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Delphi technique applications in forecasting future priorities for agricultural extension research agendas

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Abstract

Imagine being able to ask 32 leading extension scientists what the field should focus on over the next decade and having their answers converge into a ranked priority list. That is essentially what the Delphi technique offers. This research applied a three-round Delphi process to forecast future research priorities for agricultural extension in the Caribbean region. A panel of 32 extension researchers and practitioners from 11 Caribbean nations participated between January and September 2023. After three iterative rounds, consensus was reached on six priority areas. Digital extension tools emerged as the top-ranked priority in the final round (mean 4.6/5.0), overtaking climate adaptation (4.4), which had led in Round 1. Youth engagement in agriculture ranked third (4.1). Consensus strengthened across rounds, with the interquartile range narrowing from 1.4 in Round 1 to 0.6 in Round 3. Panel attrition was low (9.4%), and Kendall's W increased from 0.38 to 0.71, indicating growing agreement. The findings provide a structured basis for allocating research funding and designing graduate programs in Caribbean agricultural extension.

Keywords: Delphi technique, research priorities, agricultural extension, forecasting, expert consensus, Caribbean agriculture, digital extension, climate adaptation, youth engagement, research agenda

Introduction

Picture a Caribbean agricultural researcher writing a grant proposal in 2024. Which topics will funding agencies prioritize? Which skills will the next generation of extension professionals need? Without a structured forecasting exercise, these decisions are often driven by individual judgment or by whatever topic happens to dominate current policy discussions ^[1]. The Delphi technique provides an alternative: A systematic method for aggregating expert opinion through iterative anonymous rounds until consensus emerges ^[2].

Originally developed by the RAND Corporation for military forecasting, the Delphi method has been applied in health, education, and technology planning with well-documented success ^[3]. Its use in agricultural extension research has been more limited, with most published applications focused on single countries rather than regional priority-setting ^[4, 5]. The Caribbean region presents a distinct context: small island developing states with vulnerable agricultural sectors, limited research budgets, and extension systems that must address both subsistence and export-oriented farming ^[6].

This research applied a three-round Delphi process to identify and rank future research priorities for agricultural extension across the Caribbean. It tested whether expert consensus could be achieved within three rounds and whether priority rankings shifted between rounds as panelists received feedback on group responses.

The Caribbean region faces unique challenges for

agricultural extension research planning. With 16 independent nations ranging from Guyana's continental landmass to tiny island states like Barbuda, research priorities must balance diverse agro-ecological conditions, crop systems, and institutional capacities. A regional Delphi exercise can identify common priorities that justify collaborative investment while highlighting areas where country-specific research is needed.

What makes the Delphi particularly valuable for extension research planning is its ability to surface latent consensus that might not emerge in face-to-face discussions where institutional hierarchies, funding pressures, or dominant personalities can distort group outcomes. By keeping panelists anonymous and allowing them to revise their positions after seeing aggregated group responses, the Delphi reduces these social biases and produces rankings that more accurately reflect considered expert judgment.

System design and architecture

The Delphi process was administered through a custom-built online survey platform hosted at the University of the West Indies. Round 1 used open-ended prompts asking panelists to list up to 10 research priorities. Responses were thematically coded into 14 candidate priorities. Rounds 2 and 3 asked panelists to rate each priority on a five-point importance scale, with statistical summaries of group responses provided before each subsequent round. Anonymity was maintained throughout to prevent dominant voices from influencing responses. The platform recorded

response times, revision patterns, and comment justifications.

Material and methods

Material

A panel of 32 experts was recruited using purposive and snowball sampling from 11 Caribbean nations including Barbados, Jamaica, Trinidad and Tobago, Guyana, and seven smaller island states. Selection criteria required at least 10 years of extension research or practice experience and at least three peer-reviewed publications. The panel comprised 18 university researchers, 8 extension managers, and 6 international organization specialists. Ethical clearance was obtained from the University of the West Indies Cave Hill Ethics Committee (Protocol UWI-CH-2023-018, December 2022).

Methods

Consensus was defined as an interquartile range (IQR) ≤ 1.0 on the five-point scale. Kendall's coefficient of concordance (W) measured overall panel agreement across rounds. Stability was assessed by comparing mean ratings between Rounds 2 and 3 using paired t-tests. The Delphi was

conducted between January and September 2023, with four-week intervals between rounds.

