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Research Paper

Pig Farming in East Khasi Hills District of Meghalaya: An Analysis of Resource Use Efficiency

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ABSTRACT

An investigation on the resource use efficiency of pig farming was carried out in the Mylliem and Mawphlang blocks of the East Khasi Hills district of Meghalaya. A multistage purposive and random sampling procedure was used for the study. Primary data were collected from a sample of 66 pig farmers. Analysis of resource use efficiency has shown that the sum of elasticities of production is 33.79, which indicated an increasing return to scale operating in the pig farms under study. Among the various resources selected for the study price of piglet and concentrated feed were found to be significant for returns per pig, and other factors of production like fodder, total human labor, veterinary aid, and medicine were found to be insignificant. Resource use efficiency ratio (r) for piglet price and concentrated feed was greater unity showing that these resources were underutilized and increment in their usage would lead to maximization of profit. The results revealed further scope to invest in quality breed piglets and feed to enhance the pig farmers' profit in the state.

Highlights

- The efficiency of the various resource used in pig farming in East Khasi Hills district of Meghalaya was studied.
- The resources selected for the study were found to explain 85 percent of the total variation in the returns per pig.
- One percent increase in the price of piglet and concentrated feed may lead to an increase of 0.014 and 0.025 percent increase in the returns per pig of the pig farmers.
- The study showed the need to set up improved pig breeding and fattening units.

Keywords: Resource, efficiency, elasticities, maximization, Meghalaya

Agriculture plays an indispensable role in the global economy. Its role in ensuring food security, employment generation, poverty alleviation, and conservation of natural resources is irreplaceable (FAO, 2009). In India, approximately 60 percent of the rural households are directly or indirectly dependent on agriculture as the primary source of livelihood (Census, 2011). Livestock holds a significant position in the global and Indian economy as a major supplier of protein and complimenting crop productivity. India holds one of the world's largest livestock sectors, with 11.6 percent of the total livestock population of the world (GoI, 2019b). The contribution of the livestock sector towards the GVA of the country is 5.11 percent during 2018-19 (GoI, 2019a). In 2014-15 total pork production of the country was 464.11 thousand MT

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(metric ton), and the per capita availability was only 4.94 Kg per year (GoI, 2017).

Piggery is one of the most important livestock globally because of its potential in providing a low investment demanding enterprise with quick and high returns. According to the 20th Livestock census of India, 1.7 percent of the country's total livestock population was comprised of pigs estimated to be around 9.06 million. The total pigs in the country were constituted by 2.33 percent exotic, 21.5 percent crossbred, 73.11 percent nondescript, and the rest indigenous (GoI, 2013). There are mainly six breeds of exotic pigs, six breeds of crossbred pigs,, and five indigenous pigs being reared in India. The indigenous pig species include *Ghoongroo, Niang Megha, Agonda Goan, Tenyi Vo, Nicobari,* and *Doom*. The exotic pig species include *Landrace, Yorkshire, Hamsphire, Saddleback, Australian Large Black,* and *Duroc*.

Meghalaya has the third-highest population of pigs in the country. In 2019 total pig population in Meghalaya was 7,06,364, and total pork production was 14.93 thousand MT (GoM, 2019b). The major pig breeds reared in Meghalaya are crossbreds of *Hampshire, Saddle Black, White Yorkshire,* and indigenous breeds like *Niang Megha* and *Ghangroo*. Around 63.85 percent of the households of Meghalaya are involved in pig rearing (GoM, 2019a). Pork contributes 11.25 percent of the meat being consumed in Meghalaya (GoM, 2020). The demand for pork in Meghalaya is higher and increasing rapidly than the existing production capacity of the state. Inadequate infrastructure, shortage of inputs, lack of capital, unorganized marketing sector *etc*., were the major hurdles to the state attaining higher production potential. A large share of the piglets for rearing and concentrated feed was brought in from other states. Hence, they are scarce and costly inputs. The number of pig breeding farms selling quality piglets to the farmers was also significantly less, increasing the state's dependence on external sources for inputs. The readily available inputs included fodder feed and farm labor.

The Cobb-Douglas production function analysis indicated that the quantity of pork produced and labor in man-days feed quantity, and cost of drugs and other veterinary expenses had a positive and significant association with the gross output. Whereas experience in years and establishment level were insignificant (Ougunniyi and Omoteso, 2017). Pigpen structure, labor, feeding cost, and stocking density were found to show a positive and significant relationship with the production output through the Cobb-Douglas production function analysis (Tuan *et al.* 2020).

