

Science-policy interactions for climate-smart agriculture uptake: lessons learnt from national science-policy dialogue platforms in West Africa

Working Paper No. No.265

CGIAR Research Program on Climate Change,
Agriculture and Food Security (CCAFS)

Robert B. Zougmoré
Samuel T. Partey
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RESEARCH PROGRAM ON
**Climate Change,
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Contact:

CCAFS Program Management Unit, Wageningen University & Research, Lumen building, Droevendaalsesteeg 3a, 6708 PB Wageningen, the Netherlands. Email: ccaafs@cgiar.org

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Abstract

Science–policy interfaces are critical in shaping agricultural and environmental governance. However, connecting science with policy has always been a challenge for both scientists and policymakers. In Ghana, Mali and Senegal, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) supported the creation of a multi-stakeholder national science-policy dialogue platforms on climate-smart agriculture (NSPDP-CSA) to use scientific evidence to create awareness on climate change impacts on agriculture and advocate for the mainstreaming of climate change and climate-smart agriculture (CSA) into agricultural development plans. Since their establishment, there is limited information as to how the modes of operation and achievements of the NSPDP-CSA improve our understanding of the science-policy interfaces of agricultural and climate change decision making. This study aimed to use the evidence from the operations and achievements of the NSPDP-CSA to make recommendations for effective science-policy interaction on climate change and CSA. We used semi-structured questionnaire interviews and review of technical reports produced by the platforms to obtaining the information aforementioned. The results showed that using NSPDP-CSA may be an innovative approach to effectively engaging policymakers/decision-makers for climate change and CSA mainstreaming into agricultural development policies and plans in Ghana, Mali and Senegal. For effective science-policy interaction, the study suggests the following recommendations: (a) Institutionalising the NSPDP-CSA through embedding them within national institutions improves their credibility, relevance and legitimacy among policymakers; (b) two-way communication may have a phenomenal advantage in the co-development of solutions that address climate change vulnerabilities and impacts; and (c) using relevant communication products and packaging CSA and climate change with evidence to align with country priorities will facilitate readily uptake in policy decision-makings. A framework of operation for the platforms was suggested based on lessons learnt from the 3 countries' experiences and achievements.

Keywords

Climate change, policy, institution, partnership, knowledge, capacity building

About the authors

Dr. Robert B. Zougmore is the Africa Program Leader of CCAFS based at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Bamako, Mali.

Contact: r.zougmore@cgiar.org

Dr. Samuel T. Partey is the Science of the CCAFS West Africa Regional Program based at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Bamako, Mali.

Contact: s.partey@cgiar.org

Dr. Edmond Totin is a Climate Impact and Adaptation Expert for Climate Analytics and was previously a CCAFS Project Leader at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).

Contact: edmond.totin@climateanalytics.org.

Dr. Mathieu Ouédraogo is the Participatory Action Research Scientist of the CCAFS West Africa Regional Program based at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Bamako, Mali. Contact: m.ouedraogo@cgiar.org

Dr. Philip Thornton is the CCAFS Flagship Leader for Priorities and Policies for CSA and based at the International Livestock Research Institute (ILRI), Nairobi, Kenya.

Contact: p.thornton@cgiar.org

Dr. Naaminong Karbo is a researcher at the CSIR-Animal Research Institute of Ghana and was a former director of the same institute.

Contact: minongkordam@yahoo.com

Mr. Bougouna Sogoba is the Director of the NGO AMEDD (Association Malienne d'Eveil au Développement Durable), Koutiala, Mali.

Contact: bougouna.sogoba@ameddmali.org or bsogoba67@yahoo.fr

Mr. Bounama Dieye is a Chief of Division, Ministry of Agriculture, Senegal.

Contact: bounama1968@gmail.com

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1. Introduction

With the current trend of population growth in West Africa, the increased demand for food is a foremost challenge. When one takes into account the effects of climate change (higher temperatures, shifting seasons, more frequent and extreme weather events, flooding and drought) on food production (Jalloh et al., 2012), that challenge grows even more daunting. Agriculture as the major source of livelihood for majority of West Africans is being seriously impacted, thus creating a great threat to farmers in the region. Addressing the negative impacts of climate change on agriculture will require adaptation and mitigation efforts in line with the Malabo Declaration regarding the commitment to enhancing the resilience of livelihoods and production systems to climate variability and related risks (NEPAD, 2014). These efforts will also contribute to achieving the Sustainable Development Goals on climate action and zero hunger. The concept of climate-smart agriculture (CSA) is based on this development priorities and aims at sustainably improving food security, reducing climate-related risks and mitigating climate change (FAO, 2010).

