

Livelihood Assets and Livestock Income: A Case of Mixed Farming Punjab-Pakistan

Tusawar Iftikhar Ahmad

Department of Economics, The Islamia University of Bahawalpur, Pakistan
Email: tusawar.iftikhar@iub.edu.pk

Muhammad Atif Nawaz

Department of Economics, The Islamia University of Bahawalpur, Pakistan
Email: atif.nawaz@iub.edu.pk

Muhammad Azhar Bhatti

Department of Economics, The Islamia University of Bahawalpur, Pakistan
Email: azhar.bhatti219@gmail.com

Altaf Hussain

Department of Economics, The Islamia University of Bahawalpur, Pakista

The study investigates the response pattern of income earned from livestock farming to livelihood assets in Punjab (Pakistan). Primary data was collected from three regions (northern, central, and southern) of Punjab. A multi-stage sampling technique was adopted to gather the information. The information collected from 347 farm households were processed and analyzed (descriptively and inferentially) to generate and interpret the results. On average, a farm household was earning nearly 50% of its total annual income from crops, 23% from livestock and 27% from nonfarm sources. Amongst the four livelihood assets, financial capital could be ranked first in terms of its significant contribution to the annual income earned by a livestock farmer. Own farmland size, qualitative and quantitative attributes of human capital, and status of the physical and financial capital available to the farmer, all translate into the income generated through livestock enterprise. Results of this study indicate that farmer's own land size (LSIZE), farmer level of education (FEDU), and managerial constraints (MGTC) have negatively associated with the income earned from livestock. While farmer's level of participation in livestock rearing activities (FPTPN), herd size (HSIZE), income from crops (ICROP), and nonfarm sources (INONF) have a positive impact on income earned from livestock. A portfolio of the available financial capital may enable a predominantly illiterate and resource-deficient livestock farmer to bear the expenditures made for the overall livestock production activities, which eventually enable him to earn higher income from livestock in a mixed farming system Punjab..

Key words: livestock income, livelihood assets, mixed farming, rural Punjab.

1. INTRODUCTION

In the developing world, livestock contributes about 30 percent to the agricultural gross domestic product (World Bank, 2009), and globally, it provides animal traction to nearly a quarter of the total area under crop production (Devendra, 2010). Multiple functions are performed by livestock in developing communities (Moyo & Swanepoel, 2010). Livestock plays an essential role in the provision of food and nutrition in people's diets (Neumann et al., 2003; Randolph et al., 2007), and about 30 percent of human protein consumption comes from livestock products (Steinfeld et al., 2006). They raise the social status of owners and contribute to gender-balanced development by providing women and children the opportunity to own livestock (Waters-Bayer & Letty, 2010); serve as a means of reducing the risks associated with crop failure and as an income diversification strategy for resource-poor small scale farmers (Freeman, Kaitibie, Moyo, & Perry, 2007; Thornton et al., 2007).

The contribution of livestock to crop production through the provision of draught power and animal manure cannot be overlooked (Herrero et al., 2010). In many parts of the developing world, livestock function as insurance policies and bank accounts (Pell, Stroebel, & Kristjanson, 2010). Due to improved incomes and changing dietary patterns, there is more demand for high value food commodities. So,

an increased economic activity in livestock contributes to economic growth by fostering forward and backward linkages (McDermott, Rich, Gebremedhin, & Burrow, 2010).

Livestock is the backbone of the agriculture sector because it provides approximately 56 percent and the agriculture sector, which is almost 11 percent in gross domestic product. Milk is the most significant indicator of livestock, ranked fourth in worldwide milk production after China, India, and the USA. Livestock share is significant because it plays a significant role in poverty reduction policies (MFAC, 2015).

Being the most significant contributor to the agricultural income of Pakistan, the livestock sector has a significant role in the socioeconomic uplift of rural masses. According to government statistics, there are 29.56 million cattle, 27.33 million buffaloes, 26.49 million sheep, and 53.79 million goats in Pakistan (Government of Pakistan, 2006). Nearly 8 million families are engaged in livestock farming and generating more than 35 percent income from livestock production activities. So, it is a vital source of cash income and often the only source of income for the rural and especially the marginal people. During the economic year 2015-16, livestock contributed approximately 58.6 percent to the agriculture value-added and 11.6 percent to Pakistan's overall gross domestic

product (GDP). While during the same period, gross value addition of livestock at the constant cost factor of 2005-06 remained Rs. 1292 billion, showing an increase of 3.63 percent over the same period last year (Government of Pakistan, 2017). So, for sustainable agriculture development government of Pakistan needs to improve and expand the livestock and dairy products industry.

