

Strengthening Women's Livestock Cooperatives in Nepal with an Innovative Technology Bundle

Matt Brooks¹ Travis Lybbert¹ Nick Magnan² Conner Mullaly³
Bhola Shrestha⁴

¹University of California, Davis

²Colorado State University

³University of Florida

⁴Heifer International

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- 75%+ of the world's poor live in rural areas (World Bank, 2024)
- Livestock offer a rare opportunity to earn cash, but producers face two constraints:

Constraint 1 — Market access

Sales to meat producers are hard to coordinate — diffuse networks and buyer–seller information asymmetries.

Constraint 2 — Animal health

Veterinary care is scarce — too few knowledgeable animal health workers.

- 2x2 RCT with 93 cooperatives (71,000+ members) in rural Nepal
- Two apps to relax two constraints:

1. dCM — digital Collective Marketing (an app ecosystem)

Reduces *information frictions* in the market for goats raised by farmers in rural cooperatives and sold to urban meat producers.

2. dMCE — digital Mentoring & Continuing Education (a mobile app)

Improves the *knowledge and skills* of community animal health workers who care for the goats of farmers in these cooperatives.

- 1 Does the **dCM** improve market access?
- 2 Does the **dMCE** improve goat health?
- 3 Does the **dMCE** boost animal health worker businesses?
- 4 Does **bundling** have additional effects?

Table: Goat farmers: effects of dCM and dMCE (year 2)

	dCM		dMCE		dCM × dMCE		Control mean	N
Outcome / index	$\hat{\beta}$	95% CI	$\hat{\beta}$	95% CI	$\hat{\beta}$	95% CI		
<i>Panel 1: Goat production</i>								
Raises goats (1/0)	0.03	[-0.03, 0.10]	-0.03	[-0.09, 0.03]	0.04	[-0.08, 0.15]	0.75	2,601
Herd size	0.96*	[0.12, 1.80] [†]	-0.25	[-1.04, 0.53]	0.54	[-1.08, 2.16]	5.20	2,601
<i>Panel 3: Goat sales</i>								
Asked inventory (1/0) ^a	0.03	[-0.02, 0.08]	-0.04	[-0.09, 0.01]	-0.00	[-0.11, 0.11]	0.15	2,601
Ever sold, coop (1/0)	0.07*	[0.02, 0.12] [†]	-0.01	[-0.06, 0.04]	-0.03	[-0.12, 0.06]	0.23	2,429
Goats sold, coop	0.14*	[0.03, 0.25] [†]	-0.03	[-0.13, 0.08]	-0.04	[-0.26, 0.18]	0.22	2,429
Goats sold, non-coop	-0.06	[-0.15, 0.03]	-0.04	[-0.13, 0.05]	0.04	[-0.13, 0.21]	0.38	2,429
Revenue, coop	2.22*	[0.33, 4.10] [†]	-0.42	[-2.31, 1.47]	-0.60	[-4.42, 3.22]	4.02	2,424
Revenue, non-coop	-1.20	[-2.73, 0.33]	-0.36	[-1.92, 1.20]	0.15	[-2.71, 3.01]	6.21	2,426

Notes: Panel 2 (Goat health) and Panel 4 (Coop engagement) are omitted. [†] marks AKK 95% CIs that exclude zero. SEs cluster-robust at the cooperative (93 clusters). Revenue in 1,000 NPR. ^a Recall period October 2025–May 2026. * $q < 0.1$, ** $q < 0.05$, *** $q < 0.01$.

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Table: Animal health workers: effects of dMCE

Outcome	$\hat{\beta}$	95% CI	Control mean	<i>N</i>
<i>Panel 1: Knowledge</i>				
Domain knowledge index	0.08**	[0.02, 0.14] [†]	0.28	193
<i>Panel 2: Services</i>				
Services index (12 mo.)	0.27	[-0.52, 1.06]	11.56	691
<i>Panel 3: Business outcomes</i>				
Distinct clients (3 mo.)	0.47	[-42.27, 43.21]	208.21	620
Client visits (3 mo.)	-9.35	[-72.19, 53.48]	329.45	620
Income from services (3 mo.) ^a	-1.14	[-10.79, 8.52]	51.79	620

Notes: [†] marks 95% CIs that exclude zero. SEs cluster-robust at cooperative (93 clusters) ^a Income in 1,000 NPR. Knowledge index measured in round 5 only, leading to lower number of observations. * $q < 0.1$, ** $q < 0.05$, *** $q < 0.01$.