Given the cross-sectoral nature of climate change impact, improving the adaptive capacity of people would require an inter-disciplinary approach for climate-smart technologies, policies and institutions, which will constitute the backbone for informed development of agricultural programs, plans and strategies (Dinesh et al., 2018). Indeed, meeting the challenges associated with climate change and its impacts on agriculture and food security are unlikely without transforming the ways researchers, policymakers, farmers, civil society, and the private sector all interact. With the new challenges posed by climate change, a multitude of development actors have emerged in West Africa, yet the coordination, communication and exchange of information on the subject still remain very weak (Totin et al., 2017). For effective, timely and informed decision-making, actors need advice or insight for the multiple issues underlying their decisions. However, according to Schut et al. (2016), until now, this has been slow to materialize due to the lack of appropriate strategies to establish a fruitful dialogue between researchers and decision-makers [6]. Very often, the lack of opportunities for meetings between stakeholders, or the adequate instruments for disseminating research results do not allow "uninitiated people" to have quick access and clear understanding to use them. To address this problem, establishment of multi-stakeholder science-policy dialogue platforms is considered an opportunity to improve interactions among stakeholders in order to foster the development and strengthening of climate change policies that benefit the agricultural sector (Schut et al., 2015). These science-policy dialogue platforms, analogue to agricultural innovation platforms, can be at the village, national, regional or global levels. As a multi-stakeholder platform, they represent the larger socio-ecological system within which a particular agricultural innovation operates (Van Rooyen et al., 2017). The mode of operation of agricultural policy dialogue and innovation

platforms is seen in their interaction, negotiation and collective action towards a common goal (Schut et al., 2016).

In West Africa, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) has since 2012, supported the creation of national science-policy dialogue platforms on climate-smart agriculture (NSPDP-CSA) in Mali, Ghana and Senegal. The NSPDP-CSA, consisting of different stakeholders within the agricultural sector, were established to use scientific evidence in order to create awareness on climate change impacts on agriculture and recommend for the mainstreaming of climate change and CSA into agricultural development plans. The NSPDP-CSA were also expected to influence the environmental sectors within the respective countries. Since their establishment, there is limited information as to how the modes of operation and achievements of the NSPDP-CSA improve our understanding of the science-policy interfaces of agricultural and climate change decision making. The aim of this study is to use the evidence from the operations and achievements of the CCAFS platforms to make recommendations for effective science-policy interaction on climate change and CSA. To achieve this, we first determined the different activities implemented by the platforms under various national contexts and their contribution to national priorities on climate change, agriculture and food security. Secondly, we assessed the different forms of interaction that were at play between science and policy in the course of action of the platform by analyzing their recognition among policy actors as well as knowledge generation and communication strategies linked to decision-making processes on the mainstreaming of CSA and climate change into agricultural policies and development plans.

2. Methodology

2.1. Analytical framework

Science-policy interface (SPI) is a well-researched area in the environmental and agricultural sciences. In most environmental issues, which require inter- and transdisciplinary approaches, SPI is considered as an effective approach to take into account a variety of knowledge types, views and interests of scientists, policy actors and other decision makers (Lopez-Rodriguez et al., 2015). In the scholarly literature, ways to understand the interfaces of science and policy have been conceptualized theoretically in a number of ways. Funtowicz and Strand (2007) contextualized policy engagement strategies that may be adopted by scientists as modern, precautionary, consensus, demarcation and extended participation models. These are described in Table 1 and known to be context-specific with their advantages and downsides. Dilling and Lemos (2011) and Landry et al. (2001) also explained the different ways by which knowledge must be produced and disseminated for effective science-policy interaction. They categorized

this into three different models of science creation – science-push model, demand-pull model and the co-production model (Figure 1).

Basically, the science-push model assumes that decision-makers will make use of scientific knowledge because of their needs. Scientific production is driven by the pursuit of knowledge by the researcher rather than the policymaker (Dilling and Lemos, 2011) although the advances in the findings of the research is considered a major determinant to the utilization of knowledge by the policymaker (Landry et al., 2001).

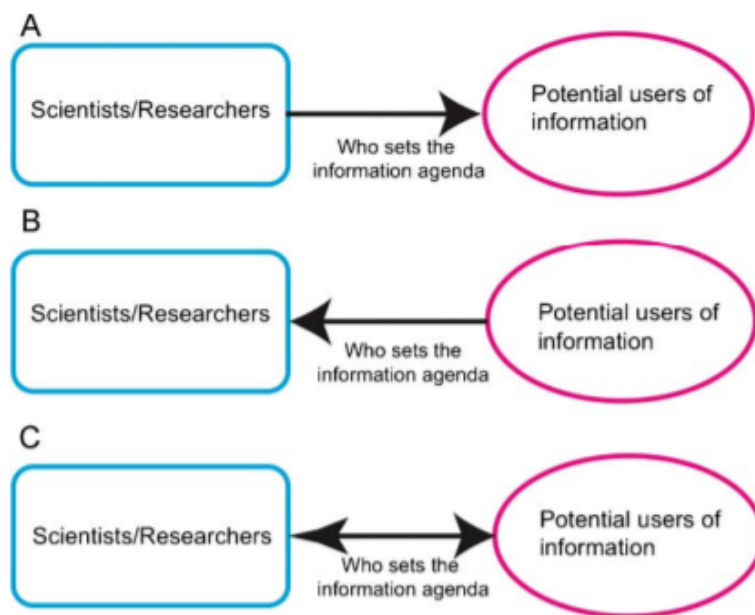


Figure 1: Models of science creation. A= Science push; B = Demand pull, C = coproduction model (Dilling and Lemos, 2011).