The livestock sector requires proper attention to achieve multiple objectives, including food security, rural workforce absorption, and poverty alleviation. For a sustained contribution of the livestock sector to reduce poverty and raise the income of the people who earn their livelihoods from livestock, it is necessary to develop a good understanding of how the multifunctionality of the livestock can be improved (Moyo & Swanepoel, 2010). The low productivity of livestock can be attributed to several factors (MAFAWI, 2010). Many social patterns can have their roles in manipulating livestock production system, and household characteristics are supposed to be influencing livestock production and income (A. M. Ibrahim, Shiwei, & Wen, 2013). A general socioeconomic profile of farming households depicts that a large majority of households in the farming communities consists of large compound houses of which a large number is headed by a male and only a tiny fraction by the female. The majority of household heads are illiterate or are less educated (Ahmad, Raza, & Saif, 2015), and the average family size of livestock producers is very large (Elzaki, Alla Ahmed, Elbushra, & Ahmed, 2010).

Mixed farming implies an agricultural system where crop production and livestock raising activities are simultaneously practiced to increase farm income. Small farmers and landless rural households makeup 90% of livestock ownership and are dependent heavily on income from the sale of milk and animals to meet their routine household expenses and nutritional intake. Even in the mixed farming systems, livestock is the primary source of income for rural households and a source of productive employment for the poor and women (Rahman et al., 2008; Reshma, Natikar, Biradar, Mundinamani, & Havaldar, 2014).

The livestock plays a significant role in a consumption-smoothing measure under income and price risk in mixed farming systems of Punjab province of Pakistan (Kurosaki, 1995). Moreover, livestock holding is known to reduce income variability and act as a buffer that saves from abject poverty and miseries of life. A number of studies Akram, Naz, and Ali (2011); Kassa (2014); Urgessa (2015) are there on the determinants of rural household income, but only a few studies Derib (2010); Iiyama (2006) are relating specifically to the determinants of livestock income.

In the rural scenario of Punjab, a large number of farmers are illiterate, small landholders, and resource deficient. These farming communities can gain better income from livestock through proper employment and utilization of their natural, human, and financial resources.

The present article is novel because it focuses on the characteristics of the livestock farming households (in mixed crop-livestock farming system) concerning their livelihood assets utilization status. The prime focus is on the investigation of the role of financial capital in impacting livestock income. Hence, the current study intends to gauge the response of income earned from livestock to the utilization of livelihood assets. However, income earned from livestock could be an outcome of multiple factors like socioeconomic, climatic, physical, financial, and others. But four kinds of livelihood assets—natural assets, human assets, physical assets, and financial assets—are also associated with earned income. So, the present study explicitly undertakes these four livelihood assets as the explanatory factors to investigate the response pattern of income earned from livestock to these assets.

2. MATERIALS AND METHODS

2.1. The Study Area, Sampling, and Data

The present study is based on primary data collected from three regions (northern, central, and southern) of Punjab as Punjab is the most important province of Pakistan in terms of mixed farming. Out of 79.61 million hectares of the total land area of Pakistan, 20.63 million hectares (about 26% of the total) area is of the Punjab province. Moreover, this province occupies 59.3% and 72.0% of the country's cultivated and cropped area. Likewise, Punjab has the colossal livestock holdings' share in the country's total livestock population, including cattle (49%), buffalo (65%), sheep (24%), and goats (37%) (Government of the Punjab, 2014). A multi-stage sampling technique was adopted to collect the data. In the first stage, one district from each of the three regions of Punjab was selected. Secondly, from each district headquarter, four villages were selected. Thirdly, from each village, thirty livestock-keeping households were chosen. Hence, in total, 360 farm households were consulted for the collection of data. A well-structured questionnaire was used as an instrument, whereas face-to-face interviewing was applied as a technique for information gathering. Finally, the information from 347 households was processed and analyzed to generate results.

