

METHODOLOGY

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A novel approach to agricultural policy analysis applied to crop diversification in Bangladesh

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Abstract

Traditional approaches to policy analysis often provide only a partial understanding of the complexities of agricultural policies and their outcomes. This study addresses the important problem of how to evaluate such policies in a manner that captures their effects across historical, political, socio- economics and environmental dimensions and operational challenges. To do so, the paper develops and applies a new analytical framework that combines elements of policy and program analysis with validation through the views of experts and intended beneficiaries. The framework integrates multiple dimensions into a cohesive structure and specifically applied to the case of crop diversification policies in Bangladesh (1971–2023), combining a PRISMA-guided systematic review of 1223 projects, trend analysis of crop production and qualitative insights from 12 key informants. The findings show that the framework uncovers critical gaps in policy design, highlights institutional and operational constraints, and brings out the perspectives of diverse stakeholders, thereby providing a more grounded account of agricultural policy outcomes of Bangladesh. The study contributes by offering a practical and adaptable method that improves transparency, deepens understanding of institutional dynamics, and supports the formulation of context-specific and effective interventions. The insights from Bangladesh demonstrate the broader relevance of the approach for low- and middle-income countries seeking to strengthen agricultural policy and promote sustainable development.

Keywords Policy analysis, Analytical framework, Crop diversification, Case study, Bangladesh

1 Introduction

Traditional policy frameworks typically adopted a top-down, technocratic perspective, focusing on technological adoption while neglecting the socio-economic diversity and institutional constraints faced by smallholder farmers [1]. As a result, they prioritized immediate productivity gains over long-term ecological sustainability, failing to adequately account for adverse consequences such as soil degradation, water depletion, and pesticide overuse, which disproportionately impacted rural populations [2]. This narrow focus led to an unequal distribution of benefits and created vulnerabilities that threatened sustainable agricultural development [3].



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This motivates a more comprehensive policy analysis that captures the multiple factors shaping outcome. Traditional models, including Multiple Streams [4], Punctuated Equilibrium [5], Centre Periphery [6], and Top Down/Bottom-Up implementation [7], offer insights but often miss socio economic, political, and ecological realities on the ground, especially for smallholders. For example, the Multiple-Streams Framework effectively explains agenda-setting and the historical context of policies, but lacks empirical testability and transparency [4, 8]. Similarly, Punctuated Equilibrium Theory, often used in health policy analysis, can explain policy shifts but is less adept at predicting the timing and nature, particularly in the case of agricultural policy analysis. The Top-Down/Bottom-Up approach highlights the role of decision-makers but often oversimplifies the dynamic nature of policy implementation and neglects local contexts [5].

The study addresses these limitations with a framework that integrates political, economic, social, and ecological dimensions. This framework goes beyond traditional approaches, incorporating a deeper understanding of the political economy of policies and the contextual factors that shape policy effectiveness. It enables a more nuanced evaluation of policies and their impact, particularly in complex environments like agriculture. The framework moves beyond technocratic assessments by adding stakeholder perspectives, socio economic context, and long-term sustainability, yielding more actionable analysis. Recent innovations in policy analysis frameworks have demonstrated the value of system dynamics approaches for analyzing policies, particularly in capturing institutional and behavioral dimensions [6].

This proposed framework is applied to the analysis of crop diversification policies in Bangladesh, which has gained prominence in South Asia as a key strategy for enhancing agricultural resilience, income generation, and food and nutrition security [9]. Crop diversification, the introduction of additional crops into existing systems, can mitigate risk, improve ecological sustainability, and reduce poverty [10, 11]. A thorough evaluation of these policies is essential to assess their tangible impacts, guide future policy-making, and improve agricultural outcomes across the region [12].

The study has both theoretical and practical implications. From the theoretical side, the study formalizes a three-stage, political economy-grounded framework that links country-sector context, institutional dynamics, and program design to observed diversification outcomes, improving construct validity and transparency through PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)-based document screening, a structured project database, crop diversity indices, and triangulated by Key informant Interviews (KII). By tracing how rice-centric historical legacies, fragmented coordination, and incentive misalignment propagate from plans into projects, the framework specifies mechanism-level pathways that researchers can test or adapt across settings while documenting data selection and assumptions for auditability. Additionally, it emphasizes iterative feedback loops and participatory validation, making it adaptable to complex policy environments. It extends existing policy theories (Multiple Streams, Punctuated Equilibrium, Top-down/Bottom-up) by systematically embedding empirical transparency and stakeholder perspectives.

From a practicality standpoint, applying the framework to understand crop diversification in Bangladesh, identifies specific operational gaps, such as limited institutional coordination, resource-intensive implementation, and insufficient monitoring. The framework provides policymakers with concrete recommendations, including

embedding diversification metrics in monitoring systems, strengthening cross-sectoral coordination, and institutionalizing farmer participation in program design. The subsequent sections of this study build on these lessons by outlining the framework in detail and demonstrating how the analysis was conducted and applied. Section 2 details the framework. Section 3 describes data and screening. Section 4 presents result on sector context, institutional diagnostics, and policy levers. Section 5 discusses implications for aligning instruments toward crop diversification, followed by limitations and next steps.

2 Theoretical background

The policy analysis framework consists of three stages (Fig. 1). Stage one focuses on sectoral analysis, covering policies, politics, socioeconomics, climate, environmental issues, and international trade [7, 13]. Stage two examines sector-specific organizations, institutions, power dynamics, ideologies, and historical change through systematic literature reviews across agriculture, food production, marketing, and consumption. It involves three analytical steps: a broad sector study, an investigation of relevant organizations and actors, and policy processes. Stage three addresses methodological considerations [14, 15].

