the total value of farm production that is from livestock, PLIVEI. Equation 2.3 shows that the variable VFPW is obtained by dividing the value of farm production, MVFP, by the number of workers, NUMW. Equation 2.4 indicates that PLIVEI is

calculated by dividing total livestock income, MLIVEI, by the value of farm production, MVFP. Coefficients a_1 and a_2 are interpreted as the impact of a $1 increase in the value of farm production and percentage change in livestock income, respectively, on the value of farm production per worker. The sign for a_1 is expected to be positive, as the value of farm production increases, the value of farm production per worker is expected to increase as well. The sign for a_2 is expected to be negative, that is, as the percentage of livestock income increases, the value of farm production per worker will decrease.

2.3.2 Labor Efficiency

Equation 2.5 shows the regression model used to estimate the impact of farm size and farms type on labor efficiency.

(2.5) $LABEFF_i = a_0 + a_1\ MVFP_i + a_2 PLIVEI + e_i$

(2.6) LABEFF= MLABOR/MVFP

(2.7) VFPW= MVFP/NUMW

(2.8) PLIVEI = MLIVEI/MVFP

Labor efficiency, LABEFF, is regressed against value of farm production, MVFP, and the percentage of total value of farm production represented by livestock income, PLIVEI . The computation of LABEFF is shown in equation 2.6, specifically, MLABOR (total tabor cost from equation 2.1) is divided by MVFP (value of farm production) to obtain labor efficiency. The calculation of the regressors is explained in equation 2.7 and 2.8. The coefficients for these variables, a_1 and a_2 can be interpreted as the marginal effect that a 1 unit change in each of the respective variables has on labor efficiency. The sign of a_1 is expected to be negative while the sign for a_2 is expected to be positive. That is, when the value of farm production increases, the

labor efficiency measure is expected to decrease, and when the percent of livestock income increases, the labor efficiency measure is expected to increase.

Chapter 3 - Data

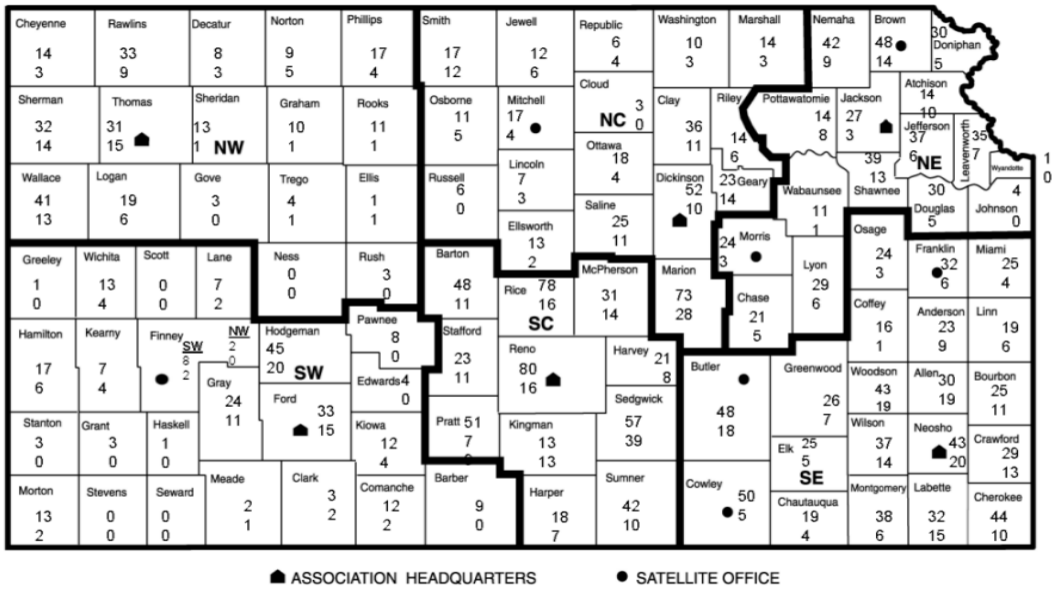
This chapter provides an overview of how the data was acquired. In addition, it provides a statistical summary of the variables used in the regressions and of the farm characteristics by region, farm size, farm type, and profit margin categories.

3.1 Enterprise Data

All data for this research was obtained from the Kansas Farm Management Association (KFMA) databank. Data is collected by the association from subscribing members located in six regional associations in Kansas. For the purposes of this study, the north and south associations of each West, Central, and East region are combined and treated as one region (Figure 3.1).

The mean of hired labor and unpaid family and operator labor costs are used to develop the enterprise labor standards. Costs for hired labor and unpaid family and operator labor are from the KFMA enterprise analysis reports. These averages are composed of cross sectional observations from the regions with members that have continuous data from 2006-2010. Due to the limited number of observations in some enterprises, any enterprise that has three years of available data will also be used. The number of years of data that are used for each enterprise is reported in Table 3.1-3.4. All livestock enterprises use only state level data that was available for years 2006-2010 with the exception of the contract turkey enterprise data which is from the Eastern region alone.

Figure 3.1 KFMA Association Map



Source: Kansas Farm Management Association

Table 3.1 Years Included for Non-Irrigated Crops

Enterprise	Region	Years
Alfalfa	State	`07-`10
	West	`06-`10
	East	`06-`10
Brome Hay	State	`08-`10
	Central	`06-`10
	East	`06-`10
Corn	State	`06-`10
	Central	`06-`10
	East	`06-`10
Cotton	East	`06-`10
C.R.P.	West	`06-`10
Grain Sorghum	State	`06-`10
	West	`06-`10
	Central	`06-`10
	East	`06-`10
Sorghum Silage	State	`08-`10
Soybeans	State	`06-`10
	Central	`06-`10
	East	`06-`10
Sudan-Cane Hay	West	`06-`10
Sunflowers	State	`06-`09
Wheat	State	`06-`10
	West	`06-`10
	Central	`06-`10
	East	`06-`10