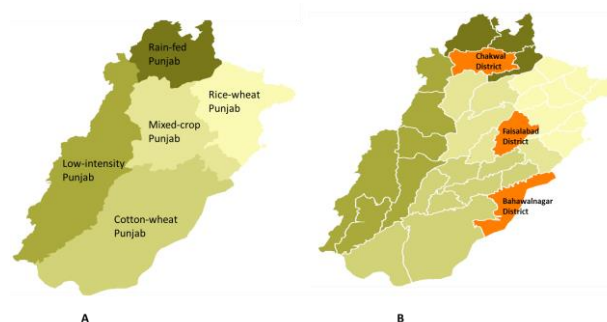


Figure 1: Panel-A representing agro-climatic zones of Punjab and Panel-B presenting selected districts from three zones

2.2. Income as an Outcome of Livelihood Assets

Theoretical analysis of household income reveals that farm

and nonfarm sources have a vital role in rural household economies (Akram et al., 2011). Income (generally expressed in monetary terms) is the consumption and saving opportunity gained by an entity within a specified timeframe (Barr, 2012). For households and individuals, income is the sum of all forms of earnings (i.e., the rents, wages, salaries, interest payments, profits, and other) received in a given period of time (Case & Fair, 2007) and for a firm, gross income can be defined as the sum of all revenue (Barr, 2012). Although income and livelihood are not synonymous, they are however inseparably connected (Schwarze, 2004b), because income "at a given point in time is the most direct and measurable outcome of the livelihood process" (Ellis, 2000). A livelihood includes the capabilities, assets (both material and social resources given in figure 2), and activities required for a means of living (Stewart Carloni & Crowley, 2005).

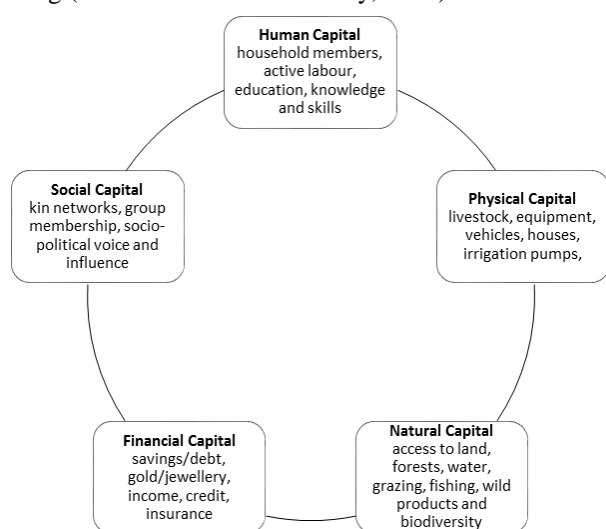


Figure 2: Types of Livelihood Assets (Adopted from Carloni & Crowley, 2005)

The livelihood approach and the assets-activities-incomes approach are the two approaches that have linked income and activities (Schwarze, 2004a). According to Ellis (2000), the assets (natural, physical, human, financial, and social capital), the activities, and the access to these assets together determine the living gained by the individual or household. The livelihood approach emphasizes the role of the household's resources as determinants of activities and highlights the link between assets, activities, and incomes (Schwarze, 2004b).

Another approach developed by Barrett and Reardon (2000) has linked assets, activities, and incomes. Assets correspond to the factors of production, activities to the ex-ante production flows of asset services, and incomes to production outputs.

According to a report Carloni and Crowley (2005), livelihood strategies refer to "the range and combination of activities and choices people make to achieve their livelihood goals." Based on their personal goals, their resource (human, natural, financial, physical, and social)

base, and their understanding of the options available, households develop and pursue different livelihood strategies. Most rural households adopt a combination of farm (crop and livestock), off-farm and non-farm activities in different seasons to earn a living. Levels of food security, income security, health, well-being, asset accumulation, and high status in the community are examples of livelihood outcomes that households achieve through their livelihood strategies (Carloni & Crowley, 2005). Livelihood assets are combined to pursue different livelihood strategies to achieve specific livelihood outcomes such as increased income (Alinovi, D'errico, Mane, & Romano, 2010).

Due to biased expenditure information obtained from livestock keepers, to analyze the determining factors of livestock income, the present study also focused only on the gross annual income from buffalo, cattle, sheep, and goats. The livestock income in this study was confined to income from the sale of animals and animals' milk in monetary terms (Derib, 2010). As depicted in the table, for the present study, annual gross income earned from livestock sources could be viewed as an outcome of using four kinds of assets: natural, human, physical, and financial capitals owned by the herders.