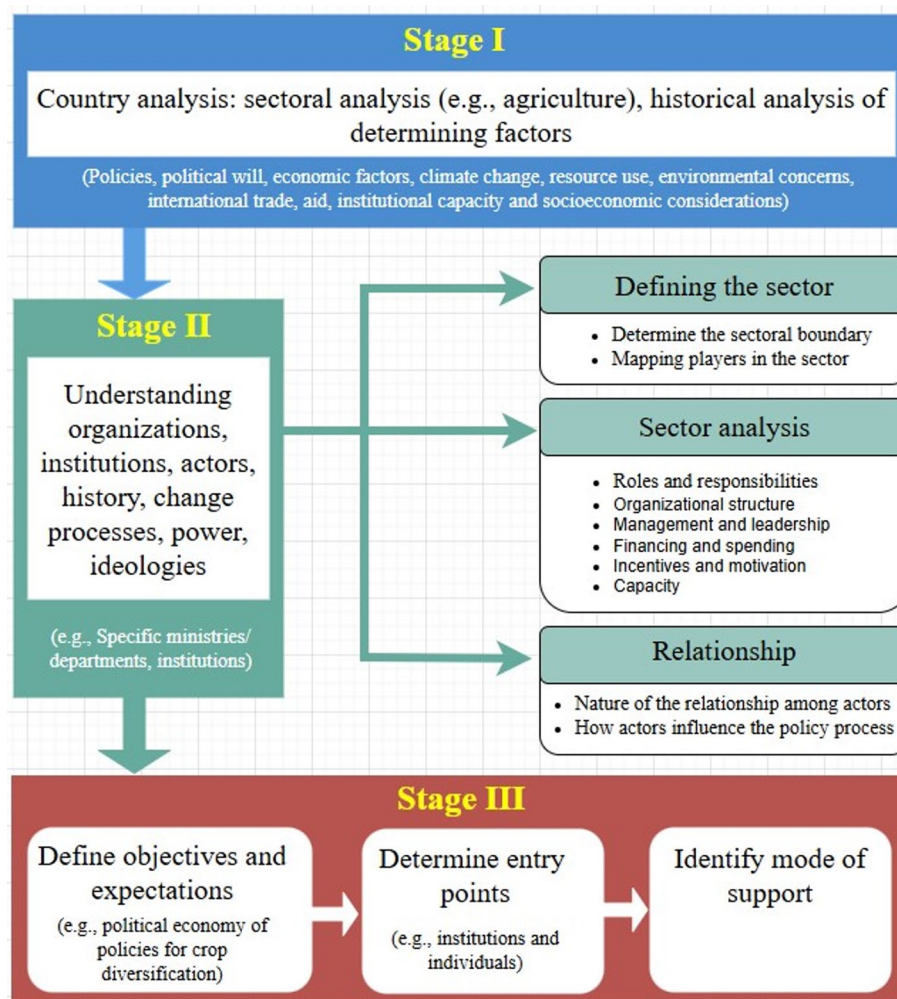


Fig. 1 Stages in policy analysis.

Source [14, 15]

2.1 Stage I: country and sector (agriculture) analysis

To understand how various factors influence policy, Moore's framework [16] and the Oxford Policy Management (OPM) framework [9] offer valuable starting points. Both frameworks begin with a broad country study, which is crucial for contextualizing sector-specific analyses. Moore's framework includes three levels of analysis: examining fundamental issues like resource endowments and social structures, assessing institutional architecture, and evaluating government capacity and accountability. Similarly, the OPM framework involves identifying country-level enablers (e.g., policies, infrastructure, skilled workforce) and barriers (e.g., regulatory constraints, corruption, technology gaps) [10].

This step maps sector challenges and opportunities and guides focused sector studies. Without detailed sectoral analysis, designing effective policies becomes difficult. Sectoral policy analysis provides insights into stakeholder roles, policy impacts, and social and political contexts [17]. Reviewing historical policies and conducting deep sectoral analysis allows for targeted policymaking, better program design, and implementation strategies [18]. Moore and OPM frameworks also examine historical legacies, change processes, structural features, and institutional interactions, highlighting their influence on policymaking and implementation (Fig. 2).

While Moncrieffe and Luttrell, Moore, and OPM guide sector political economy analysis, this study adapts them to agricultural policy and crop diversification in Bangladesh. Notably, our approach retains its focus on historical and institutional analysis but diverges in two keyways: First, *sector-specific detailing*, whereas Moncrieffe and Luttrell's Stage I centers on broad country-level political and institutional diagnostics, we refine this to capture agriculture-specific dynamics. For example, the study traces the rice centric policy legacy since the 1970s and how Five-Year Plans and reforms reinforced

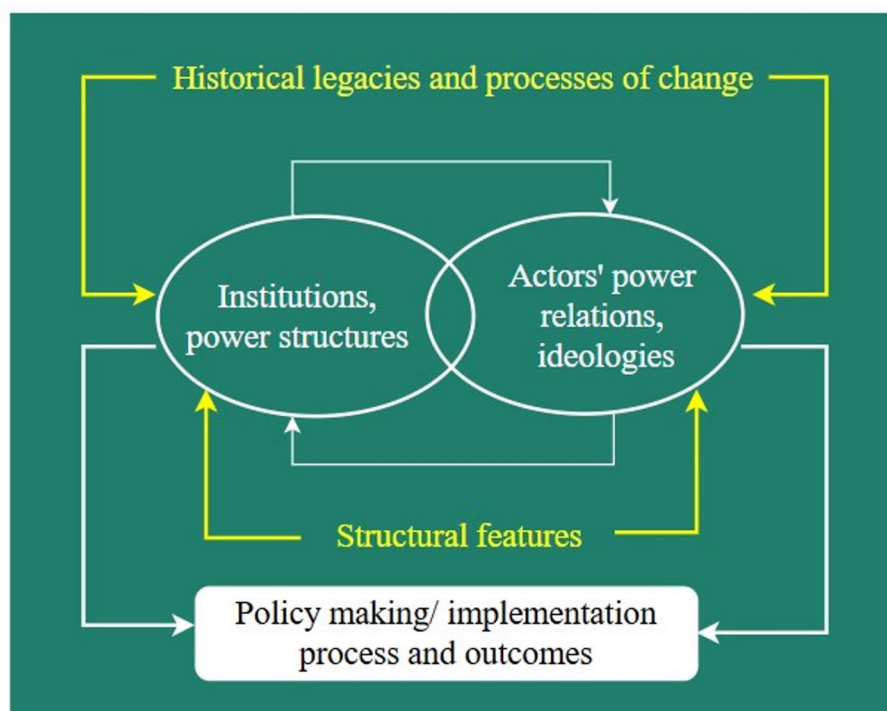


Fig. 2 Analytical framework for analyzing policies [14, 15]