Table 3.2 Years Included for Irrigated Crops

Enterprise	Region	Years
Alfalfa	West	`06-`10
Corn	State	`06-`10
	West	`06-`10
	Central	`06-`10
	East	`07-`10
Grain Sorghum	State	`07-`09
	West	`07-`09
Soybeans	State	`06-`10
	West	`06-`10
	Central	`07-`10
Sunflowers	West	`06-`10
Wheat	State	`06-`10
	West	`06-`10

Table 3.3 Years Included for No-Till Crops

Enterprise	Region	Years
Cane Hay-Sudan	West	`07-`10
Corn	State	`06-`10
	Central	`06-`10
	East	`07-`10
Grain Sorghum	West	`06-`10
	Central	`06-`10
Sorghum Silage	West	`07-`10
Soybeans	West	`07-`10
	Central	`06-`10
	East	`07-`10
Sorghum Silage	West	`07-`10
Sunflowers	West	`07-`10
Wheat	West	`07-`10
	Central	`07-`10
	East	`06-`10

Table 3.4 Years Included for Double-Crop Enterprises

Enterprise	Region	Years
Soybeans	State	`07-`09
	Central	`09-`10
	East	`06-`10
Sunflowers	State	`08-`10
	East	`07-`09

3.2 Whole-Farm Labor Data

The whole-farm labor standard estimation also uses KFMA data. Specifically, only data from members with complete and continuous 2006-2010 data are used. As with the enterprise data, information is gathered by KFMA from all six districts as described previously, northern and southern in the east, central and west region are combined to establish three regions: East, Central, and West.

A total of 1,016 farms are used in the whole-farm labor standard, value of farm production per worker, and labor efficiency regressions. Table 3.5 presents summary statistics for these 1,016 farms. The average farm acreage was 2,037 with 680 of these being owned. Of the total acres, 97 were irrigated and 1,262 were non-irrigated acres. The average value of farm production was $430,427 per year with a notable standard deviation of $401,680. Livestock income averaged $109,700 per year or 25% of value of farm production. The average number of workers per farm was 1.49. The average value of farm production per worker was $288,877/year while the average labor efficiency level was 15%. Note, this labor efficiency value is interpreted as total labor cost is 15% of the value of farm production.

Table 3.6-3.9 provides summary statistics by region, farm size category, farm type category, and profit margin category. The average total number of acres is significantly higher in the western region at 3,044 while the central and eastern acreages are similar with 1,840 and 1,919 total acres, respectively (Table 3.6). The average value of farm production follows a similar trend with the Western, Central, and Eastern regions having VFP's of $551,870, $403,193, and $418,633, respectively. The number of workers per farm is relatively similar; the eastern region is the highest with 1.56 workers while the central region has the lowest with 1.39.

Table 3.5 Data Summary All Farms

Variable	Mean	Std. Dev.
Observations	1,016	1,016
Value of farm production	$430,427	$401,680
Net farm income	$108,994	$126,217
Livestock income (VFP)	$109,700	$261,855
Custom feeding income	$ 9,870	$126,905
Hired labor expense	$15,081	$33,485
Unpaid family and operator labor	$50,945	$22,795
Total labor	$66,027	$47,130
Number of workers	1.49	1.20
Total acres	2,037	1,603
Owned acres	680	827
Non-irrigated acres	1,262	1,040
Irrigated acres	97	305
Beef cows	53	81
Dairy cows	4	24
Beef feeders	92	318

Table 3.6 Data Summary by Region

Variable	West	Central	East
Observations	132	363	521
Value of farm production	$551,870	$403,193	$418,633
Net farm income	$141,135	$96,611	$109,478
Livestock income	$75,451	$70,463	$145,716
Custom feeding income	$5,162	$2,664	$16,084
Hired labor expense	$21,065	$13,641	$14,569
Unpaid family and operator labor	$47,982	$49,179	$52,927
Total labor	$69,047	$62,820	$67,496
Number of workers	1.5	1.39	1.56
Total acres	3,044	1,840	1,919
Owned acres	1,211	488	679
Non-irrigated acres	1,980	1,283	1,065
Irrigated acres	327	109	29.5
Beef cows	41	44	62
Dairy cows	1	4	5
Beef feeders	96	73	104

Table 3.7 Data Summary by Farm Size

Variable	1	2	3	4	5
Observations	105	282	343	205	81
Value of farm production	$63,324	$173,632	$357,289	$678,570	$1,482,013
Net farm income	$5,662	$37,067	$88,805	$187,798	$379,399
Unpaid family & operator labor	$30,143	$41,860	$51,079	$61,139	$83,177
Total acres	675	1,370	1,977	2,779	4,500
Owned acres	377	541	612	801	1,534
Number of workers	0.72	1	1.36	1.94	3.62
Hired labor expense	$1,068	$3,196	$9,565	$23,731	$76,094
Livestock income	$30,768	457,583	$95,141	$135,835	$388,973
Total labor	$31,211	$45,057	$60,644	$84,870	$159,271
Non-irrigated acres	280	715	1,196	1,853	3,220
Irrigated acres	0.7	11.8	57.1	175	485
Beef cows	34.4	51.1	56	54.9	64.5
Dairy cows	2	2	4	9	3
Custom feeding income	$752	$2,060	$7,119	$6,367	$9,401
Beef feeders purchased	21	50	79	149	235

Note:
1 - Value of Farm Production less than $100,000
2 - Value of Farm Production between $100,000 and $250,000
3 - Value of Farm Production between $250,000 and $500,000
4 - Value of Farm Production between $500,000 and $1,000,000
5 - Value of Farm Production greater than $1,000,000
6 – other