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Cost-effectiveness of dCM (back-of-the-envelope)

Benefit (per coop, per year)

$$\begin{array}{l} \$10 \text{ additional revenue / farmer} \\ \times 742 \text{ farmers / coop} \\ \hline \approx \text{\$7,420 / coop / year} \end{array}$$

Cost (per coop)

$$\begin{array}{l} \$100,000 \text{ implementation} \\ \div 43 \text{ coops} \\ \hline \approx \text{\$2,325 / coop} \end{array}$$

$$\text{Benefit-cost ratio} \approx \frac{\$7,420}{\$2,325} \approx 3.2\times \text{ in one year}$$

Conclusion

- Information is a constraint to markets for goats in rural Nepal
- Mobile app relaxes that constraint, boosting sales

QR code to my website



`mspitzerbrooks.github.io`

`msbrooks@ucdavis.edu`

Goat farmers

$$Y_{ic} = \beta_1 \text{dCM}_c + \beta_2 \text{dMCE}_c + \beta_3 \text{dCM}_c \times \text{dMCE}_c + \beta_4 Y_{i0} + \beta_5 \mathbf{X}_i + \theta_s + \varepsilon_{ic} \quad (1)$$

- farmer-household i , cooperative c

Community animal health workers

$$Y_{ict} = \beta_1 \text{dMCE}_c + \beta_2 Y_{i0} + \beta_3 \mathbf{X}_i + \theta_s + \delta_t + \varepsilon_{ict} \quad (2)$$

- Health worker i , cooperative c , survey round t

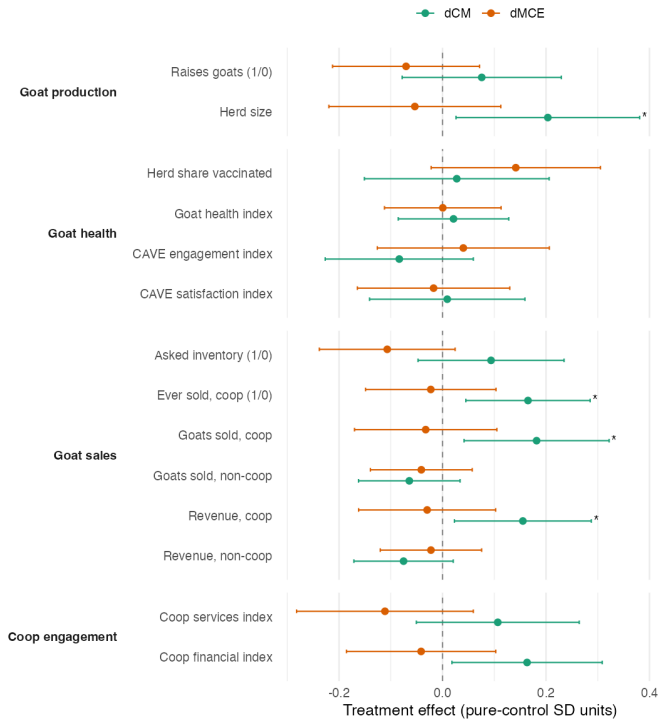


Table: Effects of dCM and dMCE on goat sales volume and revenue (year 2): long-model estimates with conventional inference

Outcome	dCM		dMCE		dCM × dMCE		Control mean	N
	$\hat{\beta}$	95% CI	$\hat{\beta}$	95% CI	$\hat{\beta}$	95% CI		
<i>Panel 1: Revenue (1,000 NPR)</i>								
Total revenue (full year)	0.32	[-3.79, 4.43]	-3.16	[-7.03, 0.71]	3.43	[-2.32, 9.19]	21.59	2,416
Revenue, during D/T	1.15	[-1.16, 3.46]	-0.61	[-3.04, 1.82]	-0.43	[-4.59, 3.73]	10.26	2,421
Revenue, not during D/T	-0.60	[-3.94, 2.73]	-2.32	[-5.38, 0.74]	4.04*	[-0.59, 8.66]	11.04	2,594
<i>Panel 2: Sales volume</i>								
Sold goat, during D/T (1/0)	0.02	[-0.03, 0.07]	-0.02	[-0.08, 0.03]	0.00	[-0.09, 0.09]	0.28	2,429
Sold goat, not during D/T (1/0)	0.03	[-0.04, 0.10]	-0.03	[-0.09, 0.04]	0.02	[-0.07, 0.11]	0.34	2,601
Goats sold, during D/T	0.09	[-0.04, 0.23]	-0.07	[-0.22, 0.07]	0.01	[-0.23, 0.26]	0.61	2,429
Goats sold, not during D/T	-0.01	[-0.22, 0.20]	-0.11	[-0.30, 0.08]	0.23	[-0.06, 0.53]	0.70	2,601