institutional inertia toward monoculture. Second, data-driven integration where our approach operationalizes the foundational analysis using a structured review of over 1200 projects (using PRISMA guidelines), Five-Year Plans, and policy documents. This adds quantifiable outcomes, including crop diversification indices such as the Herfindahl Hirschman Index, budget allocations, and project assessments. Further, we analyzed the government's ability to implement diversification programs effectively, looking at budget allocations, coordination with development partners, monitoring and evaluation practices, and responsiveness to farmer needs. This was informed by project documentation and key informants.

2.2 Stage 2: understanding organizations, institutions, and actors

Understanding organizations, institutions, and actors is essential for analyzing the political economy of policies. Actors, which include both state and non-state groups, play crucial roles in policymaking and implementation, shaping the trajectory of policies [11, 12]. Key aspects of their influence are outlined below.

2.2.1 Power, politics, and decision-making

Understanding the dynamics of decision-making is central to policy analysis. In agricultural contexts, this involves identifying key actors such as government ministries, donor agencies, NGOs, trade associations, and farmer organizations and analyzing their roles, motivations, and levels of influence [17–19]. For instance, in Bangladesh, the Ministry of Agriculture has historically led crop diversification strategies, coordinating with development partners such as IFPRI for technical support. Power is unevenly distributed, with large agribusinesses influencing policy more than marginalized groups, including women and smallholder collectives [20]. While collectives in districts like Jessore and Bogura have strengthened market access for smallholders, they still face structural limitations. Recognizing these dynamics is essential for understanding whose interests are prioritized and how power relations shape policy outcomes [21, 22].

2.2.2 Institutional incentives and policy processes

Institutions, both governmental and non-governmental, engaged in agricultural policymaking operate under varying incentives and constraints. While agribusinesses may focus on profit maximization, other stakeholders, such as environmental groups or research organizations, emphasize sustainability or long-term resilience. Government agencies and international actors often play pivotal roles in policy formulation, and their institutional structures and biases affect the design, implementation, and success of agricultural initiatives [17, 23]. Implementation is also influenced by bureaucratic efficiency, regulatory capacity, and coordination among actors. For example, despite policy interest in diversification, institutional inertia rooted in legacy rice-focused programs and donor frameworks often limit adaptive implementation. Evaluating how institutional behaviors and conflicting incentives shape the policy process is thus critical.

2.2.3 Historical and ideological influences

Historical legacies and ideological values underpin institutional behavior and policymaking processes. Past political regimes, demographic transitions, and long-term economic strategies often persist in shaping current agricultural policies [21, 24]. Additionally,

divergent ideologies such as beliefs in market liberalization versus state-led interventions impact on how policies are framed, debated, and received [25]. For example, ideological differences exist between agroecological approaches, which emphasize sustainability and smallholder resilience, and commercial farming models, which prioritize large-scale, input-intensive production. Think tanks and research bodies assess policy outcomes, but their conclusions can be shaped by funding sources or political influences [26]. Understanding these historical and ideological contexts adds depth to policy analysis, enabling a more realistic interpretation of both policy intentions and outcomes.

2.3 Methodological considerations

This section consolidates the methodological logic that links (i) clearly stated objectives and expectations, (ii) strategic entry points for policy intervention, and (iii) appropriate modes of support. The approach is actor-centered and context-aware: it recognizes how stakeholder interests and power relations shape costs, benefits, and feasibility, and it translates those insights into implementable choices for policy design and evaluation.

Objectives and expectations: First specify the policy problem and the expected outcomes, making explicit the interests and influence of key stakeholder groups and how these may affect distribution of costs and benefits. This step sets the criteria against which policies will be assessed (effectiveness, equity, implement ability, and fiscal realism) and clarifies scope (time horizon, geographies, and delivery systems). By foregrounding incentives and power structures, defining what “success” will mean, and which trade-offs are acceptable during appraisal.

Entry points for intervention: Identify where intervention is most likely to gain traction by mapping institutions and actors and balancing accessibility (where engagement is feasible) with influence (where decisions materially affect outcomes) [14]. The analysis considers stakeholder interests and coalitions, veto points, administrative feasibility, and timing (policy windows). The output is a shortlist of entry points such as specific agencies, forums, or processes through which additional or adjusted policy instruments can be introduced or coordinated.

Modes of support: Finally, match delivery modalities to sector context and beneficiary needs. Options include participatory co-design with users, mobilization of producer collectives, targeted extension and market services, and capacity building at grassroots and meso-levels [21, 27]. Selection depends on who benefits, the nature of the constraint, delivery capacity, and transaction costs. The goal is to place the right modality at the right node in the system so that support translates into uptake and sustained change.

Figure 2 summarizes how macro-level conditions such as governance structures, historical legacies, and resource endowments shape sector dynamics and, in turn, institutional behavior and actor interactions. The methodology operationalizes this logic by aligning context (signals and constraints), institutions (roles and incentives), and operations (delivery choices) into a single analytical sequence. This alignment guides data collection (documents, budgets, project records, interviews) and interpretation (triangulating portfolio patterns with stakeholder evidence), ensuring a coherent narrative while preserving the key steps needed for transparency and replication.