The results of the Cobb-Douglas production function showed that the coefficients of the piglets breed type, rearing experience, household size, education status, flock size, cost of medication correlated positively and significant with the profitability of the pig farm. The coefficient of age of household head, cost of feed, cost of labor, had a negative and significant relationship with the farm's profitability. Cost of capital and cost of water were found to be insignificant in its effect on profitability of farm (Ume *et al.* 2020). The values of results obtained from Cobb-Douglas production function showed that concentrate feed and veterinary expenses had a positive and significant association with milk production by both crossbred cows and local cows. The regression coefficient of the explanatory variable green fodder (0.67) was statistically significant only for a local. In contrast, the response to dry fodder was estimated to be positive and statistically significant only in the case of crossbred cows (Lalrinsangpuii *et al*. 2016).

The value of coefficients of multiple determination (R^2) showed that the explanatory variables selected in the model were responsible for 85 percent and 91 percent of the variation in milk production in the case of cows and buffaloes, respectively. The magnitude of regression coefficients of green fodder, dry fodder, and veterinary expenses was estimated to be positive and significant. In contrast, the same of human labor was identified as positive and significant only in the case of buffaloes (Mehra *et al.* 2018).

Reviewing the significance of the piggery sector and understanding of the efficiency of various input resources used in the rearing of pigs is necessary for effective allocation of resources to maximize the yield of pork and thereby maximize the returns to the pig farmers. Therefore, a study was conducted in the East Khasi Hills district of Meghalaya on resource use efficiency in rearing pigs for pork production to study the efficiency of various resources used in pig farming.

METHODS

Sampling technique

The present study was conducted in the East Khasi Hills district of Meghalaya, as the district had the highest pig population and pork production in the state in 2019 (GoM, 2019b). Out of the eleven blocks of East Khasi Hills district two blocks, namely; Mylliem and Mawphlang, were selected purposively as these blocks held the highest number of pigs in the district. Further, two villages *viz*, Mawpynthih and Mawbynna from the block of Mylliem and two more villages *viz.*, Laitjem and Sadew from the block of Mawphlang were selected. A list of pig rearers in each of the selected villages was prepared. A sample of 66 pig owners was drawn through a proportionate technique. Primary household data were collected on well-structured interview schedule through the personal interview method. The interview schedule consisted of the number of a pig reared by the households, the quantity of feed and fodder, medicine, human labor in physical terms, and monetary terms.

Analytical tools

Primary data regarding the different costs involved in rearing pigs for meat purposes and returns was collected from the respondent pig farmers through personal interviews using pretested interview schedule for the year 2020-21. It was analyzed, and estimated using appropriate statistical tools.

Cobb-Douglas production function

Cobb-Douglas production function was applied to analyze the efficiency of key independent variables on the output, *i.e.,* gross return available from the sale of pigs to the pig farmers. Among the different production functions, the double log form of the Cobb-Douglas production function proved to be the superior fit in the data. Therefore, it was adopted for the estimation.

The mathematical form of Cobb-Douglas production function is given below:

$$Y = AX_1^{b1}.X_2^{b2}.X_3^{b3}.X_4^{b4}.X_5^{b5}.e^u$$

Cobb-Douglas production function can be transformed into logarithmic form by taking logs on both sides and was used for estimation of the parameters of the function based on the collected sample data.

$$Log\ Y = log\ A + b_1\ log\ X_1 + b_2\ log\ X_2 + b_3\ log\ X_3 + b_4\ log\ X_4 \ldots\ldots \mu\ log\ e$$

Where,

Y = Net return per pig (₹), X_1 = Price of piglet (₹), X_2 = Concentrate feed (₹), X_3 = Fodder (₹), X_4= Total human labour (₹), X_5= Veterinary aid and medicine (₹), A = Constant (intercept), e^u = Error and b_1, b_2, b_3, and b_4 production elasticities of the respective input variables.