For the demand-pull model, Landry et al. (2001) indicate that through questing for solutions to problems, policymakers demand researchers to conduct scientific research. According to Sarewitz and Pielke (2007) the demand-pull model may sometimes lead to users of knowledge requesting for scientific information that may be difficult to produce [13]. However, knowledge produced through the demand-pull model generally have higher expectation of uptake even if not used straightforward. The third model known as the coproduction model combines the science-push and demand-pull models. In this model, knowledge is co-produced through the frequentativity or close iteratively between the scientific community and the potential users (Landry et al., 2001).

According to Cash et al. (2003), the development of knowledge products at the interface of science and policy and the scientists or institutions that produce them must be credible, salient and legitimate for an effective science-policy interaction that yields expected outcomes. By

credibility they referred to the trustworthiness, standard, technical adequacy and scientific plausibility of scientists and information delivered in the policy process (Van Enst et al., 2014). Saliency was described as the relevance of scientists and information generated to policy processes; while legitimacy was described as the manner by which scientists or knowledge developed and used in the policy process is fair, respectful of varying values and beliefs of stakeholders and their political acceptability (Cash et al., 2003; Van Enst et al., 2014; Koetz et al., 2012). Several other conditions or recommendations for effective science-policy interfaces have also been highlighted in the literature, including ensuring long-term dialogue, mutual learning and institutional support (Gorg et al., 2016; Marshall et al., 2017).

2.2. Methodology for analysis of platforms' modes of operation and achievements

To advance knowledge on how the modes of operation and achievements of the NSPDP-CSA improve our understanding of the science-policy interfaces of agricultural and climate change decision making, we first employed the three analytical categories defined by Cash et al. (2003) to determine how the platform was considered credible, salient and legitimate in carrying out their mandate of influencing policy decision-making processes. To do this, we considered the NSPDP-CSA as institutions whose implementation successes and failures may be attributed in part, to their recognition and operational strategies (Koetz et al., 2012; Koerts et al., 2011). By institutions, we do not refer to rules and norms, clusters of rights, rules, and decision-making procedures that give rise to social practice, assign roles to participants, and guide interactions as defined by Young et al. (2014). Instead, we consider institutions to be any organization, establishment, foundation, or the like, devoted to the promotion of a particular cause or program, especially one of public character (Koetz et al., 2012). Secondly, we related the platforms engagement with policymakers to the theoretical models of science-policy interactions described by Funtowicz and Strand (2007) and Udovik (2014). The models briefly described in Table 1 have been used by several researchers to address problems in the present practices of interfacing the science and policy of complex issues (Funtowicz and Strand, 2007) such as climate change. The models help determine engagement strategies and communication pathways that applied in the case of the platforms. We used context-specific actions, achievements and knowledge products of the platforms to illustrate the above determinants, thus consistent with the interpretation of CSA (FAO, 2010).

Table 1: Models of science-policy interactions used in the analysis

| Model | Explanation |
|---------------------|--|
| Modern model | This is based on the assertion that science informs policy by producing objective, valid and reliable knowledge [10]. This is followed by sorting values and prioritization for the formulation of the most applicable policy. Under conditions of uncertainties, this model may likely underestimate risks and lead to the politicization of science (Udovyk, 2014). |
| Precautionary model | This model is particularly relevant for the management of risks. It recommends taking action when the likely benefits outweigh the cost of delays. Although characterized by divergent views, the model has been used in the Rio Declaration on Environment and Development, and the exploration of approaches to Bisphenol A management in the EU (Udovyk, 2014). |
| Consensus model | This model acknowledges the multiple avenues or voices by which science speaks to policy which can be often conflicting, truths to power seen as a rescue of the modern model from conflicting certainties. Important elements in the model include scientific dialogue, creation of inter-subjective knowledge in intergovernmental expert panels, and the search for robust findings (Udovyk, 2014; Wardekker et al., 2008). |
| Demarcation model | This model assumes that individuals and institutions generating science may alter the conclusions or content of their findings based on their interests and values. As such, advice provided cannot be guaranteed to be objective and neutral which might abuse science when used as evidence in the policy process. For this reason, the demarcation between the providers of scientific information and users is recommended as a means of protecting science from potential ‘political’ interferences that may undermine its integrity. This demarcation is meant to ensure that political accountability rests with policy makers and is not shifted, inappropriately, to scientists (Funtowicz and Strand, 2007; Udovyk, 2014). |

| | |
|------------------------------|---|
| Extended participation model | This model challenges the approach of the modern model. It recommends the consideration of all knowledge systems in science-policy interactions. Instead of considering science as the sole legitimate provider of knowledge, the model suggests a more participatory approach to the management and generation of advisory services based on science. In brief, the extended participation model recommends that science should be one part of the ‘relevant knowledge’ or should be brought in as evidence for a decision or policy process (Funtowicz and Strand, 2007; Udovyk, 2014). |
|------------------------------|---|

Finally, we related knowledge generation strategies of the platforms to the three different models of science creation described by Dilling and Lemos (2011) and Landry et al. (2001) – science push-model, demand-pull model and the co-production (Figure 1).