3 Application of the analytical framework on crop diversification policies in Bangladesh

The application comprises four parts to study the political economy of crop diversification policies in Bangladesh. Firstly, *policy analysis*, which involved an evaluation of the policies related to crop diversification in Bangladesh. This process followed a structured sequence of seven steps, as illustrated in Fig. 3. The policy analysis process involved a review of historical agricultural policies. In this case, it entailed examining a range of documents, such as the government’s 5 Year Economic Development Plans, policies, annual budgets, and other government-driven initiatives aimed at agricultural development. This review served as the foundational phase of the policy analysis process. Over time, these policies have led to numerous projects, schemes, and programs that have either been completed or are currently in progress. Secondly, an analysis of *cases or projects* related to crop diversification, which have been conceived as a direct or indirect result of these policies. Among the agricultural projects, significant emphasis has been placed on the promotion of crop diversification (Annexure II). Third, Key Informant Interviews (KIIs) were conducted based on insights from the policy and case analysis, and an open-ended qualitative survey protocol was prepared (Annexure I) based on the guidelines provided by Rubin & Rubin [28] and Leech [29]. KIIs were conducted using snowball sampling to validate and gather perspectives on crop diversification projects. Informants were selected based on their involvement in projects as leads or in key roles, possessing in-depth knowledge of the project lifecycle and government perspectives.

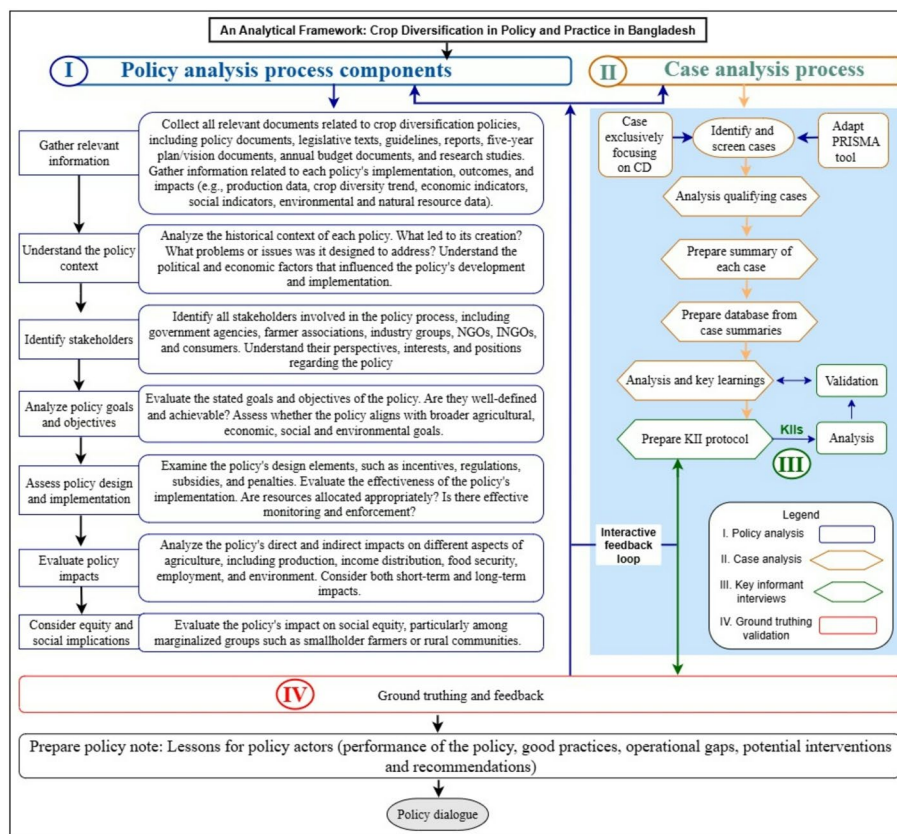


Fig. 3 Analytical framework elucidating the political economy of policies for crop diversification. Adapted from moncrieffe luttrell, and NCPI [14], [15]. Note PRISMA, preferred reporting items for systematic reviews and meta-analyses; KII, key informant interview; and CD, crop diversification

Additional information was identified through snowball sampling. Responses were analyzed, and a summary was incorporated into the main project analysis. A policy brief was then developed, offering specific recommendations to policymakers in Bangladesh [23]. Lastly, ground-truthing policy and project outcomes and impacts involves cross-validating the actual costs and benefits of projects and programs against their expected outcomes. This process includes gathering on-the-ground data and experiences directly from beneficiaries, such as farmers and household members. This work did not include ground-truthing policies and projects. Future research will benefit from deeper engagement with farmer communities to assess actual impacts, including both intended benefits and unintended consequences, thereby strengthening the practical relevance of the findings.

3.1 Methodology

Bangladesh was selected as the case study to test the analytical framework because of its pressing need to promote crop diversification and its long-standing policy focus on this issue. The country offers a unique context, with extensive historical data, diverse agro-ecological zones, and considerable institutional experimentation. As a major recipient of development aid in the region, Bangladesh has implemented a wide range of donor-supported and government-led agricultural programs with a focus on diversification over the past several decades. These characteristics provide a strong foundation for examining how policies are formulated, implemented, and experienced on the ground. Collectively, these factors make Bangladesh a suitable setting for applying and validating the proposed analytical framework, while also offering insights relevant to other low- and middle-income countries.

3.1.1 Data sources

To study the political economy of policies for crop diversification in Bangladesh, multiple data sources were used. These included government documents such as Five-Year Development Plans, annual budgets, and agricultural policies dating back to 1971. Additional sources included reports and evaluations of crop diversification projects from 1980 to 2022, donor archives, and economic surveys covering food production and demographics. Desk reviews were also conducted using official sector strategies, legislation, and policy documents. A database was compiled from the collected documents, capturing key project information, trends, and policy implications. Table 1 provides an overview of the data sources, and the corresponding analytical methods applied.