Table 3.8 Data Summary by Farm Type

Variable	1	2	3	4	5	6
Observations	620	18	74	17	29	258
Value of farm production	$437,175	$974,978	$186,660	$341,502	$415,390	$453,684
Net farm income	$118,652	$234,146	$37,403	$35,711	$91,521	$104,379
Livestock income	$37,345	$10,488	$113,912	$391,125	$425,760	$235,222
Custom feeding income	$3,098	$1,192	$989	$71,941	$98	$26,307
Hired labor expense	$11,809	$46,298	$5,767	$14,736	$42,088	$20,426
Unpaid F&O labor	$49,001	$45,683	$42,705	$47,242	$67,281	$56,756
Total labor	$60,810	$91,981	$48,472	$61,978	$109,369	$77,182
Number of workers	1.3	1.9	1.1	1.4	2.9	1.8
Total acres	1,922	2,445	1,921	2,642	881	2,408
Owned acres	581	725	727	731	533	914
Non-irrigated acres	1,482	1,178	605	408	626	1,054
Irrigated acres	66	1314	4	6	1	129
Beef cows	30	9	149	10	6	92
Dairy cows	-	-	-	-	110	5
Beef feeders	47	23	42	863	-	176

Note:

1 - non-irrigated	4 - crop/backgrounding
2 – irrigated	5 - crop/dairy
3 - crop/beef cow	6 – other

Table 3.9 Data Summary by Profit Quartile

Variable	1st Quartile	3rd &2nd Quartile	4th Quartile
Observations	254	508	254
Value of farm production	$652,701	$456,221	$156,564
Net farm income	$233,611	$96,297	$9,769
Livestock income	$106,759	$124,388	$83,266
Custom feeding income	$3,215	$15,860	$4,547
Hired labor expense	$16,371	$18,361	$7,232
Unpaid family & operator labor	$53,936	$52,572	$$44,701
Total labor	$70,307	$70,934	$51,933
Number of workers	1.54	1.61	1.21
Total acres	2,365	2,265	1,253
Owned acres	865	682	491
Non-irrigated acres	1,761	1,354	578
Irrigated acres	146	111	18
Beef cows	37	60	55
Dairy cows	2	5	6
Beef feeders	74	123	46

When value of farm production is used to divide the farms into size categories, category 3, that is those farms with VFP between $250,000 and $500,000, had the largest enrollment with 343 farms. Fewer farms were in each category and VFP declined or increased relative to category 3. Total acreage, irrigated acreage, and number of workers increased as farm size increased. The farm type summary indicated type 2, irrigated farms have by far the highest value of farm production at $974,978 with type 6, other, having the second highest at $453,684. Crop/dairy operations have the highest number of workers and crop/beef cow have the lowest number of workers, 2.90 and 1.10, respectively. The profit margin quartiles show the total number of acres for farms in the 1st quartile (which contains the farms with the highest profit margin) and 2nd and 3rd quartile are similar. However, irrigated acreage is much larger for the farms in the 1st quartile. Livestock production was also lower in the 1st quartile as compared to the other quartiles.

Chapter 4 - Results

Section 4.1 reports results of the labor requirements or standards for each enterprise for the whole state and for each region. Section 4.2 reports the results of the whole-farm labor standard regression analysis and the corresponding whole-farm labor standards. The labor standards estimated in this study are compared to current KFMA labor standards in Section 4.3. Section 4.4 presents the value of farm production per worker and labor efficiency regression results

4.1 Enterprise Labor Standards

Calculated labor standards for all enterprises with sufficient available data are reported in the Tables 4.1 to 4.5. The state averages for non irrigated crops show corn silage to be the most labor intensive, with a standard of 3.96 hrs/acre while wheat has the lowest at 1.78 hrs/acre. Non-irrigated soybeans and grain sorghum have similar labor standards, 1.96 hrs/acre and 2.03 hrs/acre, respectively. Brome hay has a labor requirement of 2.00 hrs/acre which is significantly lower than alfalfa's labor standard of 2.94 hrs/acre. Wheat has the lowest labor standard of 1.82 hrs/acre among the irrigated enterprises while grain sorghum has the highest at 2.82 hrs/ acre (Table 4.2). Unlike the non-irrigated enterprises, irrigated grain sorghum and soybeans have a much more significant spread, with grain sorghum at 2.82 hrs/acre and soybeans at 2.06 hrs/acre. Double crop soybeans (Table 4.3) are at 71% of the labor usage of non-irrigated soybeans (Table 4.1). Non-irrigated no-till crops (Table 4.4) resulted in a lower labor standard than their strictly non-irrigated counterparts. The labor requirements for soybeans, wheat, and grain sorghum as a percent of non-irrigated were, 94%, 97%, and 88% respectively.

Table 4.1 Per Acre Labor Standards for Non-Irrigated Crops

Enterprise	Labor Standard 5yr	Region
Corn	2.11	State
	-	West
	2.02	Central
	2.22	East
Grain Sorghum	2.03	State
	1.04	West
	2.09	Central
	1.78	East
Wheat	1.78	State
	1.81	West
	1.90	Central
	1.71	East
C.R.P.	-	State
	-	West
	-	Central
	0.24	East
Soybeans	1.96	State
	-	West
	1.87	Central
	1.99	East
Alfalfa	2.94	State
	2.03	West
	-	Central
	3.84	East
Brome Hay	2.00	State
	-	West
	1.37	Central
	1.81	East
Corn Silage	3.96	State
	-	West
	2.57	Central
	3.84	East

Table 4.1 Cont. Per Acre Labor Standards for Non-Irrigated Crops

Enterprise	Labor Standard 5yr	Region
Sudan-Cane Hay	-	State
	1.53	West
	-	Central
	-	East
Sorghum Silage	3.21	State
	-	West
	-	Central
	-	East
Cotton	-	State
	-	West
	-	Central
	1.82	East
Sunflowers	1.45	State
	-	West
	-	Central
	-	East

Table 4.2 Per Acre Labor Standards for Irrigated Crops

Enterprise	Labor Standard 5yr	Region
Corn	2.36	State
	2.61	West
	2.04	Central
	3.85	East
Grain Sorghum	2.82	State
	2.41	West
	-	Central
	-	East
Wheat	1.82	State
	2.08	West
	-	Central
	-	East
Soybeans	2.06	State
	2.61	West
	2.19	Central
	-	East
Alfalfa	-	State
	1.70	West
	-	Central
	-	East
Sunflowers	-	State
	1.73	West
	-	Central
	-	East