Data and information collection on the platforms’ operation strategies, communication strategy, knowledge products developed, activities and achievements, were done through semi-structured questionnaire interviews structured around the above-mentioned areas (Dinesh et al., 2018; Fowler, 2013). We also followed up sometimes with additional open-ended questions to bring further insights on the targeted aspects of the platform work. Respondents included per country (i) the chair, (ii) the vice-chair (iii) and the secretary of the platforms and (iv) three decision-makers (mainly heads of departments) in the government ministries of agriculture, research and environment. Information collected with each respondent were triangulated with those from other respondents. In addition, we conducted reviews of various information sources produced by the platforms. Indeed, the numerous reports and knowledge products developed by the platforms (Table 3) were powerful means to cross-check results achieved and coherence of views expressed by the respondent vis-à-vis the platforms’ operation strategies, communication strategy, knowledge products developed, activities and achievements. In total, about 28 knowledge documents for Ghana, 24 for Mali and 28 for Senegal were used as sources of information. While of qualitative nature, information and opinions collected from respondents were also important to better understand perspectives and experiences of countries’ actors involved or interested by these national platforms (Sarewitz and Pielke, 2007).

3. Results

The operations and achievements of the NSPDP-CSA were analyzed vis-à-vis the 3 expected determinants: (1) Mandate of influencing policy decision-making, (2) knowledge generation for effective science-policy interaction and (3) engagement and communication pathways for effective science-policy interaction.

3.1 Mandate of the platforms for influencing policy decision-making

We analyzed the credibility, legitimacy and saliency of the platforms as institutions carrying out the mandate of producing and sharing scientific knowledge that will influence science-policy interaction for decision-making (Cash et al., 2003). Considering the cross-cutting nature and corollary complexities of climate change issues, it is crucial that the platforms be legitimated to undertake the science-policy interactions for climate change policy decision-making. Legitimacy was described as the manner by which scientists or knowledge developed and used in the policy process is fair, respectful of varying values and beliefs of stakeholders and their political acceptability (Cash et al., 2003; Van Enst et al., 2014; Koetz et al., 2012). This was triggered through the use of a participatory approach to set up the country platforms as explained in Figure 2. Such participatory approach allowed for the development of multi-stakeholder entities with cognitive diversity and have interest in climate-smart agriculture decision-making processes (Joyce, 2003). The setup of the country platforms started with a regional workshop in Dakar, Senegal with various representatives of Ghana, Mali and Senegal. Generally, the representatives originated from six key sectors: environment, agriculture, research, Academia, farmers and civil society organizations. The goal of the workshop was to have high level representation of decision makers or policy advisors from the above sectors to discuss the relevance of putting in place a specific national science-policy dialogue platform for each of the three countries, and in case such platforms already existed in a given country, what specific actions would be needed to make it operational. As such, and besides specific goals to be pursued by the platforms, they were also expected to help fill some gaps within the already existing national climate change committees (NCCC) in the countries. As an example, a study by Sogoba et al. (2014) in Mali revealed that although the five thematic groups defined within the National Climate Change Committee cover national climate change priority areas, they haven't been able to generate information products that can inform decisions by policymakers. The NSPDP-CSA can therefore contribute in this direction.

Following the regional workshop, participatory in-country meetings led to the definition of composition, leadership, vision, mission and operating strategies of the platforms. Considered as complementary to already existing initiatives and knowledge networks for combating climate change, it was recommended first and foremost by majority of stakeholders at the workshop to establish a core of up to ten national organizations, and then proceed further with the gradual engagement of other categories of actors. The country core teams also decided to designate an institutional focal point that will coordinate and facilitate the platform operations. The choice was to select the most appropriate organization that could ease bringing on board the thematic shortcomings of countries' NCCC vis-à-vis agriculture and food security. On this basis, the platforms' focal organizations were: Senegal – National Agriculture Directorate (DA), Ghana

- Animal Research Institute under the Council for Scientific and Industrial Research (CSIR-ARI) and Mali - Environment and Sustainable Development Agency (AEDD).