3.1.2 Key informant interview design and sampling

Key informant interviews (KIIs) were designed following qualitative interview protocols adapted from Rubin & Rubin (2011) and Leech (2011). Informants were selected using snowball sampling, starting with individuals in leadership or critical roles in crop diversification projects. The selection was based on expertise in project design, implementation, and policy-level insights. Informants were identified through referrals during the initial interviews.

To mitigate potential bias, we implemented several safeguards: informants were drawn from diverse institutional backgrounds (e.g., government, international research bodies, NGOs and private sector), and we ensured variation in roles (from policymakers

Table 1 Data sources and methods for data analysis

Data sources	Method
Crop diversification projects in Bangladesh since the 1980s	Content analysis using PRISMA guidelines [30]
Knowledge and experience of the national and international staff involved in project implementation and national agricultural policymaking	Key Informant Interviews using snowball sampling. List of diverse key informants is provided as Annexure III
Bangladesh agriculture development plan documents	Content analysis
Bangladesh's annual budget documents	Content analysis
Bangladesh's agricultural policies since 1971	Content analysis
Crop diversity trend in Bangladesh	Crop diversity index [26]
Economic survey documents: food production and demographics	Trend analysis (food, population, budget allocation, etc.)
Key informants, including government (national/local), business, NGOs/CSOs	Brainstorming with sector experts. This was in addition to the snowball survey
Official sector documents: strategies, legislation, regulations, and reports	Desk reviews

to field-level practitioners) and geographic representation across project sites. We also maintained thematic balance by including informants knowledgeable about policy design, implementation, and monitoring. Finally, we triangulated interview data with documentary sources such as project reports and official records to validate the perspectives shared. These measures helped ensure a broad and balanced representation of views while reducing the risk of homogeneity inherent in snowball sampling.

3.1.3 Data collection procedures

A systematic screening of literature and project documents was conducted using PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The search focused on projects from 1980 to 2022 using keywords such as “crop diversification,” “farming diversification,” “income diversification,” and “livelihood diversification.” When documents were unavailable digitally, outreach efforts included contacting project directors. Documents were screened by title, abstract, objectives, and findings. Relevant information was compiled into a database (Annexure II), which served as the foundation for comparative analysis.

3.1.4 Data analysis techniques

Several methods were employed for data analysis in this study. Content analysis was conducted on policy and development documents, following the PRISMA guidelines (Fig. 4). A list of qualitative open-ended questions prepared that clarifies and validates the results we found through the content analysis of policies and development documents. Qualitative analysis of Key Informants (KII) helped synthesize insights and validate project data. KIIs were thematically analyzed manually. A descriptive comparison was undertaken to summarize the project's impacts, sustainability, and alignment with policy objectives. Insights from the KIIs were integrated into the analysis and used to prepare a policy brief. Insights from KIIs were integrated into the broader analysis and contributed to the development of a policy brief with recommendations for policymakers in Bangladesh [23].

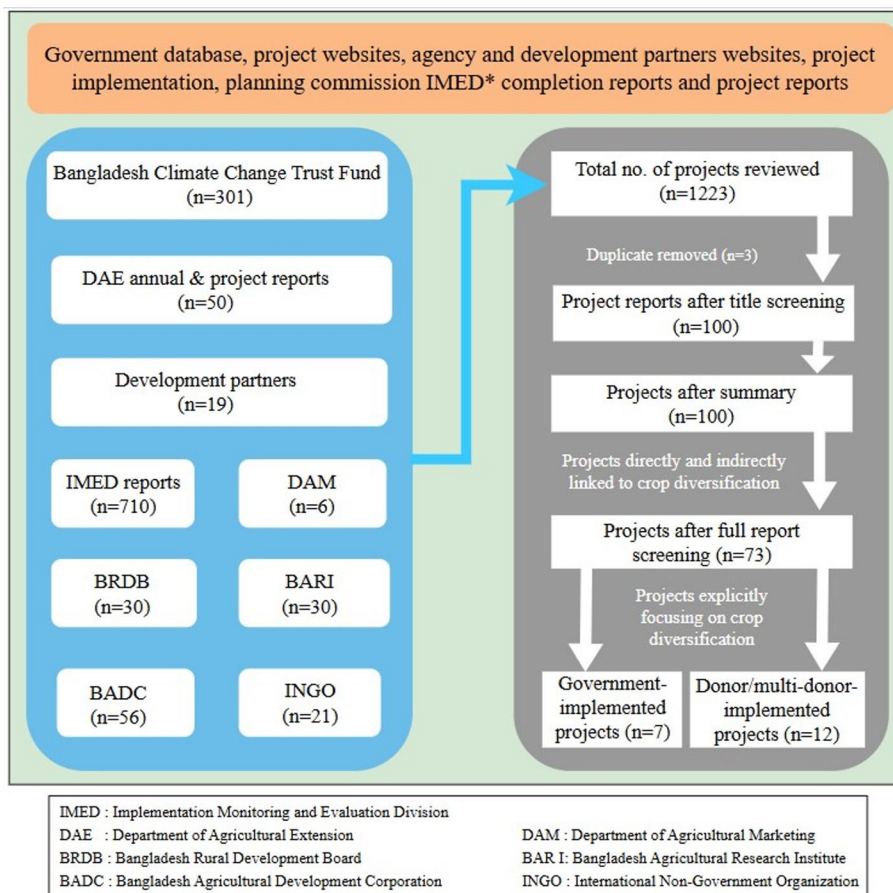


Fig. 4 Flow diagram showing the systematic PRISMA screening process

3.1.5 Key inclusion/exclusion criteria of projects/cases

Projects and programs promoting crop diversification from the 1980s to the present were included. A total of 1223 projects were identified for review. Projects without a focus on crop diversification were excluded. Due to limited digital documentation before 2010 and varying levels of institutional archiving, not all projects had complete records. However, donor archives provided reliable records for selected years.