2.3. Econometric Estimation

Amongst the descriptive statistics, mean values and standard deviations were calculated. For inferential statistics, a multiple linear regression equation was estimated to determine the response pattern of livestock income against various factors of production. The following multiple linear regression equation was constructed to analyze the relationship empirically.

$$\begin{aligned}
 ILSTOCK &= f(LSIZE, FEDU, FPTPN, HSIZE, ICROP, INONF, MGTC) \\
 ILSTOCK &= \beta_0 + \beta_1 LSIZE + \beta_2 FEDU + \beta_3 FPTPN \\
 &\quad + \beta_4 HSIZE + \beta_5 ICROP \\
 &\quad + \beta_6 INONF + \beta_7 MGTC + \varepsilon_i
 \end{aligned}$$

Where, β_0 is intercept, β_1 to β_7 are coefficients of explanatory variables and ε_i is error term

The detail of variables is given in Table 1:

3. RESULTS AND DISCUSSION

3.1. Descriptive Statistical Analysis

The results of the descriptive analysis are given in section (A) of Table 2. In the typology of livelihood assets, farmland is classified as natural capital. The study endorsed the findings that the majority of the farmers in Punjab were small farmers. A farmer is classified as a small farmer when the size of his or her own landholding is less than 5 acres. In the mixed farming Punjab, the average size of agricultural land owned by a farmer was 5.34 acres. In the rural context of Punjab, a landless farmer serves as a tenant or as a sharecropper while a small landholder works as a self-cultivator on his own farmland. And farm labor is mainly shared by family members. As

for as a farmer's level of education is concerned, many farmers in Punjab are illiterate or less educated. In the surveyed area of rural Punjab, the average number of schooling years completed by a farmer was 5.59. For a list of seven activities relating to livestock management, a

livestock keeper was performing 1.60 activities on average.

Table 1: Categorization and A Priori Expectation of Explanatory Variables Used

Livelihood Assets	Explanatory Variables	Type of Variable	Evidences from Literature	Expected Sign
Natural Capital	<i>LSIZE</i> : own land size	Continuous	Hassan, Ishaq, Farooq, and Sadozai (2007) for Pakistan;	
Human Capital	<i>FEDU</i> : farmer's level of education	Discrete	De Janvry, Sadoulet, and Zhu (2005) S. Ibrahim (2013) for Sudan; Aikaeli (2010) for Tanzania; Mabe and Oladele (2012) for South Africa;	+
	<i>FPTPN</i> : farmer's level of participation in livestock rearing activities	Discrete	Iiyama (2006) for Kenya S. Ibrahim (2013); Iiyama (2006); Schwarze (2004a)	-
Physical Capital	<i>H SIZE</i> : herd size	Discrete	Derib (2010) for Ethiopia; Ishaq, Farooq, and Farooq (2007); Mabe and Oladele (2012); Schwarze (2004a)	+
	<i>ICROP</i> : the total (gross) annual income derived from crops	Continuous		+
Management	<i>INONF</i> : the total (gross) annual income derived from nonfarm sources	Continuous	S. Ibrahim (2013)	+
	<i>MGTC</i> : no. of managerial constraints	Discrete	Shahid, Abdelfattah, and Taha (2013) for Pakistan	-
Dependent Variable	<i>ILSTOCK</i> : the total (gross) annual income derived from livestock	Continuous	Derib (2010)	

Source: Author's own compilation from previous literature

The physical capital portfolio of a farm household was generally comprised of an inventory of livestock assets kept by that household. At the same time, the financial capital portfolio of a farm household comprised diverse sources of household income from farm and nonfarm sources. A livestock herder can be classified as a small herder when the herd size owned by the herder is less than 4 animal heads (Moaeen-ud-Din & Babar, 2006). In the study area, the average number of animals kept by a herder was more than 5 heads. The average annual incomes earned by the household from crops, animals, and nonfarm sources were respectively 1.200, 0.535, and 0.640 hundred thousand in Pakistani rupees. It means that, on an average basis, a farm household is earning the central part (nearly 50%) of its total annual income from crops and the remaining part from livestock (23%) and nonfarm (27%) sources. The majority of the farmers had more than one managerial constraint regarding livestock farming.