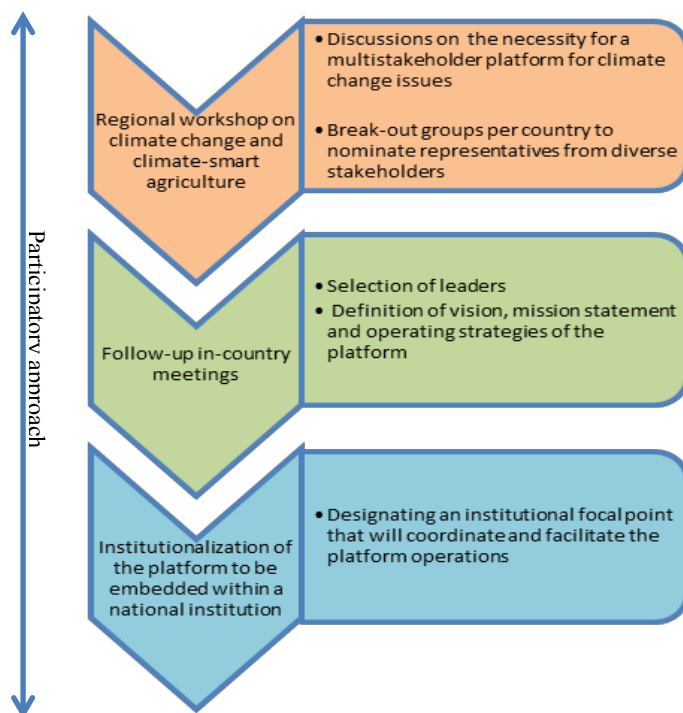


Figure 2: Process of setting up national science-policy dialogue platforms on climate-smart agriculture in Ghana, Mali and Senegal

The general composition of the platforms are depicted as shown for in Figure 3 for Ghana case.

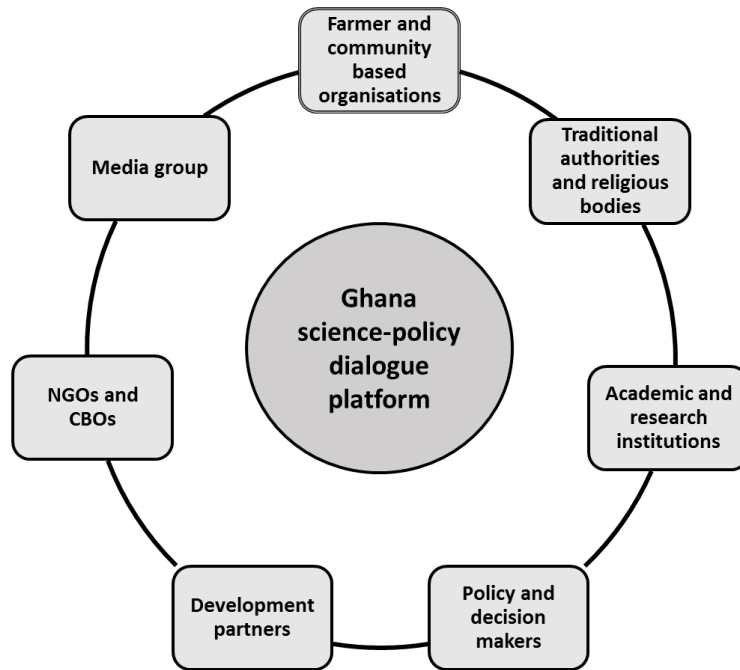


Figure 3: Composition of the Ghana national science-policy dialogue platform on climate change, agriculture and food security

Table 2 also provides characteristics of the 3 country platforms with information on number of members, representing organizations and websites. While the country platforms are generally embedded within different national institutions, the core leadership for all of them consisted of a Chairperson, Vice Chair, Secretary, Accountant, Monitoring and Evaluation Officer and a Communication Officer. In order to reinforce their legitimacy at the country level, the leadership was balanced among different organizations with shared responsibilities. For instance in Ghana, while the chairperson is from the Council for Scientific and Industrial Research (CSIR), the vice chairperson is from the Ministry of Food and Agriculture (MoFA). In Mali, the chairperson is from agriculture sector (DNA) while the vice-chair is from the environment sector (AEDD).

Table 2: Characteristics of the national science-policy dialogue platforms from 2012-2017

| | Ghana | Mali | Senegal |
|---|---|---|--|
| A. KNOWLEDGE SHARING SITES (Webpage or website) | http://www.csir-stepri.org/?item=269 | http://c-casamali.org | www.ccasa-senegal.org |
| B. PLATFORM COMPOSITION | | | |
| Coordinating organisation | Council for Scientific and Industrial Research-Animal Research Institute (CSIR-ARI) | National Directorate of Agriculture (DNA) | Agriculture of Directorate (DA) |

| | | | |
|---|---|---|--|
| Vice chair organisation | Ministry of Food and Agriculture (MoFA) | Environment and Sustainable Development Agency (AEDD) | National Agency of Civil Aviation and Meteorology (ANACIM) |
| Number of organisations members of the core team | 11 | 9 | 7 |
| Total number of organisations members of the platform | 40+ | 20 | 30 |
| Total number of persons members of the platform | 65 | 30 | 100 |
| Ratio of females in the platform (%) | 25 | 25 | 30 |
| Number of sub-national level platforms | 10 | 3 | 14 |