3.1.6 Project extraction and quality assessment

From the systematic review, 81 projects were selected for detailed analysis, with 19 explicitly mentioning crop diversification as a primary objective. Data included project objectives, funding sources, duration, geographical scope, implementing agencies, and monitoring mechanisms. Additional aspects such as subsidies, climate resilience, sustainability indicators, and market linkages were also documented. Given the variation in reporting formats and availability, a qualitative and descriptive method was adopted to assess and compare the policy relevance, outcomes, and sustainability of the projects.

3.1.7 Additional sources of information

To enhance the analysis, supplementary information was drawn from institutional reports, crop trend data, national statistics, and records on agricultural institutions and

their capacities. These helped contextualize the political and institutional dynamics influencing crop diversification efforts.

3.1.8 Engagement with internal experts

The analytical framework benefited from collaboration with individuals possessing deep institutional knowledge. Senior officials from the Ministry of Agriculture in Bangladesh and researchers from IFPRI and CIMMYT provided insights into policy formulation, funding processes, and implementation challenges. These engagements were conducted ethically, with emphasis on transparency, confidentiality, and professional respect. This collaboration enriched the understanding of internal motivations and constraints influencing crop diversification policies in Bangladesh.

3.1.9 Ethical considerations

All data collection and interviews followed ethical research standards. Informed consent was obtained from all participants. Confidentiality and professionalism were strictly maintained throughout. Special attention was given to transparency in data reporting and respectful engagement with informants. Application No. IREC.2024.011.

4 Discussion

In policy analysis, it is uncommon to follow a systematic review guided by explicit inclusion and exclusion criteria derived from PRISMA, despite the usefulness of such an analysis in identifying policy directions that may not be overtly stated. While PRISMA was originally developed to guide systematic reviews of peer-reviewed clinical and scientific literature, its structured and transparent approach offers value for policy and program analysis as well [17]. In policy studies, the available evidence is often drawn from government documents, project reports, and program evaluations rather than peer-reviewed publications. These documents, although not peer-reviewed in the academic sense, typically undergo rigorous internal review and approval processes within government systems, which ensure a degree of reliability and accountability.

In our study, PRISMA was adapted to organize and assess this type of evidence systematically. The framework was used to establish clear inclusion and exclusion criteria, document the search and selection process, and provide transparency in how project and program materials related to crop diversification were identified and reviewed. This adaptation allows us to apply the benefits of systematic review methods such as reducing bias and increasing replicability within a policy review setting. At the same time, we acknowledge that applying PRISMA in policy analysis has limitations. Unlike peer-reviewed scientific literature, government and program documents may vary in accessibility, consistency, and comprehensiveness. Furthermore, because the framework was designed for academic studies, some aspects (such as standardized measures of study quality) cannot be applied in the same way to project documents. We therefore used PRISMA as a guiding structure rather than a strict protocol, tailoring it to the context of project and program review. The PRISMA's approach has been adapted for systematic reviews and evidence syntheses in policy analysis, social programs, and education, where methodological transparency and clear reporting of selection criteria are also critical [17].

For instance, the application of the framework revealed that most crop diversification initiatives since the 1980s were driven by government plans and donor funding. A systematic screening of 1,223 projects identified 81 for in-depth review; however, only 19 clearly stated crop diversification as an objective. This illustrates the benefit of having inclusion and exclusion criteria using PRISMA approach, which allow probing both explicit and implicit policy objectives. The framework's advantage lies in its ability to address various dimensions, including historical, political, and social aspects, which traditional policy analysis tools often overlook comprehensively. The focus on understanding institutions in the second phase is also crucial for agricultural policies, as the policy environment, institutions, and various stakeholders interact and shape the policy outcome.

The novel analytical framework for examining the agricultural policies was developed and applied to crop diversification policies and practices in Bangladesh, validating its adaptability to this context [18]. We analyzed crop diversification policies, programs, and projects from 1980 to 2022. The findings demonstrate the framework's effectiveness in revealing valuable insights, policy gaps, operational challenges, and practical guidelines for policymakers and development practitioners to enhance the effectiveness of crop diversification efforts toward sustainable agriculture.

The analytical framework presented in this paper offers a comprehensive approach to understanding the political economy of agricultural policies and addresses several limitations of traditional policy analysis methods. Unlike earlier frameworks such as those proposed by Moncrieffe and Luttrell, Moore, and OPM, which provide general guidance for sectoral political economy analysis, our adaptation is tailored to the specific context of agricultural policy such as crop diversification in Bangladesh. One of the key strengths of this framework is its multi-dimensional scope, with explicit attention to political, economic, social, and ecological dimensions. This aligns with recent policy analysis trends that stress the importance of cross-sectoral integration, as highlighted by Candel and Biesbroek [24]. For example, Stage I of our framework integrates a comprehensive country and sector analysis, providing essential context for understanding the formulation and implementation of policies. Our approach also introduces sector-specific detailing, moving beyond broad country-level political and institutional diagnostics to focus on agriculture-specific dynamics. A detailed historical analysis of Bangladesh's rice-centric policy trajectory since the 1970s demonstrates how successive Five-Year Plans and agricultural reforms reinforced institutional inertia toward monoculture. In addition, the framework emphasizes data-driven integration. Building on over 1,223 projects systematically reviewed using PRISMA guidelines, as well as Five-Year Plans and policy documents, the analysis is grounded in quantifiable outcomes such as crop diversification indices (e.g., Herfindahl–Hirschman Index), budget allocations, and project impact assessments [18, 23]. This contrasts with the largely qualitative orientation of earlier frameworks and enhances both rigor and transparency. Finally, the framework places significant emphasis on organizations, institutions, and actors (Stage II). This is particularly relevant in the agricultural sector, where, as Mockshell and Birner [25] note, the complex interplay among diverse stakeholders significantly influences policy outcomes. By systematically analyzing decision-making processes, power structures, and institutional roles, our framework provides a nuanced understanding of how agricultural policies are shaped and implemented.

