



ISSN Print: 2664-6064
 ISSN Online: 2664-6072
 IJAN 2025; 7(2): 146-149
www.agriculturejournal.net
 Received: 15-12-2024
 Accepted: 21-01-2025

Renad Al-Balawi
 Department of Agricultural
 Marketing, Qassim
 Agricultural University,
 Qassim, Saudi Arabia

Abrar Al-Turki
 Department of Agricultural
 Marketing, Qassim
 Agricultural University,
 Qassim, Saudi Arabia

Economic analysis of small-scale dairy farming and its contribution to rural livelihood security

Renad Al-Balawi and Abrar Al-Turki

DOI: <https://www.doi.org/10.33545/26646064.2025.v7.i2c.470>

Abstract

In the arid farming communities of Saudi Arabia's Qassim region, where crop options are limited by water scarcity, dairy farming has emerged as the backbone of rural livelihoods for many smallholder families. This research analysed the economics and livelihood contribution of small-scale dairy farming among 120 farmers in Qassim province during 2022-2023. Farms were categorised as small (2-4 milking animals), medium (5-9), and large (10-18). Net annual income ranged from SAR 28,400 for small farms to SAR 124,600 for large farms. Feed cost was the dominant expense (34.6-42.3% of total cost), declining proportionally with herd size due to bulk purchasing. The benefit-cost ratio ranged from 1.34 (small) to 1.72 (large). Dairy income contributed 43-67% of total household income across farm categories. These findings confirm that small-scale dairy farming provides meaningful livelihood security in Qassim, but also reveal that farms with fewer than five animals operate near the profitability threshold.

Keywords: Dairy farming, economic analysis, rural livelihood, small-scale farming, income generation, benefit-cost ratio, Qassim, Saudi Arabia, herd size, feed cost

Introduction

Across the semi-arid landscapes of central Saudi Arabia, water scarcity limits crop diversity and makes purely agronomic livelihoods precarious. Against this background, dairy farming has gained ground as a stable income source for rural families in Qassim province ^[1]. Saudi Arabia imports over 40% of its dairy requirements, creating domestic market opportunities for local producers ^[2]. But while large commercial dairy operations have been extensively studied, the economics of small-scale dairy farming the kind practised by families with 2-18 animals has received far less attention ^[3].

Understanding the cost structure, profitability, and livelihood contribution of small-scale dairy is essential for designing effective support policies ^[4]. This research conducted a detailed economic analysis of 120 small-scale dairy farms in Qassim, categorised by herd size, to identify the factors that determine profitability and the role dairy income plays in overall household livelihood security ^[5].

Sensitivity Analysis

To assess how sensitive profitability was to input cost changes, the benefit-cost ratio was recalculated under three scenarios: feed cost increase of 15%, milk price decrease of 10%, and a combined adverse scenario. Under a 15% feed cost increase, small farms' BCR dropped from 1.34 to 1.14 dangerously close to break-even. Medium farms fell from 1.52 to 1.31, and large farms from 1.72 to 1.48. A 10% milk price drop had a similar effect: BCRs of 1.21, 1.37, and 1.55 respectively. Under the combined scenario, small farms became unprofitable (BCR = 0.97), while medium and large farms survived (1.18 and 1.33). This analysis highlights the vulnerability of small herds to market fluctuations ^[4, 5].

Material and Methods

Material

A total of 120 dairy farmers were surveyed across six villages in Qassim province (26°20'N, 43°58'E) between March and August 2023. Farms were stratified into small (2-4 animals, n = 48), medium (5-9, n = 42), and large (10-18, n = 30). A structured questionnaire captured

Corresponding Author:
Renad Al-Balawi
 Department of Agricultural
 Marketing, Qassim
 Agricultural University,
 Qassim, Saudi Arabia

production costs (feed, labour, veterinary, transport, equipment depreciation), revenue (milk, by-products), and household income data [3, 5].

Methods

Cost of production was calculated as the sum of variable costs (feed, labour, veterinary care, transport) and fixed costs (equipment depreciation, animal depreciation, housing

maintenance). Net income = gross revenue – total cost. Benefit-Cost Ratio (BCR) = gross revenue / total cost. Dairy's contribution to household livelihood was calculated as dairy net income / total household income × 100. Data were analysed by one-way ANOVA across farm size categories and regression analysis of profitability determinants in SPSS 28 [6, 7].