The participatory and inclusive organization and implementation of the above processes for structuring the platforms also contributed to their credibility among national stakeholders. By credibility, van Enst et al. (2014) referred to the trustworthiness, standard, technical adequacy and scientific plausibility of scientists and information delivered in the policy process. Indeed, the trustworthiness and credibility got also increased through organization and coordination by the platforms of major policy initiatives, which led to awareness-raising and engagement of high level policy policymakers (e.g. development of a national CSA action plan in Ghana, Organization of a high-level policy event on climate change mainstreaming into the presidential plan for an emerging Senegal by 2030, with attendance of parliamentarians, Mayors, Permanent Secretaries, etc.).

From the interviews conducted in Ghana, Mali and Senegal, it was evident that the platforms registered as not-for-profit organizations and embedded themselves within existing national institutions as affiliate organizations. In Senegal, a ministerial decree was published in 2015 by the Minister of Agriculture and Rural Equipment to formally institutionalize the platform as a sub-component of the National Climate Change Committee. The decree provided guidance on membership, organisational structure and operating mode of the platform. Under the overall coordination of the platform's chairperson based at the Directorate of Agriculture (DA), five work streams were constituted and assigned to specific institutions: (i) state technical services and decentralized structures are led by the DA; (ii) policy decision makers is led by the Environment Committee of parliament; (iii) research is led by the University of Dakar, the Senegalese Institute for Agricultural Research (ISRA), the National Agency of Civil Aviation and Meteorology (ANACIM); (iv) civil society is led by the national umbrella organization of producer organizations (CNCR); and (v) media is led by a monthly newspaper on agriculture (Agropasteur). Seen as a sub-component of the National Climate Change Committee, the platform is entrusted by the government to handle all aspects of agriculture and

food security vis-à-vis climate change in Senegal. The above settings definitely confirmed the credibility of the platform to deliver scientific information that will guide decision making on climate change issues.

In Mali, the formal creation of the platform was acted upon through an administrative decision in February 2013 by the Environmental Agency for Sustainable Development (AEDD). Formed by the government of Mali in 2010, AEDD was mandated to integrate climate change and coordinate government adaptation and mitigation actions in Mali (Andrieu et al., 2017). Given its position in the climate change institutional landscape of Mali, AEDD was designated as the focal point of the platform, therefore ensuring the secretariat while the National Directorate of Agriculture (DNA) plays the role of chair. It is to note that a Civil Society organization (AMEDD) is also providing technical support to AEDD to animate and implement the platform's activities, therefore increasing the trustworthiness and technical adequacy of the platform. Overall, the platform is considered as an impetus booster to the thematic group on "adaptation to climate change including risks and disasters" of the National Climate Change Committee (Sogoba et al., 214).

In Ghana, the platform was officially launched in November 2012, and formally registered in March 2015 as a not-for-profit entity with certificate from the Register General of Ghana to commence business. In terms of leadership, while the chairperson is from the Council for Scientific and Industrial Research (CSIR), the vice chairperson is from the Ministry of Food and Agriculture (MoFA). Since its launch and registration, the Ghana platform has gained the reputation for climate change and CSA advocacy among government institutions (e.g. MoFA, CSIR, the Environmental Protection Agency), some parliamentarians, NGOs, development organizations (such as the Food and Agricultural Organization of the United Nations), some research centers of the CGIAR consortium such as the International Centre for Tropical Agriculture (CIAT) whose activities in Ghana has involved the platform.

Generally, respondents considered the decision to register and embed the platforms within national institutions as relevant to improve their recognition and visibility among policy decision-makers. Besides recognition by policymakers, interviewees within the platform confirmed institutionalization of the platforms was key to benefiting from funding support from donor organizations who place strong emphasis on the credibility and legitimacy of organizations before granting funding support. For instance, the platforms in Ghana and Senegal obtained funding from the Food and Agriculture Organization of the United Nations (FAO) and the West Africa Agricultural Productivity Program (WAAPP) respectively for various activities on CSA based on evidence of the affiliation to national institutions and the knowledge products on climate change and CSA they have been able to produce. Decision-

makers interviewed also confirmed that by registering and embedding the NSPDP-CSA into already functional and recognized institutions, it allowed for building confidence in their mission, research methodology and results. Apart from CCAFS, the platforms' activities are funded through bilateral sources (e.g. FAO, USAID, WAAPP, collaboration with other CGIAR centers, etc.).

