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Innovation platforms as catalysts for multi-stakeholder agricultural extension in Caribbean small island developing states

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Abstract

Traditional linear extension models struggle with the complex challenges facing Caribbean agriculture. This research evaluated innovation platforms (IPs) as an alternative extension model in Jamaica, comparing six IP communities with six matched non-IP communities (n = 247 households) across four parishes between April 2022 and October 2023. IP communities scored significantly higher on all six functions: knowledge exchange (4.31 vs. 2.67), technology dissemination (4.17 vs. 2.83), market linkage (3.89 vs. 2.41), collective action (3.76 vs. 2.34), input access (3.54 vs. 2.91), and policy dialogue (3.42 vs. 2.18), all $P < 0.01$. Network analysis showed IP communities had 2.8 times more inter-stakeholder connections.

Keywords: Innovation platforms, multi-stakeholder extension, Caribbean agriculture, small island developing states, knowledge exchange, collective action, market linkage, network analysis, Jamaica

Introduction

Caribbean SIDS face limited arable land, extreme weather vulnerability, high input costs, and fragmented markets ^[1, 2]. Jamaica, with over 200,000 farmers on an average 1.2 hectares, exemplifies these challenges ^[3]. Extension services have followed top-down approaches that do little to facilitate broader stakeholder coordination ^[4].

Innovation platforms create structured spaces where farmers, researchers, suppliers, buyers, and policy makers interact to identify shared problems and develop coordinated solutions ^[5, 6]. African evidence suggests IPs accelerate technology adoption and improve market access ^[7, 8], but Caribbean SIDS experience remains undocumented.

This research assessed: (a) the comparative performance of IP and non-IP communities across six extension-related functions; (b) the structure and density of stakeholder networks within IP communities; and (c) the mechanisms through which IPs generated value for participating smallholders ^[9, 10].

Materials and Methods

Materials

Six IP communities were matched with six non-IP

communities across St. Elizabeth, Manchester, St. Ann, and Portland parishes between April 2022 and October 2023. IPs had been active for at least 18 months. Matching was based on parish, crop type, farm size, and market distance. The sample included 128 IP and 119 non-IP households (n = 247). The 48-item survey measured platform functions, network ties, and household characteristics. Semi-structured interviews with 24 IP members and 12 facilitators provided qualitative depth. Ethics approval: UWI Ethics Committee (Protocol UWI-FFA-2022-023, March 2022).

Methods

Platform function performance was measured through six composite indices (4-5 items each) on a 5-point scale. Between-group comparisons used independent t-tests with Bonferroni correction for multiple comparisons. Stakeholder network analysis mapped ties between seven stakeholder categories in each community using density, centrality, and clustering metrics. Qualitative interviews were analyzed using framework analysis with codes derived from innovation systems theory. All quantitative analyses used SPSS 28.0 and UCINET 6.0 at $P < 0.05$.

Results

Table 1: Innovation platform function performance: IP versus non-IP communities

Platform Function	IP (n=128)	Non-IP (n=119)	t-value	Effect d	p-value
Knowledge exchange	4.31	2.67	8.47	1.12	< 0.001
Technology dissem.	4.17	2.83	7.23	0.94	< 0.001
Market linkage	3.89	2.41	7.91	1.03	< 0.001
Collective action	3.76	2.34	7.64	0.99	< 0.001
Input access	3.54	2.91	2.68	0.35	0.008
Policy dialogue	3.42	2.18	6.38	0.83	< 0.001

IP communities scored significantly higher on all six functions after Bonferroni correction. Effect sizes ranged from large (knowledge exchange, $d = 1.12$) to small-

medium (input access, $d = 0.35$). Knowledge exchange and market linkage showed the strongest IP advantages.

Table 2: Stakeholder network characteristics in IP and non-IP communities

Network Metric	IP Communities	Non-IP Communities	p-value
Network density	0.71	0.28	< 0.001
Mean degree centrality	4.83	1.72	< 0.001
Clustering coefficient	0.64	0.31	< 0.001
Betweenness (farmer node)	0.38	0.12	0.002
Inter-stakeholder ties	18.4	6.6	< 0.001

Network analysis revealed stark structural differences. IP communities had 2.8 times more inter-stakeholder ties (18.4 vs. 6.6), substantially higher network density (0.71 vs. 0.28),

and greater farmer betweenness centrality (0.38 vs. 0.12), indicating that IPs position farmers more centrally within agricultural information and service networks.