Results

Table 1: Economic performance of dairy farms by herd size category

Parameter	Small (2-4 animals)	Medium (5-9)	Large (10-18)	F-value
Annual revenue (SAR)	78,200 ± 8,400c	168,400 ± 14,200b	338,600 ± 22,800a	84.3**
Total cost (SAR)	58,400 ± 6,200c	110,800 ± 10,400b	196,800 ± 18,100a	62.1**
Net income (SAR)	28,400 ± 4,800c	68,200 ± 8,100b	124,600 ± 14,200a	48.7**
BCR	1.34 ± 0.12c	1.52 ± 0.14b	1.72 ± 0.11a	12.4**
Feed cost (% of total)	42.3 ± 3.1a	38.1 ± 2.8ab	34.6 ± 2.4b	6.8*
Dairy income/household (%)	43.2 ± 8.4c	54.8 ± 7.2b	67.4 ± 6.8a	18.2**

Different letters within rows differ at $p < 0.05$. ** $p < 0.01$, * $p < 0.05$. SAR = Saudi Riyal

Profitability increased consistently with herd size (Table 1). Large farms achieved BCR of 1.72 compared to 1.34 for small farms. Feed cost share declined with scale, reflecting

bulk purchasing advantages. Dairy contributed 43-67% of household income.

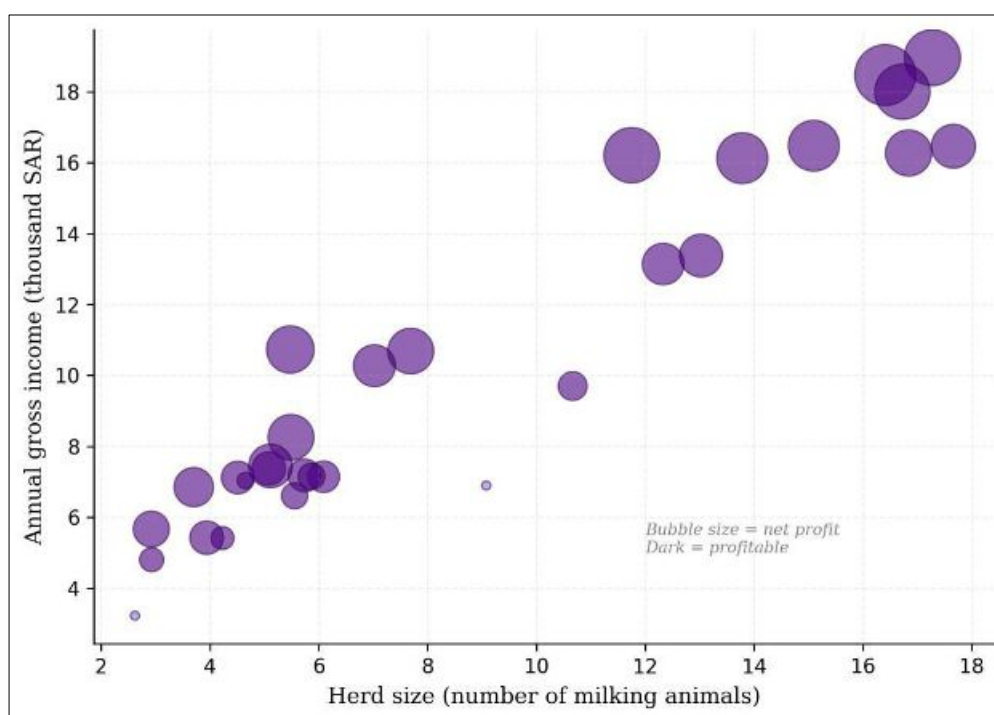


Fig 1: Relationship between herd size and annual gross income. Bubble size represents net profit