Saliency was described by Cash et al. (2003) as the relevance of scientists and information generated to policy processes. The process through which relevant knowledge products are developed commences with the inclusive identification of priorities and the planning of yearly activities. The surveys revealed that the core teams within the platforms meet to lead the development of yearly work plans which are then validated by the platform members with various activities implemented under the coordination of the secretariat within the group. Regular meetings (on average once a month) are organized to review progress of activities. In addition, capacity training workshops were organized for knowledge sharing and learning around specific climate change topics and policy studies defined by the platform. Indeed, given the diversity and field of specializations of the different stakeholders within the platforms, it was necessary that their capacities be built to enable them effectively engage policymakers in addressing knowledge gaps on climate change, while also getting to know evidence-based CSA solutions. This is identified as a core requirement for effective science-policy interactions (Totin et al., 2017). Numerous awareness-raising meetings were organized on various topics of interest for the countries (e.g. the importance of climate information for decision-making on climate risk management, the concept of CSA and what it entails for countries' climate change strategies and policies, public debates on national TV about national adaptation plans, high-level policy events with policy and decision-makers). Some of the above-mentioned awareness-raising initiatives have used capitalization documents developed by the platforms. For instance, Ghana produced 4 working papers, Mali 3 and Senegal 3, which saliently address topics covering doubts and uncertainties among policymakers (Table 3). The platforms also attended and contributed to global-level events such as the UNFCCC' Conference of Parties, the global CSA alliance meetings. For instance at the COP in Warsaw, a learning workshop on "Agriculture in National Adaptation Plans (NAP)" gathered representatives from 12 countries, including those of platforms from Ghana and Mali. They developed a NAP analytical framework and a policy brief with recommendations on solutions to successful national adaptation plans (Kissinger et al., 2014).

3.2. Knowledge generation

We relate knowledge generation strategies of the platforms to the three different models of science creation i.e. science push-model, demand-pull model and the co-production (Figure 1). From the interviews, the platforms revealed that the main approaches for defining activities

focused at generating knowledge and informing and engaging policy decision makers. Respondents confirmed that knowing what national agricultural policy, plan, program or strategy to target for climate change and/or CSA mainstreaming was a challenging one. To do this, they use desktop reviews and also organize meetings with decision-makers (mostly high-level government officials and heads of government departments) within the ministries of agriculture and in some instances with parliamentarians in their network, to develop a compendium of existing and proposed national policies, plans, programs and strategies in the agricultural sector that are being drafted, finalized, validated or approved by parliament (. In addition, the platforms resort to both primary and secondary research information to characterize the agricultural sectors of the countries, and review information on climate change vulnerabilities, impacts on agriculture and food security and existing adaptation strategies. In doing this, they also develop a compendium of available CSA options that can help farmers build adaptive capacity to climate change and variability. The costs and benefits of adopting specific CSA options are also evaluated and explained.

Deciding on what agricultural policy or development plan to prioritize for CSA mainstreaming has depended on what decision makers deem as most urgent and relevant. The platforms therefore worked in collaboration with policymakers in the identification and implementation of solutions. With this approach, the platform members gain awareness of the variety of directions in which their research findings can impact policy while policymakers/decision-makers note areas where more applied research may be required. The platforms consider this manner of working and co-creating knowledge with decision-makers as central for improving the uptake of policy recommendations. In Mali for instance, the adoption of the two-way communication approach emanated from a diagnosis study that analyzed and shed light on the current situation of actors and organizations, barriers and opportunities for an operational dialogue between national climate change stakeholders (Sogoba et al., 2014). Recommendations from the study, contributed to improving inter-institutional dialogue and well-informed decision-making on climate change.

All scientific evidences on climate change vulnerabilities, impacts on agriculture, adaptation strategies and CSA options are published as easily accessible communication products such as working papers, policy briefs, Info Notes which come in both paper prints and electronic forms (Table 3).

Table 3: Knowledge products generated and policy processes contributed by the science-policy dialogue platforms from 2012-2017

| | Ghana | Mali | Senegal |
|--|-------|------|---------|
| | | | |

| PUBLICATIONS | | | |
|--|---|---|---|
| Number of working papers | 4 | 3 | 3 |
| Number of Info Notes | 4 | 2 | 3 |
| Number of Flyers/ brochures | 3 | 2 | 5 |
| Number of blogs | 4 | 6 | 5 |
| Number of journal papers | 0 | 1 | 0 |
| Other products | 3 proceedings, 5 videos, 2 reports | 4 videos, 2 radio programs | 7 videos |
| CONTRIBUTIONS TO POLICIES PROCESSES | | | |
| Policy processes influenced | 3 | 2 | 3 |
| Contributed processes of national/sub-national policies/ plans | National CSA investment framework, Livestock policy action plan, District-climate change action plans & budgets | CSA for climate resilient communities' project in Mali, CSA mainstreamed into Mali GCF calls. | PRACAS, PSE, National agriculture action plan |