Table 4.3 Per Acre Labor Standards for Non-Irrigated Double-Crops

Enterprise	Labor Standard 5yr	Region
Soybeans	1.41	State
	-	West
	1.51	Central
	1.55	East
Sunflowers	1.43	State
	-	West
	-	Central
	1.22	East

Table 4.4 Per Acre Labor Standards for Non-Irrigated No-Till Crops

Enterprise	Labor Standard 5yr	Region
Corn	-	State
	1.05	West
	2.01	Central
	2.49	East
Grain Sorghum	-	State
	1.18	West
	1.84	Central
	-	East
Wheat	-	State
	1.00	West
	1.74	Central
	2.02	East
Soybeans	-	State
	1.66	West
	1.79	Central
	2.16	East
Corn Silage	-	State
	1.15	West
	-	Central
	-	East
Cane Hay-Sudan	-	State
	1.48	West
	-	Central
	-	East
Sorghum Silage	-	State
	1.67	West
	-	Central
	-	East
Sunflowers	-	State
	1.66	West
	-	Central
	-	East

Table 4.5 Labor Standards for Livestock Enterprises

Enterprise	Units	Labor Standard 5yr	Region
Beef Cows, Sell Calves	Head	5.42	State
Beef Cows, Sell Feeders	Head	5.55	State
Beef Backgrounding	Head	1.30	State
Beef Backgrounding-Finishing	Head	1.57	State
Beef Grazing	Head	1.45	State
Dairy	Head	36.64	State
Sow and Litter/Sell Mkt Hogs	Litter	6.89	State
Contract Turkeys	Head	0.0352	East

Section 4.2 Whole-Farm Labor Standard

The whole-farm regression coefficients are provided in Table 4.6-4.10. Labor standards are not provided for regressions with statistically insignificant variables. As discussed in chapter 2, the expected sign for each coefficient is positive. Using these regression coefficients, labor standards for each farm characteristic are calculated and reported in Table 4.11-4.14. Irrigated acres were commonly insignificant in the regressions when characterized by farm type and size. This is most likely due to the low number of observations available when the data is categorized using these characteristics.

Each standard was adjusted using the overhead cost multiplier described in Chapter 2. The regression estimates for all 1,016 farms resulted in an adjustment from 1.02 hrs/acre to 1.85 hrs/acre for non-irrigated acres and from 1.61 hrs/acre to 2.92 hrs/acre for irrigated acres. Whether this increase provides evidence that labor requirements reported by managers are underestimated due to failure to allocate at least a portion of the overhead cost to individual enterprises is discussed below.

Section 4.3 Comparison with Current KFMA Labor Standards

Table 4.15 displays the previously estimated labor standards that are used by the Kansas Farm Management Association. When compared to the 2006-2010 calculated enterprise standards, deviations are observed. The largest change in crops is for irrigated alfalfa. The labor standard declined from 3.85 hrs/ acre to 1.70 hrs/acre. With the exception of irrigated grain sorghum, all irrigated crop labor requirements decreased. When compared to the 21 previous KFMA labor standards, 14 of the enterprise labor standards have decreased. When regional non-irrigated wheat is compared to the previous standards the eastern region is similar. However, the central and western regions have differences with an increase of 0.20 and 0.96, respectively.

Table 4.6 Regression Coefficients for Labor Expense on All Farms

Variable	Coef.	Obs
Non-Irrigated Acres (MDACRES)	18.26**	1,016
Irrigated Acres (MIACRES)	28.74**	1,016
Livestock (MLIVEI)	0.0971**	1,016
Intercept	29,561**	1,016
R^2	.58	

** indicates significance at the 1% level

Table 4.7 Regression Coefficients for Labor Expense Based on Farm Region

	Variable	Coef.	Obs	R^2
East				.63
	Non-Irrigated Acres	25.65**	521	
	Irrigated Acres	63.18**	521	
	Livestock	0.0887**	521	
	Intercept	25,375**	521	
Central				.59
	Non-Irrigated Acres	21.77**	363	
	Irrigated Acres	34.34**	363	
	Livestock	0.1238**	363	
	Intercept	22,424**	363	
West				.61
	Non-Irrigated Acres	10.43**	132	
	Irrigated Acres	31.28**	132	
	Livestock	0.1036**	132	
	Intercept	30,342**	132	

Note:
* indicates significance at the 5% level
** indicates significance at the 1% level

Table 4.8 Regression Coefficients for Labor Expense Based on Farm Size

Size	Variable	Coef.	Obs	R^2
1				.31
	Non-Irrigated Acres	33.61**	105	
	Irrigated Acres	419.94	105	
	Livestock	0.2205**	105	
	Intercept	14,745**	105	
2				.10
	Non-Irrigated Acres	4.10*	282	
	Irrigated Acres	21.27	282	
	Livestock	0.0650**	282	
	Intercept	38,130**	282	
3				.29
	Non-Irrigated Acres	2.49	343	
	Irrigated Acres	22.57**	343	
	Livestock	0.0887**	343	
	Intercept	47,932**	343	
4				.29
	Non-Irrigated Acres	6.70*	205	
	Irrigated Acres	7.15	205	
	Livestock	0.0890**	205	
	Intercept	59,097**	205	
5				.37
	Non-Irrigated Acres	11.79*	81	
	Irrigated Acres	14.86	81	
	Livestock	0.0761**	81	
	Intercept	84,517**	81	