The application of this framework to crop diversification policies in Bangladesh demonstrates its practical utility. The review traces how diversification efforts evolved over time, highlighting shifts in design, funding, and implementation [23]. This long-term perspective is crucial for understanding policy trajectories and outcomes, as emphasized by Knickel et al. (2018) [31] in their analysis of agricultural modernization policies.

One notable finding from the application of this framework is the identification of both explicit and implicit crop diversification objectives in various projects [18, 23]. This observation aligns with recent research by Eitzinger et al. [32], who highlights the importance of recognizing both direct and indirect policy interventions in promoting agricultural diversification. The framework's ability to capture these nuances enhances its value as an analytical tool.

Using PRISMA to screen projects adds rigor and addresses a common criticism of policy analysis frameworks, namely limited transparency in data selection and analysis [15]. This methodological innovation enhances the reproducibility and credibility of the findings, setting a new standard for transparency in agricultural policy analysis.

The engagement with 'internal experts' and key informants, as described in Sect.3.6, is a critical component of the framework. This approach aligns with recent calls for more participatory and inclusive policy analysis methods [19]. By incorporating diverse perspectives, including those of government officials and project implementers, the framework provides a more holistic understanding of policy dynamics and challenges.

The emphasis on ground-truthing policy outcomes, impacts and feedback loop is a crucial aspect of the framework that addresses a common criticism of top-down policy analysis approaches. As noted by Meijer, Lorenz, and Wessels [22], the disconnect between policy intentions and on-ground, realities often lead to suboptimal outcomes. By incorporating beneficiary experiences and local data, this framework provides a more accurate assessment of policy impacts.

The framework's ability to trace the historical evolution of crop diversification policies in Bangladesh offers valuable lessons for other developing countries grappling with similar agricultural challenges [23]. As Pingali (2012) notes that understanding the historical context of agricultural policies is crucial for designing effective interventions in the face of emerging challenges like climate change and food security.

While the framework was applied to Bangladesh as a case study, its structure, grounded in historical, political, institutional, and socio-economic analysis, allows for adaptation to a wide range of agricultural contexts in other low- and middle-income countries. For example, its multi-stage design enables researchers and policymakers to integrate context-specific data and stakeholder perspectives relevant to their settings. Looking ahead, this analytical framework has the potential to inform more effective and context-specific agricultural policies. Its comprehensive approach could be particularly valuable in addressing complex challenges such as climate resilience in agriculture, a topic of increasing importance as highlighted by [20].

5 Conclusion

The analytical framework presented in this paper represents a significant advancement in agricultural policy analysis. By integrating political economic considerations, historical context, and stakeholder perspectives, it offers a more nuanced and comprehensive approach to understanding policy dynamics. Its application to crop diversification

in Bangladesh demonstrates its practical utility and potential for adaptation to other agricultural policy contexts beyond crop diversification. The insights gained from this framework and its application have important implications for policymakers, researchers, and development practitioners [18, 23]. A more comprehensive understanding of factors shaping agricultural policies can improve intervention design, resource allocation, and the sustainability of agricultural systems. As agriculture continues to face complex challenges, including climate change, food security, and economic pressures, frameworks like the one presented here will be increasingly valuable. They offer a path towards more informed, context-specific, and impactful agricultural policies that can address the needs of farmers, consumers, and the environment in an integrated manner. One key limitation of this study is the limited availability of digital documentation for projects prior to 2010. Although physical records were accessed for this period, some relevant initiatives may have been excluded due to incomplete or inaccessible archival systems. This constraint affected the comprehensiveness of the project review and underscores the importance of strengthening documentation and record-keeping practices within the sector.

6 Future research

Future research could build this framework in several important ways. First, it could be refined by incorporating quantitative indicators, to strengthen the evaluation of policy outcomes. Second, while this study applied the framework to crop diversification in Bangladesh, future research should test its adaptability across different agricultural sectors and subsectors such as irrigation reform, subsidy allocation, land tenure, livestock, fisheries, and agroforestry and in diverse geographical contexts. Comparative studies of this kind would help demonstrate the framework's broader relevance and highlight any sector-specific adjustments required for effective use. Third, the framework could be enhanced through the application of emerging analytical tools. For example, network analysis could be used to map relationships among institutions and stakeholders, while machine learning approaches could help identify hidden patterns in project data and policy networks. These methods would strengthen the capacity to analyze complex institutional interactions and policy outcomes. Finally, one limitation of this study was the absence of ground-truthing with farming communities/beneficiaries. Future work should prioritize field-level validation to assess whether the intended policy outcomes align with actual experiences on the ground, including unintended consequences. Such engagement would help close the gap between policy design and farmer realities, thereby enhancing the framework's practical relevance.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1007/s43621-025-02445-6>.

Supplementary Material 1.

Supplementary Material 2.

Supplementary Material 3.

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Author contribution

Ravi Nandi: Writing—original draft, Validation, Supervision, Methodology, Formal analysis, Data curation, Conceptualization. Timothy J. Krupnik: Writing—review & editing, Supervision, Resources, Funding acquisition. Bhuvana, Srijeeth, Avinash and Wais Kabir: Writing—review & editing, Investigation, Data curation.

Data availability

The data collected and analyzed is made available to the public and is provided as Annexure II.