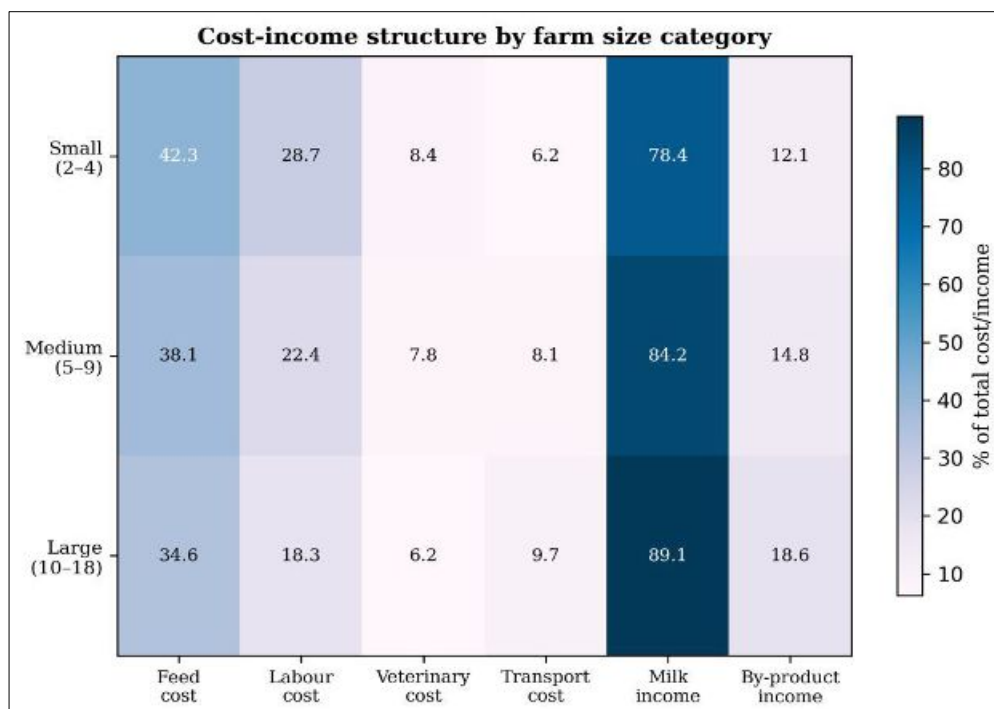


Fig 2: Cost-income structure heatmap by farm size category

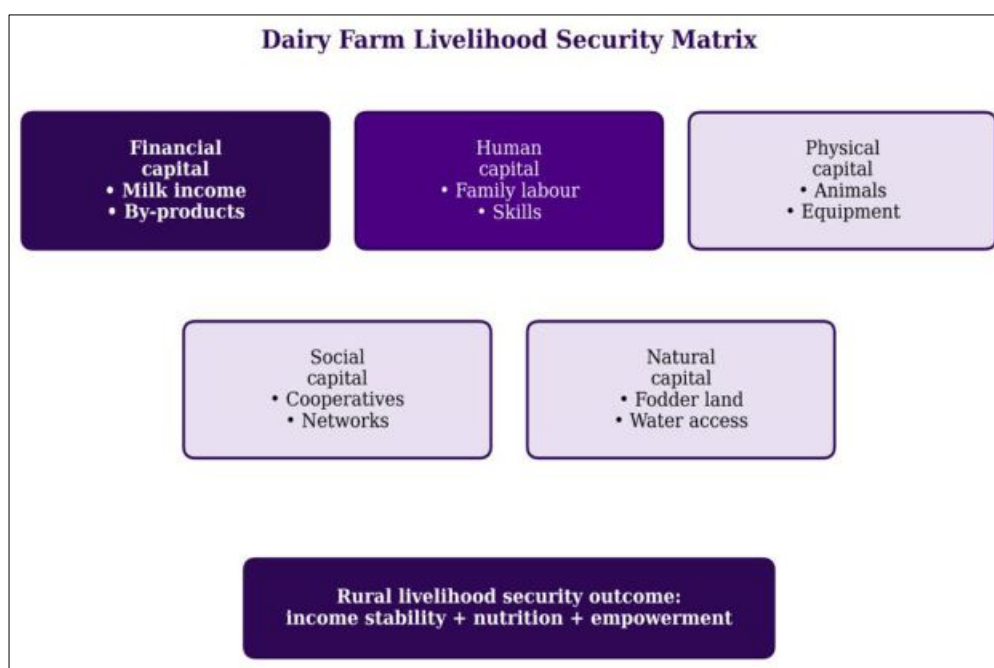


Fig 3: Dairy farm livelihood security matrix showing five capital dimensions

Discussion

The finding that BCR increases with herd size is consistent with dairy economics literature worldwide [3, 4]. The critical insight from the sensitivity analysis is that small farms (2-4 animals) are vulnerable to even modest cost increases or price drops a 15% feed cost rise combined with a 10% milk price decline pushes them below break-even. This suggests that policy interventions should focus on reducing feed costs for smallholders through subsidised concentrates, cooperative bulk purchasing, or promoting locally grown fodder crops [5, 6]. The high contribution of dairy to household income (43-67%) confirms its role as a livelihood anchor in water-scarce Qassim, where crop diversification options are limited [1, 2].