* Indicates significance at the 5% level

** Indicates significance at the 1% level

1 - Value of Farm Production less than $100,000

2 - Value of Farm Production between $100,000 and $250,000

3 - Value of Farm Production between $250,000 and $500,000

4 - Value of Farm Production between $500,000 and $1,000,000

5 - Value of Farm Production greater than $1,000,000

Table 4.9 Regression Coefficients for Labor Expense Based on Farm Type

	Variable	Coef.	Obs	R^2
1				.58
	Non-Irrigated Acres	17.45**	620	
	Irrigated Acres	31.08**	620	
	Livestock	0.1522**	620	
	Intercept	27,222**	620	
2				.92
	Non-Irrigated Acres	15.31**	18	
	Irrigated Acres	44.92**	18	
	Livestock	0.12	18	
	Intercept	13,689	18	
3				.66
	Non-Irrigated Acres	34.58**	74	
	Irrigated Acres	-175.2	74	
	Livestock	0.0488*	74	
	Intercept	22,765**	74	
4				.30
	Non-Irrigated Acres	50.17	17	
	Irrigated Acres	-165.4	17	
	Livestock	0.0415	17	
	Intercept	26,206	17	
5				.91
	Non-Irrigated Acres	55.25**	29	
	Irrigated Acres	-2,209	29	
	Livestock	0.1189**	29	
	Intercept	25,680*	29	
6				.55
	Non-Irrigated Acres	17.35**	258	
	Irrigated Acres	17.76*	258	
	Livestock	0.0861**	258	
	Intercept	36,331**	258	

* indicates significance at the 5% level
** indicates significance at the 1% level

1 - non-irrigated
2 - irrigated
3 - crop/beef cow
4 - crop/backgrounding
5 - crop/dairy
6 - other

Table 4.10 Regression Coefficients for Labor Based Expense on Profit-Margin Quartiles

	Variable	Coef.	Obs	R^2
1st Quartile				.42
	Non-Irrigated Acres	15.94**	254	
	Irrigated Acres	19.74**	254	
	Livestock	0.0540**	254	
	Intercept	33,607**	254	
3rd & 2nd Quartile				.70
	Non-Irrigated Acres	22.63**	508	
	Irrigated Acres	27.26**	508	
	Livestock	0.1213**	508	
	Intercept	22,147**	508	
4th Quartile				.60
	Non-Irrigated Acres	20.42**	254	
	Irrigated Acres	69.80**	254	
	Livestock	0.1698**	254	
	Intercept	24,738**	254	

Note:

* indicates significance at the 5% level

** indicates significance at the 1% level

Table 4.11 Labor Standards Calculated by Region

	East	West	Central	All Farms
Non-Irrigated Acres				
Labor Standard	1.44	0.59	1.22	1.02
Adjusted	2.31	1.04	1.90	1.85
Irrigated Acres				
Labor Standard	3.55	1.76	1.93	1.61
Adjusted	5.68	3.13	3.00	2.92
Livestock Income				
Labor Standard	0.0050	0.0058	0.0069	0.0054
Adjusted	0.0080	0.0104	0.0108	0.0099

Table 4.12 Labor Standards Calculated by Farm Size

Farm Size	1	2	3	4	5	All Farms
Non-Irrigated Acres						
Labor Standard	1.89	0.23	-	0.38	0.66	1.02
Adjusted	3.57	1.50	-	1.24	1.41	1.85
Irrigated Acres						
Labor Standard	-	-	1.27	-	-	1.61
Adjusted	-	-	6.04	-	-	2.92
Livestock Income						
Labor Standard	0.0124	0.0036	0.0050	0.0050	0.0043	0.0054
Adjusted	0.0235	0.0237	0.0237	0.0165	0.0091	0.0099

1 - Value of Farm Production less than $100,000
2 - Value of Farm Production between $100,000 and $250,000
3 - Value of Farm Production between $250,000 and $500,000
4 - Value of Farm Production between $500,000 and $1,000,000
5 - Value of Farm Production greater than $1,000,000

Table 4.13 Labor Standards Calculated by Farm Type

Farm Type	1	2	3	4	5	6	All Farms
Non-Irrigated Acres							
Labor Standard	0.98	0.86	1.94	-	3.10	0.97	1.02
Adjusted	1.77	-	3.66	-	4.05	1.84	1.85
Irrigated Acres							
Labor Standard	1.74	2.52	-	-	-	1.00	1.61
Adjusted	3.16	-	-	-	-	1.88	2.92
Livestock Income							
Labor Standard	0.0085	0.0065	0.0027	-	0.0067	0.0048	0.0054
Adjusted	0.0155	-	0.0052	-	0.0087	0.0091	0.0099

1 - non-irrigated
2 - irrigated
3 - crop/beef cow
4 - crop/backgrounding
5 - crop/dairy
6 - other

Table 4.14 Labor Standards Calculated by Profit Margin

	1st Quartile	2nd & 3rd Quartile	4th Quartile	All Farms
Non-Irrigated Acres				
Labor Standard	0.89	1.27	1.15	1.02
Adjusted	1.71	1.85	2.19	1.85
Irrigated Acres				
Labor Standard	1.11	1.53	3.92	1.61
Adjusted	2.12	2.22	7.48	2.92
Livestock Income				
Labor Standard	0.003	0.0068	0.0095	0.0054
Adjusted	0.0058	0.0099	0.0182	0.0099

Table 4.15 Current KFMA Labor Standards

Crop hr/acre	East	Central	West	Irrigated
Wheat	1.85	1.70	0.95	2.15
Corn	3.00	2.55	1.30	3.05
Grain Sorghum	2.15	1.80	1.10	2.20
Soybeans	2.05	1.90	1.05	2.15
Alfalfa	6.05	5.30	2.80	3.85
Brome	2.45	1.75	1.35	2.35
Silage	5.50	4.90	4.20	4.65

Livestock Labor Standards		Units
Beef Cows	7.40	Head
Dairy Cows	47.2	Head
Swine-Litters	5.30	Litter

Grain sorghum labor requirements increased when compared to the previous standards in the Eastern and Central regions. However, the Western region shows a decrease. Labor requirements for irrigated crops increased for grain sorghum and soybeans, and decreased for wheat and corn.