Resource use efficiency

The following formula calculated the resources-use efficiency (r) of independent variables:

$$r = \frac{MVP}{MIC}$$

Where $MVP_i = b_i \frac{\underline{Y}}{\underline{X}}$

MVP_i = Marginal value product of I^{th} input, b_i = Production elasticity with respect to X_i, $\underline{Y}$ = Geometric mean of the dependent variable Y, $\underline{X}$ = Geometric mean of the independent variable, MIC_{Xi} = P_{Xi}, MIC_{Xi} = Marginal input cost of i^{th} input, P_{Xi} = Unit price of i^{th} input

The decision rule for determining resource use efficiency as per (Mehra *et al.* 2018):

r > 1 underutilization of resources

r = 1 optimal use of resources

r < 1 over use of resources

RESULTS AND DISCUSSION

The results obtained from the present study and the related discussions are depicted under the following subheads:

Cost and returns incurred in pig farming for pork production

The different average costs involved in pig farming were calculated using standard techniques and listed in Table 1. The different costs incurred by the pig rearers include the price of piglet of ₹ 3200,

₹ 3217.21 per pig for concentrated feed, ₹ 562.58 for fodder, ₹ 476.06 for veterinary aid and medicine, and ₹ 3237.27 for human labor. The cost of human labor contributed the highest share to the total cost (30.27%) followed by concentrate feed (30.09%) and price of piglet (29.93%). The total cost incurred by the pig rearers was found to be of ₹ 10693.12 per pig. The average meat yield per pig was found to be 47.73Kg. Total returns available to the pig farmers was observed to be of ₹ 18137.40 per pig. Net return earned by the pig rearers was estimated to be of ₹ 7444.28 per pig.

Table 1: Average cost and returns incurred for pork production (In ₹/pig)

Particulars	Costs	Percentage share in total cost
Price of piglet	3200	29.93
Concentrate feed	3217.21	30.09
Fodder	562.58	5.26
Total human labour	3237.27	30.27
Veterinary aid and medicine	476.06	4.45
Total Cost	**10693.12**	**100.00**
Yield per pig (Kg)	47.73	
Returns (₹380/Kg of pork)	18137.40	
Net Return	7444.28	

Source: *Primary data.*

Resource use efficiency in pig farming for pork production

The value of the coefficient of determination (R^2) of the fitted function was estimated to be 0.78. The value indicated that 78 percent of the total variation in the returns per pig (dependant variable) was caused by the explanatory variables incorporated in the model and the remaining variation was caused by variables not taken into consideration. The sum of elasticities of production was found to be 33.79, which indicated an increasing return to scale operating in the pig farms under study.

It is evident from Table 2 that the price of the piglet was significantly related to the dependent variable at a 1 percent level of significance. Concurrently, the explanatory variable concentrate feed was also associated with associated with the dependent variable significantly at 1 percent level of significance. The rest of the explanatory variables included in the model, such as Fodder, Veterinary aid and medicine, and Total human labor was identified to have no significant association with the returns per pig.

The value of the coefficient of regression for the explanatory variable price of piglet was estimated to be 4.37, which indicates that a change of 1 percent in the price of piglet would lead to a change of 4.37 percent in the returns per pig of the pig farmer. The pig farmers in the region were facing a shortage in quality piglets, so higher investment for better quality piglet breeds could increase the profitability of the pig farmers. The regression coefficient on concentrated feed was estimated to be 8.69, which shows that an increase of 1 percent in the concentrate feed cost would lead to an increase of 8.69 percent increase in the returns per pig of the pig farmer, and similar results were shown by Tuan *et al.* in 2020. The farmers were found to use less than the recommended quantity of concentrated feed for pigs, so purchasing more feed can drastically increase the returns of the pig farmers.

Table 2: Estimated production function of pig farming for pork production

Independent Variables	Coefficients	Standard error	p-value
Intercept	-38210.38	5035.02	0.00
Price of piglet	4.37*	1.58	0.00
Concentrate feed	8.69*	1.84	0.00
Fodder	8.44	8.19	0.30
Veterinary aid and medicine	14.98	10.04	0.14
Total human labour	-2.69	1.91	0.16

***Indicates p<0.05 and *indicates p<0.01, respectively.*

Table 3: Efficiency of resources used in pig farming for pork production

Independent Variables	Co-efficients	Marginal value product	Marginal input cost	Efficiency ratio
Price of piglet	4.37	3349.00	3200.00	1.04
Concentrate feed	8.69	6528.91	3271.21	1.99
Fodder	—	—	—	—
Veterinary aid and medicine	—	—	—	—
Total human labour				

From the results of resource use efficiency estimation shown in Table 3, it can be observed that efficiency ratio (r) value for piglet price and concentrated feed was greater unity showing that these resources were underutilized and increment in their usage would lead to maximization of profit.