Notes: Year-2 (D/T 2082) effects on goat sales volume and revenue. Revenue in 1,000 NPR; counts unconditional (non-sellers = 0). “During D/T” = Dashain/Tihar (survey Sec. 4.1); “not during D/T” = rest of year (Sec. 4.2); “Total” = full year. Long model (PAP Eq. 1, interaction-inclusive): each term reports $\hat{\beta}$ with its conventional cluster-robust 95% CI ($\hat{\beta} \pm 1.96$ se); *no* AKK bias-aware interval and *no* multiple-testing adjustment. Stars are the conventional *p*-value; [†] marks 95% CIs excluding zero. SEs cluster-robust at the cooperative; controls by post-double-selection LASSO. Baseline (Round-1, D/T 2080) included where a direct analog exists, with listwise deletion of respondents lacking it; outcomes without a baseline use strata FE + PDS-LASSO only. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table: Effects of dCM and dMCE on goat sale prices (year 2, D/T): long-model estimates with conventional inference

Outcome	dCM		dMCE		dCM × dMCE		Control mean	N
	$\hat{\beta}$	95% CI	$\hat{\beta}$	95% CI	$\hat{\beta}$	95% CI		
<i>Panel 1: Through cooperative</i>								
Revenue ÷ number of goats	-821.65	[-2702.25, 1058.95]	-219.36	[-2108.98, 1670.26]	982.89	[-1694.22, 3659.99]	18655.26	379
NPR/kg, midpoint (most & least exp.)	16.86**	[0.61, 33.11] [†]	26.29***	[7.76, 44.82] [†]	-25.74**	[-50.96, -0.52] [†]	507.93	382
NPR/kg, most expensive	17.70**	[2.42, 32.97] [†]	22.11**	[5.34, 38.88] [†]	-21.99*	[-45.82, 1.84]	513.12	382
NPR/kg, least expensive	18.20	[-4.58, 40.97]	35.22**	[9.07, 61.36] [†]	-34.12**	[-67.19, -1.04] [†]	491.89	269
<i>Panel 2: Outside cooperative</i>								
Revenue ÷ number of goats	-646.10	[-2406.00, 1113.80]	247.26	[-1437.66, 1932.17]	-1325.01	[-3636.97, 986.94]	16776.65	408
NPR/kg, midpoint (most & least exp.)	4.58	[-12.20, 21.36]	10.21	[-8.42, 28.85]	-16.06	[-44.40, 12.29]	542.05	219
NPR/kg, most expensive	2.78	[-14.10, 19.66]	6.17	[-12.40, 24.75]	-8.79	[-37.35, 19.77]	546.79	218
NPR/kg, least expensive	-3.07	[-20.63, 14.49]	10.11	[-9.82, 30.04]	-25.37*	[-54.11, 3.38]	536.58	148

Notes: Year-2 Dashain/Tihar (D/T 2082) goat *prices*, by sales channel. Each price is observed only for farmers who sold through that channel, so estimates are effects *among sellers* on a treatment-selected subsample; *N* varies with channel and item nonresponse. The per-kg prices are the winsorized (5/95) survey items; “Revenue $\div$ number of goats” is total channel revenue over goats sold. Prices in NPR. (Per-head price items are omitted: coop sellers reported per kg, with 0–1 per-head responses.) Long model (PAP Eq. 1, interaction-inclusive): each term reports $\hat{\beta}$ with its conventional cluster-robust 95% CI ($\hat{\beta} \pm 1.96$ se); *no* AKK bias-aware interval and *no* multiple-testing adjustment. Stars are the conventional *p*-value; [†] marks 95% CIs excluding zero. SEs cluster-robust at the cooperative; controls by post-double-selection LASSO. Baseline (Round-1, D/T 2080) included where a direct analog exists, with listwise deletion of respondents lacking it; outcomes without a baseline use strata FE + PDS-LASSO only. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