The estimated non-irrigated whole-farm labor standards are compared to the average current labor standards for the four main crops, wheat, corn, grain sorghum, and soybeans. The previous standards are significantly higher. However, when compared to the adjusted estimated standard they are very similar. The Eastern region had an increase of 0.05, while the Western region increased by 0.06 and the Central region decreased by 0.08. Current irrigated corn standards compared to the estimated whole-farm irrigated standard had a similar trend. The current estimates are much lower than the previous estimates. However, when the overhead and managerial cost adjustment is added, both the western and central regions are very similar with computed standards of 3.13 hrs/acre and 3.00 hrs/acre compared to the current standard of 3.05 hrs/acre. Eastern Kansas did show an increase from 3.05 hrs/acre to 3.55 hrs/acre.

Tables 4.16-4.17 provide a comparison of the labor requirements computed in this study with the previous standards. To allow for non-irrigated whole-farm labor standards to be compared with the other two, the four most common non-irrigated crops; wheat, corn, grain sorghum, and soybeans, were averaged together for both the KFMA and enterprise labor standards.

From Table 4.16 that the enterprise labor standards and the adjusted whole-farm regressions suggest that the previously calculated KFMA standard for non-irrigated crops is low. This table also provides evidence that when using regression estimations on whole-data, an adjustment for the labor allocated to the intercept is necessary. Beef cows and dairy both indicate

4.16 Comparison of Non-Irrigated Labor Standards

State Level Non-Irrigated Crops Hrs/Acre	
KFMA Average	1.78
Enterprise Average	1.97
Estimated Whole-Farm	1.02
Adjusted	1.85

Note:
KFMA and Enterprise Standards are composed of the averages of Wheat, Corn, Grain Sorghum and Soybeans

4.17 Comparison of Irrigated Crop Labor Standards

State Level Irrigated Crops Hrs/Acre	
KFMA Average	3.05
Enterprise Average	2.36
Estimated Whole-Farm Adjusted	1.61 2.92

a decrease in labor requirements when compared to the enterprise estimations, from 7.40 hrs/head to 5.42 hrs/head for beef cows and 47.20 hrs/head to 36.64 hrs/head for dairy. However, the swine enterprise showed an increase from 5.30 hrs/litter to 6.89 hrs/litter.

Section 4.4 Value of Farm Production per Worker and Labor Efficiency

Regression coefficients for value of farm production per worker are reported in table 4.18-4.20. Labor efficiency regression results are reported in table 4.21-4.23. The value of farm production per worker regression coefficients for MVFP (Value of Farm Production) and PLIVEI (Percent of Value of Farm Production from Livestock) had the expected signs on the whole- farm level as well as for the regional and profit margin regressions. It is important to note that PLIVEI was expressed in decimal form in the value of farm production per worker and labor efficiency regressions. For all farms, the coefficient for MVFP was 0.2632 and was significant at the 1% level. Using this coefficient, a $1 increase in value of farm production would result in an increase the value of farm production per worker of $0.26. PLIVEI had a value of -106,841, which was also significant at the 1% level. Each 1% increase in livestock income results in a $1,068 decrease in value of farm production per worker. Value of farm production had the largest impact on value of farm production per worker in the Central region while the Western region had the largest negative effect from PLIVEI at -$336,455. Figure 4.1 and 4.2 illustrate how value of farm production and percentage of farm income from livestock production effect value of farm production per worker.

When examining tables 4.21-4.23, it should be noted that labor efficiency is computed by dividing total labor expense by value of farm production, therefore a smaller value of labor efficiency represents an improvement. The coefficients for both value of farm production, MVFP, and percent livestock income, PLIVEI, when regressed against labor efficiency, both had

Table 4.18 Value of Farm Production per Worker for All Farms

	Coefficient	Standard Error
MVFP	0.2632**	0.0112427
PLIVEI	-106,841**	10610.09
INTECEPT	210,545**	7559.012
Number of observations	1016	
R^2	0.4128	

* indicates significance at the 5% level

** indicates significance at the 1% level

Table 4.19 Value of Farm Production per Worker by Region

	Coefficient	Standard Error	Observations
West			132
MVFP	0.2834**	0.0334	
PLIVEI	-336,455**	89,678	
INTECEPT	271,459**	31,029	
R^2	0.4237		
Central			363
MVFP	0.3044**	0.0190	
PLIVEI	-86,146**	17,773	
INTECEPT	185,150**	10,871	
R^2	0.4651		
East			521
MVFP	0.2253**	0.0148	
PLIVEI	-97,573**	12,045	
INTECEPT	216,944**	10,078	
R^2	0.3832		

Table 4.20 Value of Farm Production per Worker by Profit Margin Quartile

	Coefficient	Standard Error	Observations
1st Quartile			254
MVFP	0.2546**	0.0262	
PLIVEI	-46425.09	37,353	
INTECEPT	283,711**	21,551	
R^2	0.2733		
3rd &2nd Quartile			508
MVFP	0.1542**	0.0134	
PLIVEI	-112,235**	14,865	
INTECEPT	253,549**	8,772	
R^2	0.2641		
4th Quartile			254
MVFP	0.2750**	0.0297	
PLIVEI	-38,740**	6,285	
INTECEPT	112,355**	6,651	
R^2	0.3268		

Table 4.21 Labor Efficiency Regression Results for All Farms

	Coefficient	Standard Error
MVFP	-1.76E-07**	1.38E-08
PLIVEI	0.1799**	0.0130
INTECEPT	0.2489**	0.0093
Number of observations	1,016	
R^2	0.282	

* indicates significance at the 5% level

** indicates significance at the 1% level

Table 4.22 Labor Efficiency by Region

	Coefficient	Standard Error	Observations
West			132
MVFP	-9.86E-08**	1.63E-08	
PLIVEI	0.1554**	0.0437	
INTECEPT	0.2144**	0.0151	
R^2	0.2998		
Central			363
MVFP	-2.09E-07**	2.23E-08	
PLIVEI	0.1166**	0.0209	
INTECEPT	0.2713**	0.0128	
R^2	0.2782		
East			521
MVFP	-2.04E-07**	2.31E-08	
PLIVEI	0.1977**	0.0187	
INTECEPT	0.2560**	0.0157	
R^2	0.2874		