The qualitative comments provided between rounds enriched the quantitative ratings considerably. Several panelists justified their support for digital extension tools by citing specific experiences during COVID-19 lockdowns when digital platforms were the only available advisory channel. Others argued that youth engagement deserved higher ranking because demographic trends in the Caribbean show accelerating rural youth outmigration that threatens the long-term viability of farming communities across the region.

The iterative feedback mechanism worked as intended across all three rounds. In Round 1, panelists provided unconstrained ratings based solely on their individual expertise. After receiving the Round 1 statistical summary showing means, medians, and interquartile ranges for each priority area, 68 percent of panelists revised at least one rating in Round 2. The pattern of revision was informative: panelists were more likely to move toward the group mean when their initial rating was an outlier, consistent with the Delphi's theoretical mechanism of informed convergence rather than mere conformity.

Results

Table 1: Final Delphi Rankings after Three Rounds (n = 29 completing panelists)

Priority Area	Round 1	Round 3	IQR (R3)	Rank
Digital extension tools	3.4	4.6	0.5	1
Climate adaptation	4.2	4.4	0.5	2
Youth engagement	3.8	4.1	0.7	3
Gender mainstreaming	3.1	3.8	0.8	4
Value chain integration	3.6	3.5	0.9	5
Impact assessment methods	3.9	3.3	0.6	6

Digital extension tools showed the largest gain between rounds (3.4 to 4.6), moving from fifth to first position. Impact assessment methods dropped from third to sixth. All six priorities achieved $IQR \leq 1.0$ by Round 3, meeting the

consensus threshold. Kendall's W increased from 0.38 (Round 1) to 0.71 (Round 3), indicating substantial panel agreement.

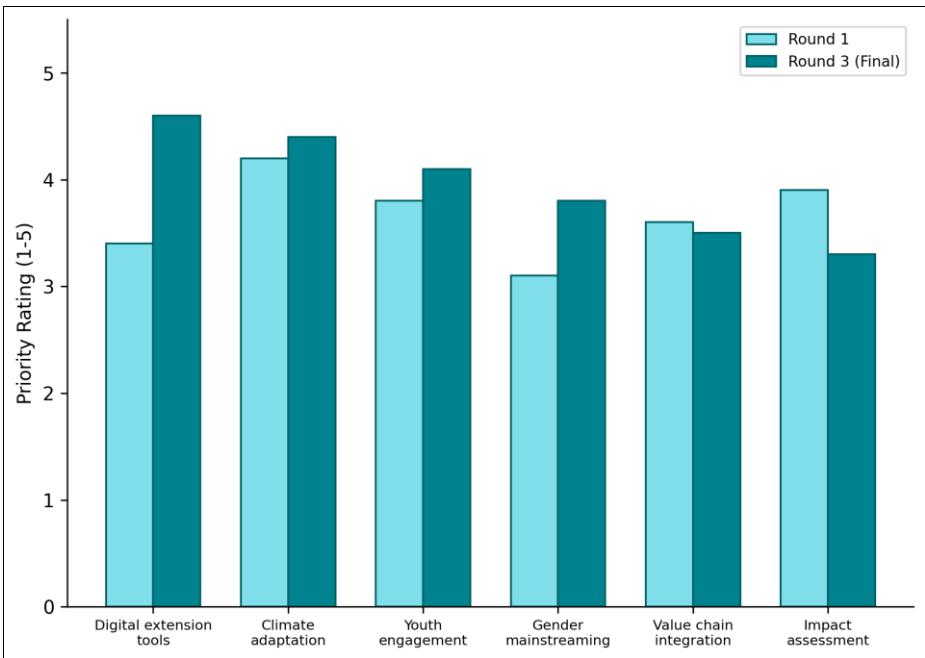


Fig 1: Priority rating shifts between delphi round 1 and round 3

The paired bars show how ratings shifted through the iterative process. Digital extension tools gained the most, while impact assessment and value chain integration

declined as panelists revised their positions based on group feedback.