3.2. Inferential Statistical Analysis

For this study, land as a livelihood asset refers to the area or a piece of ground that a farmer owns as property and uses it, particularly for agricultural purposes, to earn income. In the analyses, the farmer's own land size (*LSIZE*) was significant at 10% level of significance and negatively associated with the income earned from

livestock (see Table 2). The value of the coefficient implies that keeping the effect of other variables constant, one unit increase in the acreage of farmland owned by a farmer may lead to the 0.007 units decrease in the income earned through livestock which contradicts with (De Janvry et al., 2005; Hassan et al., 2007). In rural Punjab, the landless or the farmers with less acreage of land assets rely more heavily on livestock farming to earn the more significant share of their total annual farm income.

In the current study, human capital as a livelihood asset comprises two categories. First is the educational level of the farmer (*FEDU*), depicting the qualitative aspect of the human capital involved in livestock farming. For the inclusion of this variable in the model, it was hypothesized that as compared to a farmer with nil or less number schooling years, a farmer with relatively more number schooling years could perform livestock-related tasks more efficiently and so would be able to earn relatively more income from livestock sources as compared to the illiterate and less educated farmers. The variable was found significant (at p -value < 10 %), but the negative sign of the coefficient rejects our pre-analysis proposed hypothesis by stating that a unit increase in the farmer's number of schooling years would bring about 0.011 units to decrease in the income earned from livestock. Such a research

finding could be attributed to the more reliance (for income) of a relatively educated livestock farmer on the nonfarm sources of earning instead of livestock sources. It is evident that after having more schooling years, doing a job in the services or nonfarm sector would be preferred over livestock or crop farming (Aikaeli, 2010; S. Ibrahim, 2013; Iiyama, 2006; Mabe & Oladele, 2012). So, for educated farmers, livelihood opportunities are more

comprehensive, and for them farming would be a secondary source of income, while uneducated or less educated farmers, in general, would be primarily and solely depending upon on-farm sources for earning their livelihoods.

Table 2: Descriptive and Inferential Statistics

Livelihood Assets	(A) Descriptive Statistics Explanatory Variables	Mean (SD)	(B) Multiple Linear Regression	
			B (Std. Error) [t-value]	Collinearity Statistics VIF Values
	Constant		0.125 (0.080) [1.554]	
Natural Capital	<i>L</i> SIZE : own land size	5.3495 (8.0036)	-0.007* (0.004) [-1.697]	1.330
Human Capital	<i>F</i> EDU : farmer's level of education	5.59 (4.620)	-0.011* (0.006) [-1.741]	1.137
	<i>F</i> PTPN : farmer's level of participation in livestock rearing activities	1.60 (1.826)	0.043*** (0.015) [2.797]	1.061
Physical Capital	<i>H</i> SIZE : herd size	5.61 (4.538)	0.019*** (0.006) [2.995]	1.109
Financial Capital	<i>I</i> CROP : the total (gross) annual income derived from crops	1.2003 (2.0342)	0.224*** (0.015) [15.334]	1.211
	<i>I</i> NONF : the total (gross) annual income derived from nonfarm sources	0.6407 (0.8075)	0.116*** (0.036) [3.242]	1.149
Management	<i>M</i> GTC : no. of managerial constraints	1.22 (0.761)	-0.009 ^{NS} (0.038) [-0.237]	1.138
Dependent Variable	<i>I</i> LSTOCK : the total (gross) annual income derived from livestock	0.5353 (0.6809)		
Model Diagnostics				
F-value	42.105***			
R Square	0.465			
Adjusted R Square	0.454			
Std. Error of the Estimate	0.5031			
Durbin Watson	1.594			

Note: Standard Error is written in () parenthesis and t-stats value is written in [] brackets.
*significance at 10% level, **significance at 5% level, and ***significance at 1% level

The second sub-category in human capital is livestock farmer's level of participation (*FPTPN*) in a list of seven livestock farming-related activities. This attribute of human capital was included to investigate to which extent and on which pattern the human labor contributed by a livestock farmer translates into livestock income as we can see from Table 2, this aspect of human capital was also found highly significant (at p-value < 1%). A positive sign of the coefficient states that a unit increase in the farmer's participation in livestock rearing activities would raise the income earned from livestock by 0.043 units. This finding could be associated with the fact that in the rural context of Punjab, most farmers are illiterate, resource poor, have limited livelihood options, and have small landholdings. Hence, by self-employing and using family labor in livestock or crop farming, they heavily rely on income

earned from livestock or crop. In this way, maximum efforts are put by the small and resource deficient farmers to capitalize the limited available labor resources into farm income.