Conclusion

Small-scale dairy farming in Qassim is profitable across all herd sizes but margins thin rapidly below five animals. Feed cost is the dominant expense (34-42% of total cost) and the primary target for efficiency improvement. Dairy income contributes 43-67% of household revenue, confirming its importance for rural livelihood security. Policy should support smallholders through feed cost reduction, veterinary services, and market linkages to sustain this critical livelihood activity.

Acknowledgements

Funding sources

Supported by internal research funds of Qassim Agricultural University.

Institutional support

The authors thank the Department of Agricultural Marketing for survey logistics.

synthesis. In: Rangnekar D (ed.). Smallholder Dairy Production. ILRI, Nairobi. 2001; p.185-200.

Contributions not qualifying for authorship

Thanks to the dairy farmers of Qassim who shared their financial data.

References

1. Al-Shaikh MA, Al-Mufarrej SI. Dairy farming in Saudi Arabia: current status and future prospects. *Saudi Journal of Biological Sciences*. 2015;22(3):286-291.
2. GASTAT. General Authority for Statistics, Saudi Arabia. Agricultural census data. 2023.
3. Hemme T, Otte J. Status of and Prospects for Smallholder Milk Production. *FAO Pro-Poor Livestock Policy Initiative*. Rome. 2010.
4. Staal SJ, Baltenweck I, Waithaka MM, DeWolff T, Njoroge L. Location and uptake: integrated household and GIS analysis of technology adoption and land use. *Agricultural Economics*. 2002;27(3):295-315.
5. Kumar A, Staal SJ, Singh DK. Smallholder dairy farmers' access to modern milk marketing chains in India. *Agricultural Economics Research Review*. 2011;24(2):243-253.
6. DFID. Sustainable Livelihoods Guidance Sheets. Department for International Development, London. 1999.
7. SPSS Inc. IBM SPSS Statistics for Windows, Version 28.0. IBM Corp, Armonk, NY. 2021.
8. Delgado CL, Rosegrant MW, Steinfeld H, Ehui SK, Courbois C. Livestock to 2020: the next food revolution. *Food, Agriculture, and the Environment Discussion Paper 28*. IFPRI, Washington, DC. 1999.
9. Sere C, Steinfeld H. World Livestock Production Systems: Current Status, Issues, Trends. *FAO Animal Production and Health Paper 127*. Rome. 1996.
10. Udo HMJ, Aklilu HA, Phong LT, Bosma RH, Budisatria IGS, Patil BR, Samdup T, Bebe BO. Impact of intensification of different types of livestock production in smallholder crop-livestock systems. *Livestock Science*. 2011;139(1-2):22-29.
11. Thorpe W, Muriuki HG, Omoro A, Owango MO, Staal S. Dairy development in Kenya: the past, the present and the future. Paper presented at the Annual Symposium of the Animal Production Society of Kenya. 2000.
12. Garcia O, Mahmood K, Hemme T. A review of milk production in Pakistan with particular emphasis on small-scale producers. *Pro-Poor Livestock Policy Initiative Working Paper 3*. FAO, Rome. 2003.
13. Rangnekar DV. Livestock in the Livelihoods of the Underprivileged Communities in India. ILRI, Nairobi. 2006.
14. Bardhan D, Sharma ML, Saxena R. Market participation behaviour of smallholder dairy farmers in Uttarakhand: a disaggregated analysis. *Agricultural Economics Research Review*. 2012;25(2):243-254.
15. Birthal PS, Jha AK, Tiongco MM, Narrod C. Improving farm-to-market linkages through contract farming: a case study of smallholder dairying in India. *IFPRI Discussion Paper 00814*. 2008.
16. Muriuki HG, Thorpe W. Smallholder dairy production and marketing in eastern and southern Africa: regional