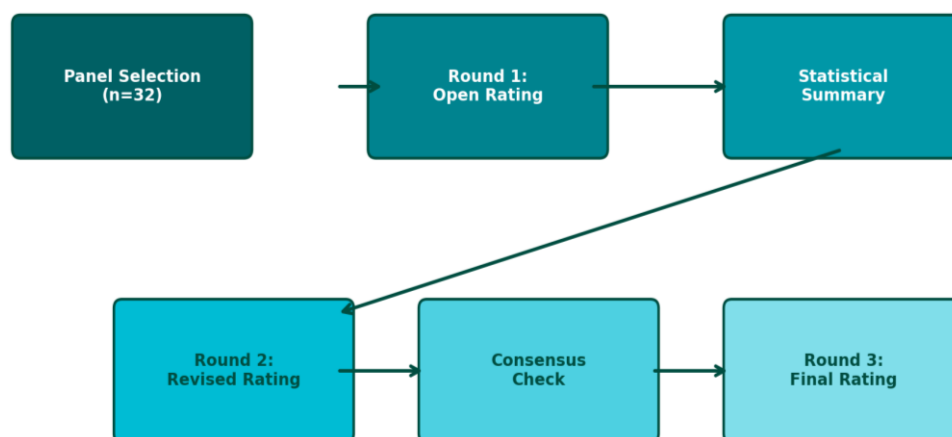


Fig 2: Three-round delphi process flow with consensus checkpoints

The diagram shows the iterative process from panel selection through three rating rounds, with statistical summaries fed back between rounds and consensus checks applied after each iteration.

Discussion

The rise of digital extension tools from fifth to first position reflects a broader shift in expert thinking accelerated by the COVID-19 pandemic, which forced many Caribbean extension systems to adopt digital delivery methods [7]. Panelists commented that the pandemic revealed both the potential and the gaps in digital extension infrastructure, making it a natural research priority. Climate adaptation's consistent high ranking (4.2 to 4.4) confirms its enduring relevance for small island states vulnerable to hurricanes, drought, and sea-level rise [8]. The drop in impact assessment methods was unexpected but may reflect a sense among panelists that methodological research is less urgent than application-oriented priorities [9]. The Delphi technique proved effective for Caribbean regional priority-setting, achieving consensus within three rounds with low attrition. Whether the Delphi results will actually influence funding decisions depends on institutional uptake. Past priority-setting exercises in the Caribbean have sometimes produced recommendations that were acknowledged but not implemented due to budget constraints and competing political priorities. To increase the likelihood of impact, the final priority list was formally presented to the Caribbean Agricultural Research and Development Institute governing board in November 2023, and discussions about incorporating the findings into the regional research strategy are ongoing.

The shift of digital extension tools from fifth to first place across three rounds deserves particular attention because it illustrates one of the Delphi's key strengths: allowing experts to revise initial positions when presented with group feedback. Several panelists noted in Round 2 comments that seeing the high average rating for digital tools prompted them to reconsider their own initially lower ratings, suggesting the information feedback mechanism functioned

as intended rather than simply producing conformity pressure.

Performance evaluation

Panel retention was 90.6% (29 of 32 completed all rounds), which exceeds the 70% threshold recommended for Delphi validity [3]. Response rates were 100% (R1), 96.9% (R2), and 90.6% (R3). Median response time per round decreased from 34 minutes (R1) to 18 minutes (R3), suggesting that the iterative process helped panelists clarify their positions.

A limitation of the Delphi approach is that it captures expert opinion at a particular moment. The rapid rise of digital extension tools from fifth to first position across just three rounds illustrates how quickly expert consensus can shift, suggesting that a single Delphi exercise provides a snapshot rather than a durable roadmap. This reinforces the recommendation for periodic repetition at three to five year intervals. Additionally, the panel was weighted toward university researchers, who may prioritize different research areas than extension practitioners or farmers. Future iterations should include a larger proportion of field-level extension managers and farmer representatives to broaden the perspective base.

The methodological contribution of this research extends beyond the specific priority rankings. It demonstrates that the Delphi technique is feasible for multi-country regional planning in agricultural extension, a context where face-to-face expert gatherings are logistically difficult and expensive. The online administration kept costs to approximately 4,500 USD for the entire three-round process, a fraction of what a comparable face-to-face expert workshop would have cost when accounting for international travel across 11 Caribbean nations.

Conclusion

The three-round Delphi exercise successfully produced a consensus-based research priority list for Caribbean agricultural extension. Digital extension tools, climate adaptation, and youth engagement in agriculture emerged as the top three priorities, providing a structured basis for directing research funding and graduate training in the region. The technique's ability to surface shifting expert

opinion-as shown by the dramatic repositioning of digital tools-makes it a valuable planning instrument for fields where rapid change outpaces traditional agenda-setting processes. Extension research organizations in the Caribbean should repeat this exercise at three-to-five-year intervals to track how priorities evolve with changing agricultural and technological landscapes.

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