* indicates significance at the 5% level

** indicates significance at the 1% level

Table 4.23 Labor Efficiency by Profit Margin Quartile

	Coefficient	Standard Error	Observations
1st Quartile			254
MVFP	-1.10E-06**	1.49E-07	
PLIVEI	0.2106**	0.0315	
INTECEPT	0.4861**	0.0334	
R^2	0.2796		
3rd &2nd Quartile			508
MVFP	-7.85E-08**	6.92E-09	
PLIVEI	0.0663**	0.0077	
INTECEPT	0.1984**	0.0045	
R^2	0.279		
4th Quartile			254
MVFP	-5.15E-08**	5.42E-09	
PLIVEI	0.0245**	0.0077	
INTECEPT	0.1541**	0.0044	
R^2	0.2809		

* indicates significance at the 5% level

** indicates significance at the 1% level

Figure 4.1 VFP/W vs. Percent of Farm Production from Livestock

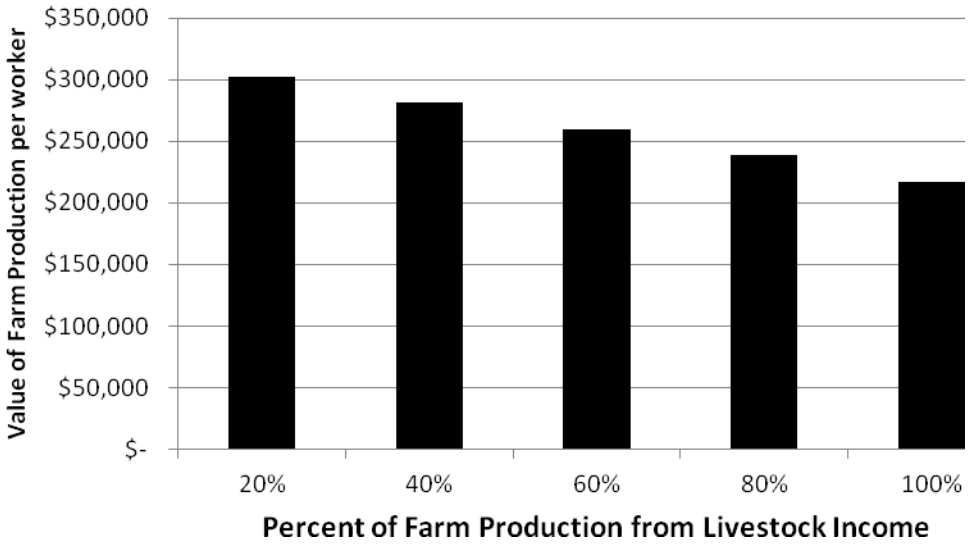
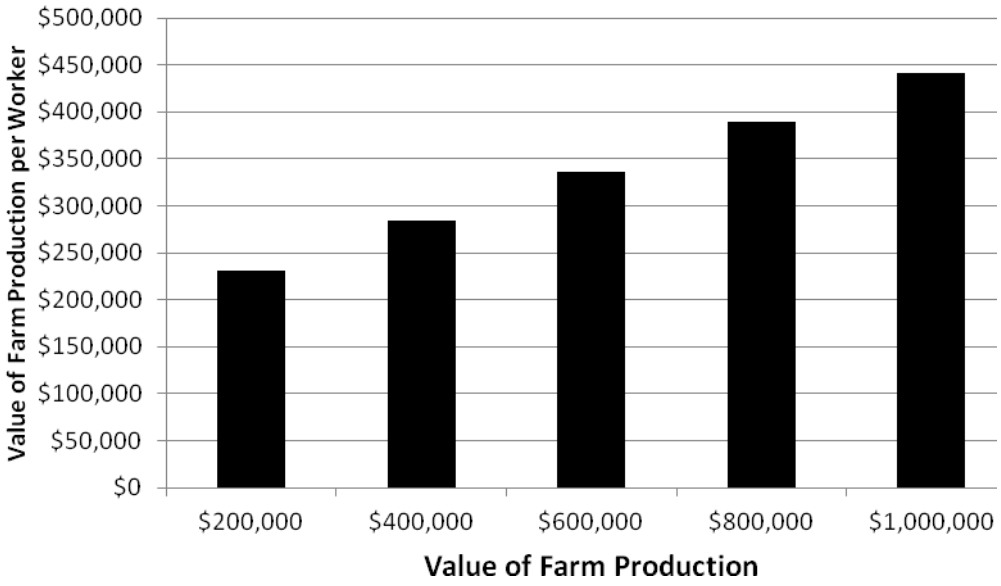


Figure 4.2 VFP/W vs. VFP



the expected signs. In all models, increases in MVFP resulted in improvements in labor efficiency while increases in PLIVEI resulted in a deterioration of labor efficiency. Figure 4.3 and 4.4 examine how labor efficiency is affected by changes in value of farm production and by the percentage of farm income from livestock production.