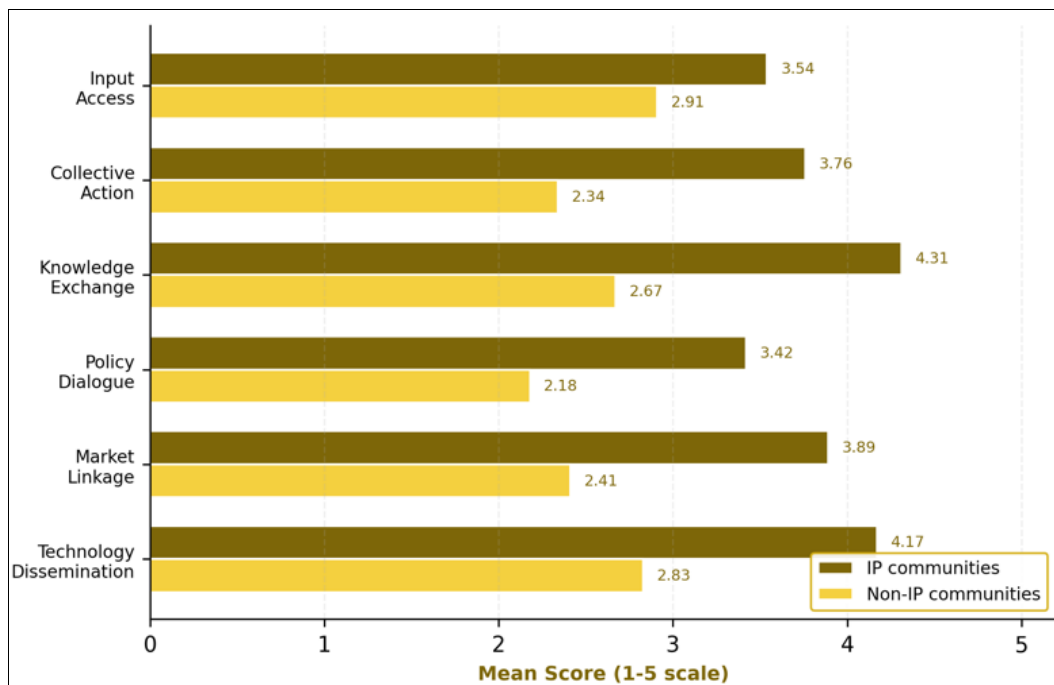


Fig 1: Innovation platform function performance scores comparing IP and non-IP communities across six extension-related functions