Declarations

Ethics approval and consent to participate

Taken.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. dv

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References

1. Birner R, Resnick D. The political economy of policies for smallholder agriculture. *World Dev.* 2010;38:1442–52.
2. Pingali PL. Green revolution: Impacts, limits, and the path ahead. National Academy of Sciences; 2012.
3. Hazell P, Poulton C, Wiggins S, Dorward A. The future of small farms: trajectories and policy priorities. *World Dev.* 2010;38:1349–61.
4. Weible CM. Expert-based information and policy subsystems: a review and synthesis. *Policy Stud J.* 2008;36:615–35. <https://doi.org/10.1111/j.1541-0072.2008.00287.x>.
5. Cairney P. Understanding public policy: theories and issues. Bloomsbury Publishing; 2019.
6. Momeni M, Razavi V, Zahedi S, Momeni F, Behzadian K, Dolatabadi N. A study of the required sustainability-driven institutional and behavioural mechanisms to tackle the anticipated implications of agricultural water price shocks: a system dynamics approach. *Sci Rep.* 2023;13:15397.
7. Meckling J, Karplus VJ. Political strategies for climate and environmental solutions. *Nat Sustain.* 2023. <https://doi.org/10.1038/s41893-023-01109-5>.
8. Heikkila T, Cairney P. Comparison of theories of the policy process. In: *Theories of the policy process*. Routledge; 2018. p. 301–27.
9. Duncan A (2003) Drivers of Change: reflections of experience to date. In: Discussion note prepared by Alex Duncan, with contributions from Stephen Jones, Evelyn Dietsche, and participants at a workshop held in Oxford on June 23rd
10. Schleiff MJ, Kuan A, Ghaffar A. Comparative analysis of country-level enablers, barriers and recommendations to strengthen institutional capacity for evidence uptake in decision-making. *Health Res Policy Syst.* 2020;18:78. <https://doi.org/10.1186/s12961-020-00546-4>.
11. Howlett M, Ramesh M, Perl A. Studying public policy: Policy cycles and policy subsystems. Oxford University Press Toronto; 1995.
12. Heyi ND. Policy actors and institutions in the policy process at sub-national level in Ethiopia: the case of oromia regional state. *J Sustain Dev Afr.* 2020;22:2.
13. World Bank (2007) International trade and climate change: economic, legal, and institutional perspectives. The World Bank
14. Moncrieffe J, Luttrell C. An analytical framework for understanding the political economy of sectors and policy arenas. ODI Lond; 2005.
15. NCPI (2003) NCPI State Policy Assessment Toolkit: Conceptual Framework. <http://tinyurl.com/kppy8a7m>. Accessed 29 Aug 2023
16. Moore M (2001) Types of Political Systems: a Practical Framework, for DFID staff. Lond DFID Mimeo
17. Page MJ, Moher D, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. PRISMA 2020 explanation and elaboration: updated guidance and exemplars for reporting systematic reviews. *BMJ.* 2021. <https://doi.org/10.1136/bmj.n160>.
18. Nandi R, Krupnik TJ, Kabir W. Crop diversification in Bangladesh: Public policy provisions, practices, and insights for future initiatives. *J. Agric. Food Res.* 2024;18:101486. <https://doi.org/10.1016/j.jafr.2024.101486>
19. Rogge KS, Pfluger B, Geels FW. Transformative policy mixes in socio-technical scenarios: the case of the low-carbon transition of the German electricity system (2010–2050). *Technol Forecast Soc Change.* 2020;151:119259.
20. Loboguerrero Rodriguez AM, Birch J, Thornton PK, Meza L, Sunga I, Bong BB, Rabbinge R, Reddy M, Dinesh D, Korner J (2018) Feeding the world in a changing climate: an adaptation roadmap for agriculture. The Global Commission on Adaptation. Rotterdam and Washington, DC. 20 p. <https://hdl.handle.net/10568/97662>
21. Yang Y, Tan X, Shi Y, Deng J. What are the core concerns of policy analysis? A multidisciplinary investigation based on in-depth bibliometric analysis. *Humanit Soc Sci Commun.* 2023;10:1–12.
22. Meijer A, Lorenz L, Wessels M. Algorithmization of bureaucratic organizations: using a practice lens to study how context shapes predictive policing systems. *Public Adm Rev.* 2021;81:837–46. <https://doi.org/10.1111/puar.13391>.
23. Nandi R, Krupnik TJ, Kabir W, Jackson T. Nurturing the sustainable food systems: crafting policies and practices for crop diversification in Bangladesh. *Front Sustain Food Syst.* 2024;8:1459526. <https://doi.org/10.3389/fsufs.2024.1459526>.
24. Candel JLL, Biesbroek R. Policy integration in the EU governance of global food security. *Food Secur.* 2018;10:195–209. <https://doi.org/10.1007/s12571-017-0752-5>

25. Mockshell J, Birner R. Who has the better story? On the narrative foundations of agricultural development dichotomies. *World Dev.* 2020;135:105043. <https://doi.org/10.1016/j.worlddev.2020.105043>
26. Kumar Sharma P (2017) Pattern of crop concentration and crop diversification-An economic analysis
27. Browne J, Coffey B, Cook K, Meiklejohn S, Palermo C. A guide to policy analysis as a research method. *Health Promot Int.* 2019;34:1032–44.
28. Rubin HJ, Rubin IS. *Qualitative interviewing: The art of hearing data.* Sage; 2011.
29. Leech BL. Asking questions: techniques for semistructured interviews. *PS Polit Sci Polit.* 2002;35:665–8.
30. Moher D. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: the PRISMA Statement. *Ann Intern Med.* 2009;151:264. <https://doi.org/10.7326/0003-4819-151-4-200908180-00135>.
31. Knickel K, Redman M, Darnhofer I, Ashkenazy A, Calvao Chebach T, Sumane S, et al. Between aspirations and reality : making farming, food systems and rural areas more resilient, sustainable and equitable. *J. Rural Stud.* 2018;59:197–210.
32. Eitzinger A, Binder CR, Meyer MA. Risk perception and decision-making: do farmers consider risks from climate change?. *Clim Change.* 2018;151:507–524. <https://doi.org/10.1007/s10584-018-2320-1>

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