CONCLUSION

Pig farming holds an important position among the animals reared for meat in Meghalaya, as it is highly integrated into the social and cultural values of the community. Pig farming provides additional income and resilience to the farmers as well as help in recycling farm and food waste. Realizing the sectorector's significance in the region, this study was conducted in the East Khasi Hills district of Meghalaya by adopting a multistage sampling technique with proportionate random sampling. The sample respondents included 66 pig farmers from Mylliem and Mawphlang Block of East Khasi Hills district. The analysis showed that among the various explanatory variables selected for the study, the price of piglet and concentrated feedwas significantly associated with returns per pig, and the return to scale was estimated to be increasing. It was observed that a 1 percent increase in the price of piglet and concentrated feed might lead to an increase of 4.37 and 8.69 percent increase in the returns per pig of the pig farmers. It was also observed that resource use efficiency ratio (r) for piglet price and concentrated feed was greater unity showing that these resources were underutilized and increment in their usage would lead to maximization of profit.

There is still a shortage in advanced breeding farms, and availability of good quality piglets in the region, and the availability of these resources can significantly improve the earnings of the pig farmer. Higher investment in the concentrate feed for the pig farm was also identified to be a critical factor towards higher earnings of the pig farmers.

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REFERENCES

Census, 2011. Office of the Registrar General and Census Commissioner. Ministry of Home Affairs, Government of India, New Delhi. (Available from: https://censusindia.gov .in/2011-common/censusdata2011.html accessed on 8th January 2021).

FAO. 2009. Livestock, food security and poverty reduction, The state of food and agriculture. Statistical database of Food and Agriculture Organization of the United Nations, Rome. (Available from: http://www.fao.org/3/i0680e/i0680e.pdf accessed on 8th January 2021).

GoI. 2013. Breed Survey. Ministry of Fisheries, Animal Husbandry and Dairying, Govt. of India (Available from: http://www.dof.gov.in/sites/default/files/2019-12/BreedingSur veyBookCorrected.pdf accessed on 10th February, 2021).

GoI. 2017. National Action Plan Pig 2022. Ministry of Fisheries, Animal Husbandry and Dairying, Govt. of India (Available from: http://dahd.nic.in/sites/default/filess/NAPon Pig.pdf accessed on 8th January, 2021).

GoI. 2019a. 20th Livestock Census. Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, New Delhi. (Available from: http://dahd.gov.in/sites/default /filess/20thLivestockcensus-2019All IndiaReport_0.pdf accessed on 8th January 2021).

GoI. 2019b. National Accounts Statistics. Ministry of Statistics and Programme Implementation, Government of India, New Delhi. (Available from: http://mospi.nic.in/publication/national-accounts-statistics-2019 accessed on 8th January 2021).

GoM. 2019a. Statistical handbook Meghalaya. Directorate of Economics and Statistics, Government of Meghalaya, Shillong. (Available from: https://meghealth.gov.in/statistics/Handbook_2019.pdf accessed on 8th January, 2021).

GoM. 2019b. Report on integrated sample survey for estimation of production milk, egg and meat year 2019-20. Directorate of Animal Husbandry and Veterinary, Government of Meghalaya, Shillong. (Available from: http://megahvt.gov.in/iss_reports/ISS_Report_ 2018-19.pdf accessed on 8th January 2021).

GoM. 2020. Piggery Mission. Cooperation Department, Government of Meghalaya, Shillong. (Available from: https://megcooperation.gov.in/piggerymission/Piggery_Mission_1.pdf accessed on 10th January 2020).

Lalrinsangpuii, Malhotra, R. and Priscilla, L. 2016. Economics of Milk Production and its Constraints in Mizoram. *Indian J. Dairy Sci.*, **69**(5): 588-595.

Mehra, K., Singh, V. and Nazir, H. 2018. Resource Use Efficiency in Milk Production and Milk Utilization Pattern of Milk Producers in Hilly Areas of Kumaon Region of Uttarakhand. *Int. J. Pure App. Biosci.*, **6**(4): 736-743.

Ogunniyi, L.T. and Omoteso, O.A. 2011. Economic Analysis of Swine Production in Nigeria: A Case Study of Ibadan Zone of Oyo State. *Int. J. Hum. Ecol.*, **35**(2): 137-142.

Tuan, T., Yin, T., Cuong, T., Tiep, N. and Konig, S. 2020. Production Efficiency Analysis of Indigenous Pig Production in Northwest Vietnam. *Vietnam J. Agric. Sci.*, **3**(4): 882-891.

Ume, S.I., Onwujiariri, E.B. and Nnadozie, A.K.O. 2020. Pig Farmers' Socio-economic Characteristics as Determinant to Pig Production and Profitability in the Tropics. *Int. J. Inf. Res. Rev.*, **7**(4): 394-405.