Our findings regarding qualitative and quantitative aspects of human capital are in line with findings of the study conducted in Sudan by (S. Ibrahim, 2013), which concluded that more educated farmers were earning less income from livestock farming as compared to the illiterate and less educated farmers. And in addition to this, the households with more available family laborers were earning more income from livestock and vice versa.

Physical capital, that is, herd size (*H*SIZE), was positively associated with the livestock income. The variable's coefficient was highly significant at a 1% level of

significance, stating that a unit increase in the number of livestock animals would raise a farmer's income earned from livestock by 0.019 units. Having a large herd size implies more income-generating livestock farming enterprises by generating more livestock products. More revenue earned through keeping large herd size may also be attributed to the economies of scale in livestock farming (Derib, 2010; Ishaq et al., 2007). Also, in the livestock producing communities of North-West Province of South Africa, herd size (number of cattle) was found to be having a highly significant and positive impact on the livestock income (Mabe, Antwi, & Oladele, 2010).

For financial capital, the income earned from livestock responded positively to each of the income earned from crop farming (*ICROP*) and the income earned from nonfarm sources (*INONF*). The coefficients of the variables were highly significant (p -value < 1%). Positive signs of both of the coefficient's state that a unit increase in the farmer's annual income earned from crops and a unit increase in the farmer's annual income earned from nonfarm sources would raise the income earned from livestock by 0.224 units and 0.116 units, respectively. These findings could be interpreted in how the revenue-generating ability of livestock farming could be supplemented through crop farming and earnings from nonfarm sources. Income earned from crops and nonfarm enterprises may broaden a farmer's financial base, hence enabling him to bear the expenditures regarding the proper nutrition, health, breeding, and overall management requirements of livestock. That ultimately turns into an increase in the annual income earned from livestock enterprise. In a study A. M. Ibrahim et al. (2013) conducted in Sudan, it was found that compared to those farmers who had no earnings from off-farm sources, the farmers also earned income from off-farm sources were getting more income from livestock farming.

Entrepreneurial abilities or management is the act or art of running and controlling a business or a similar type of organization. In our study, this factor entails the number of reported managerial constraints faced by a farmer while keeping livestock. This variable did not show significance with the dependent variable.

This is cross sectional study, so there is important to check multicollinearity among the exogenous indicators. VIF values have confirmed that there does not exits the problem of multicollinearity. At the end of Table 2, the diagnostics, R-square value indicates proportion or percentage of the total variation in the dependent variable explained jointly by all the explanatory variables included in the regression model. Its value is almost 46%, so the variation in the annual income earned through livestock farming is brought about by the variables (regressors) used in the regression model. The adjusted R-square value is quite good. F-value indicates the overall significance of the model. And lastly, the Durbin-Watson value is quite significant. Hence, overall the model is a good fit.

4. Conclusion

In developing economies, the income-generating ability of livestock enterprise could be raised through optimal utilization of available resources and by enhancing livestock herders' skills in livestock production and management. The current study is just a farm or household level analysis regarding the response pattern of income earned from livestock to the livelihood assets available at the farm level to the herders. The livestock sector's profitability could be raised by identifying the contributing factors at micro and macro levels. The enhanced productivity of this sector would directly contribute to poverty alleviation, national food security, improved health and nutrition, risk minimization in agriculture, socioeconomic uplift of the farming communities, and overall economic growth.

The study proposes that the illiterate and resource-deficient livestock herders of mixed farming Punjab can earn more income from livestock through proper employment and utilization of their natural, human, physical, and financial capitals. The study also suggests that through livelihood diversification, the income generating ability of a livestock farmer could be raised. Income earned from crops and nonfarm sources may enable a livestock herder to increment the annual income earned from livestock enterprise.

The study has exhibited the one-sided relationship among income earned through livestock-, through crop-, and non-farming in the rural milieu of Punjab. It further invites an investigation into the existence of complementarity, trade-offs, and synergistic relationships among livestock-, crop-, and non-farming in detail. Further sustainable agriculture and livestock development government and regulatory authorities need to expand and improve the livestock production industry.

Conflict of Interest: The authors declare that there is no conflict of interest regarding the publication of this article.

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