Figure 4.3 Labor Efficiency vs. Percent of Farm Production from Livestock

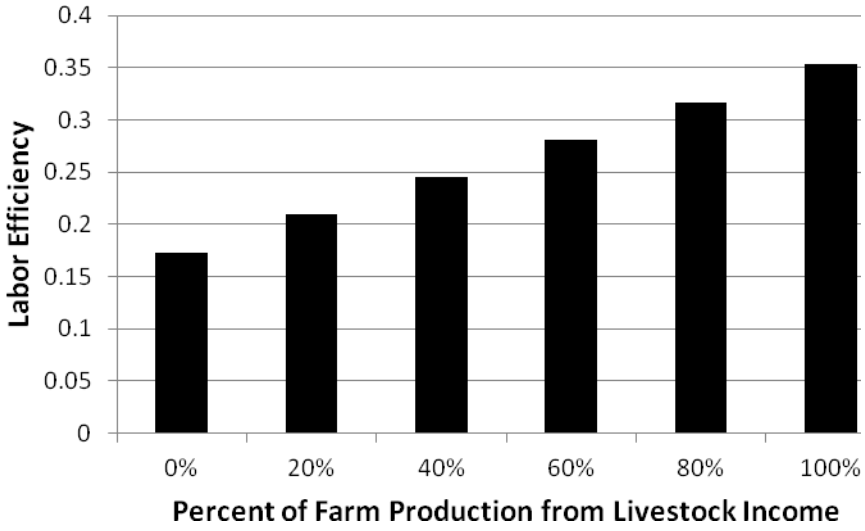
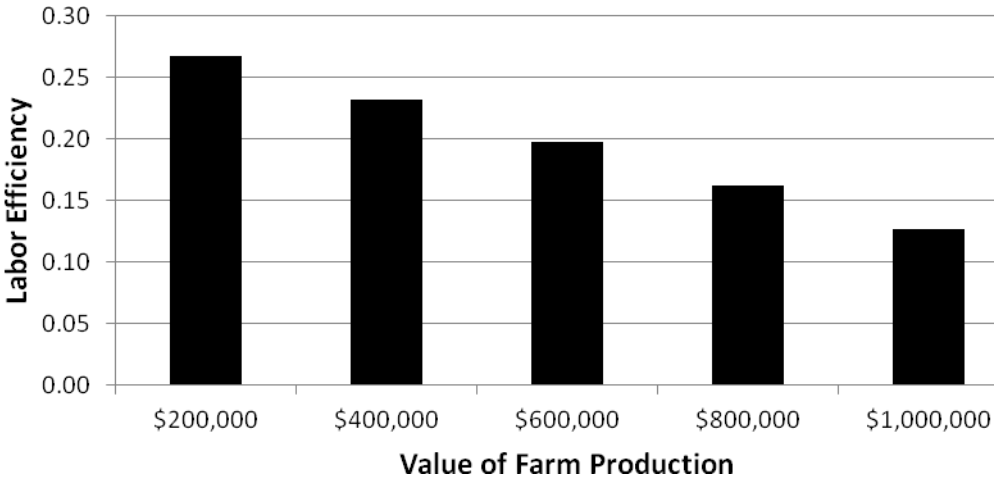


Figure 4.4 Labor Efficiency vs. Value of Farm Production



Chapter 5 - Conclusions

This chapter provides a brief overview of the thesis. It provides a discussion of how each labor requirement or standard can be used in practical application. Limitations of the research are also presented.

5.1 Thesis Synopsis

The purpose of this project was to develop labor standards that can be used to measure farm efficiency and diagnose productivity issues at the enterprise level. These labor standards were developed using KFMA whole-farm data and enterprise summary reports from 2006-2010. The standards were developed with the intent to be used by the Kansas Farm Management Association. The current standards that are being used are considered out of date due to changes that have occurred in production practices since their estimation in the early 1990's. Labor efficiency and productivity estimations, which vary across regions in Kansas and by farm size, are also included in this research. These measures will provide additional information when labor standards are adopted in practice.

Enterprise summary reports were used to estimate crop and livestock enterprise labor standards. They were used to develop an understanding of the labor requirements for various crops and cropping practices. Regression estimates were used to calculate the labor standards on a whole-farm level and help determine how labor requirements vary by farm characteristics as well as attempt to capture overhead and managerial costs. Farm characteristics include farm size, farm type, region, and profitability. Two efficiency measures, value of farm production per worker, and labor efficiency were also estimated for these farm characteristics.

The enterprise labor standards were calculated and compared to the current KFMA standards. The results show that the majority of crops have smaller labor requirements than

previously estimated. These were then compared to the labor standards resulting from the whole-farm regression estimations. To account for overhead and managerial labor costs, an adjustment multiplier was developed and applied to the new labor standards. The significant increase observed after the overhead adjustment was made suggests that the previous labor standards may not reflect the entire labor cost associated with a particular production process and adjustment to the enterprise level standards is warranted. Efficiency measures were developed to provide an understanding of how farm characteristics and location can effect labor requirements and help further refine labor standards used in practice. Value of farm production per worker was found to increase when an operation's total value of farm production increased, while percent of income (VFP) from livestock production had a negative effect on this measure. Labor efficiency was found to be effected by these two variables in a similar way.

5.2 Limitations and Application

One limitation of this thesis is that enterprise summary reports are only available for the more common enterprises. Those enterprises which are less common that have sufficient data may be composed of only a few farms. The whole-farm data that was used had sufficient observations, 1,016 farms, however, when regression estimates are used on data from smaller categories such as farm type and size, the number of observations becomes relatively small making it difficult to derive reliable information.

The method of calculating enterprise level labor standards and then adjusting them by trends observed in the whole-farm regression estimates that have been corrected for overhead costs can provide benefits over other methods of deriving standards. Farm manager surveys can be used to elicit labor requirements, however it is not unreasonable to assume that many of these operators will not include managerial and overheard costs when they are asked to estimate their

labor requirements for particular production practices. The method used in this thesis also allows for updates to be achieved with a minimal amount of work due to the fact that the information used in the estimations is already collected annually by the Kansas Farm Management Association.

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Appendix A - Definitions of Variables Using SAS Databank Variables

mlabor = total labor expense (hired, family, and operator)

v574 + v316 + v973 + v1030

dacres

v330

iacres

v327

mlivei = accrual income from livestock production (value added measure)

v274+v277+v275+v508+v276+v278+v509+v279+v1249+v1251+v1253+v1255

+v1257+v1259

mvfp = value of farm production

v005

plivei = percentage of value of farm production from livestock production

(v274+v277+v275+v508+v276+v278+v509+v279+v1249+v1251+v1253+v1255

+v1257+v1259) / v005

numw = number of workers

v011

vfpw = value of farm production per worker

v005 / v011

labeff = labor efficiency

(v574+v316+v973+v1030) / v005