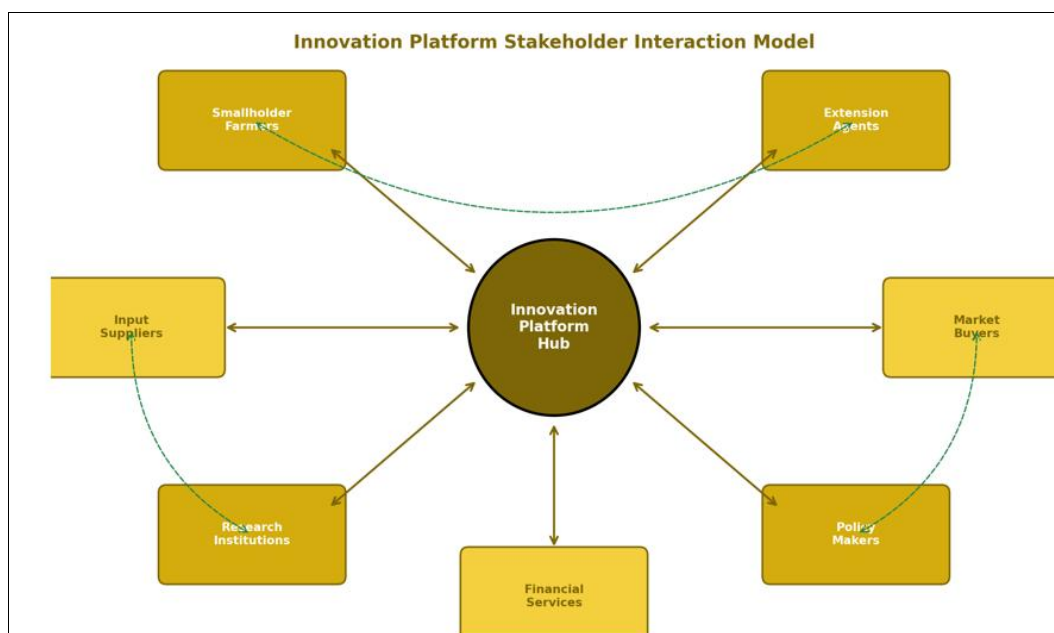


Fig 2: Innovation platform stakeholder interaction model showing bidirectional relationships between the platform hub and seven stakeholder categories

Comprehensive Interpretation

Interview data illuminated how IPs generated their advantages. Participants consistently described the value of face-to-face interaction with stakeholders they would not normally encounter. Farmers reported that direct engagement with market buyers reduced information asymmetry and improved bargaining positions, while input suppliers described more efficient distribution through collective purchasing arrangements. Platform facilitators emphasized that the most productive IP sessions were those where genuine negotiation occurred between stakeholders with competing interests, suggesting that productive friction rather than forced consensus drives IP value.

Discussion

Strong IP advantages across all functions support the proposition that multi-stakeholder platforms address systemic constraints more effectively than linear models^[5, 6]. Large effects on knowledge exchange and market linkage align with East African evidence^[7, 11], while the weaker input access effect reflects established commercial supply chains that IPs supplement^[12].

The 2.8-fold difference in inter-stakeholder ties suggests IPs fundamentally restructure information flow^[13]. Non-IP networks were sparse and farmer-agent dominated, while IP communities showed dense multiplex networks connecting farmers to researchers, buyers, and policy actors, a transformation particularly valuable where institutional resources are limited^[2, 14].

Elevated farmer betweenness centrality indicates IPs reposition farmers from peripheral recipients to central network nodes, underpinning improved market linkage and collective action outcomes^[15].

Ethical Considerations

Evaluating community-level interventions raises questions about fairness and potential harm to comparison communities. Non-IP communities were informed that

research findings would inform future extension programming and that IP establishment in their communities was planned for the subsequent program cycle. Individual informed consent was obtained from all survey respondents. Platform meeting observations followed established community protocols, and sensitive information about market relationships and income was collected confidentially. Research findings were shared with all participating communities, including non-IP communities, through community feedback sessions conducted in accessible formats. The research team included Jamaican researchers familiar with local agricultural and social dynamics.

Limitations

The quasi-experimental design cannot rule out selection effects; communities with IPs may have had pre-existing advantages in social capital or institutional engagement. The 18-month minimum IP operation period means that findings reflect relatively mature platforms and may not generalize to newly established IPs. Self-reported function scores may overestimate performance among IP members who have invested time in the platform. Network analysis captured formal ties but may miss informal interactions that operate outside platform structures. The Jamaican context, while representative of Caribbean SIDS, has institutional features that differ from Pacific or Indian Ocean island states.

Practical Applications

Platform design should prioritize knowledge exchange and market linkage functions, which deliver the strongest comparative advantages. Facilitators should manage productive stakeholder friction rather than avoid it, since genuine negotiation drives IP value. Network development should connect farmers to non-traditional partners like market buyers and policy actors. For SIDS, the multi-stakeholder model concentrates coordination functions that would otherwise require separate institutional arrangements.

Conclusion

Innovation platforms produced significantly stronger outcomes than conventional extension across all six functions measured in Jamaican farming communities, with the largest advantages in knowledge exchange and market linkage. Network analysis confirmed that IPs fundamentally restructured stakeholder interactions, creating denser, more connected networks that positioned farmers centrally rather than peripherally.

For Caribbean SIDS facing tight resource constraints and complex agricultural challenges, innovation platforms offer an extension model that generates coordination value through multi-stakeholder engagement rather than relying on individual agent-farmer contacts. The model appears particularly suited to small island contexts where institutional resources are scarce and the benefits of improved coordination are proportionally large.

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