3.3 Engagement and communication pathways for effective science-policy interaction

We analyzed the platforms engagement and communication pathways based on the theoretical models of science-policy interactions described by Funtowicz and Strand (2007) and Udovyk (2014) (Table 1). Funtowicz and Strand (2007) contextualized policy engagement strategies that may be adopted by scientists as modern, precautionary, consensus, demarcation and extended participation models. The communication within the platforms and with other national and regional stakeholders was crucial to the effective science-policy interaction. This was concretized through different mechanisms such as: (1) the platforms core teams' regular meetings to prioritize their yearly work plans and monitor progress on implementation of planned activities, but also through the overall platform members' meetings to discuss and validate work plans, terms of references and results of commissioned studies; (2) various capacity training workshops organized for knowledge sharing and learning around specific climate change topics and policy studies selected by the platform; (3) the use of the knowledge communication products for high-level policy engagements to advocate and inform policy changes and decision-makings on climate change, agriculture and food security; (4) the widespread dissemination of knowledge and information through media and websites. The Senegal platform in particular has a dedicated website where they largely share information on the platform's activities and disseminate knowledge they generated (<http://ccasa-senegal.org/>).

The other platforms have created dedicated web pages within the focal entity's website (Table 2). Examples on how the above-described communication pathways were effective are detailed in below sections on countries' achievements.

3.4 Examples of the platforms' activities and achievements

Although several results were achieved by each platform, the aim of this section is to provide specific examples that could feed the discussions on how lessons learnt from the science-policy dialogue platforms in Ghana, Mali and Senegal can contribute to advancing knowledge about how the roles and modes of operation of multi-stakeholder policy dialogue platforms can inform sound policy decision making. In most cases, the example achievements are a result of the combination of the 3 above determinants expected from the platforms (Mandate, Knowledge generation, engagement and communication). Information reported here were obtained from reviews of various technical reports submitted by the platforms to CCAFS and crossed with interviews with the chairpersons and secretary members of the platforms.

3.4.1 Ghana

In the quest to identify agricultural policy initiatives for CSA mainstreaming, the platform in January 2014 organized a high-level national policy event which saw the attendance of government ministers, members of parliament, national research directors, academics and other high-level policymakers. The aim of the event was (1) to make parliamentarians and high-level policymakers aware of the vulnerability of Ghana's agriculture and food systems to climate change and (2) to recommend policy and budgetary support for actions to adapt Ghana's agriculture and food systems to climate change. During this event, the platform used various communication products such as policy briefs, booklets and working papers capturing topics on climate change impacts on agriculture in Ghana and CSA to lead intellectual and policy discussions. Knowledge shared by the platform on evidenced-based climate change impacts and implications for food security in Ghana aroused the urgent need to give climate change full consideration in all agricultural development policies and plans. Decision-makers including parliamentarians from the Committee on the Environment agreed to support the mainstreaming of climate change into agricultural investments initiatives in Ghana (<https://ccafs.cgiar.org/blog/>). The final statement by parliamentarian also included support for research on CSA to benefit the most vulnerable populations [27]. In addition, the policy discussions led to the Ministry of Food and Agriculture asking the platform to lead the development of Ghana's first National CSA Action Plan targeted at ensuring the ground-level operationalization of the eight program areas of the agriculture and food security focus areas of Ghana's National Climate Change Policy (NCCP). The NCCP was developed by a multi-stakeholder group to affirm Ghana's ambition to mitigate risks posed by climate change (Essegbey et al., 2016). In collaboration with the Ministry of Food and Agriculture (MoFA),

the platform developed and launched in 2015 the country CSA action plan (2016-2020). Specific strategies were formulated in the CSA action plan to contribute to developing climate-resilient agriculture and food systems for all agro-ecological zones, as well as the human resource capacity required for a climate-resilient agriculture promotion in Ghana. Its development was made possible through the active engagement of various public and private entities in Ghana through dialogue and knowledge exchanges. The methodology for developing the national CSA action plan comprised desk research, data collection through interviews and participatory workshops and small group meetings. Today, the CSA action plan is recognized by all stakeholders as a ground operation policy document for agricultural development in Ghana. A financial plan for the implementation of the action plan is currently being developed by the platform in close collaboration with various stakeholders such as the ministries of agriculture, environment, finance, local government and rural development.

3.4.2 Mali

Pursuant to the Paris Agreement, the Government of Mali identified the potential for its agricultural sectors to deliver adaptation-mitigation synergies, as well as economic, environmental and social co-benefits. CSA is therefore identified in the Nationally Determined Contributions (NDC) of Mali as one viable strategy to meeting its adaptation and mitigation goals. In view of this, the government is taking major steps to demonstrate its intentions to mainstream CSA by looking at ways to prioritize CSA options, and develop bankable proposals that can help solicit funds from climate finance initiatives such as the Green Climate Fund (GCF) for implementation of its NDC. In addition, the intensions of the Economic Community of West African States (ECOWAS) to improve on the deficiencies of the National Agricultural Investment Plans (NAIPs) of member-states by integrating CSA in the NAIPs has called for urgent action for the Government of Mali to review its NAIPs for CSA mainstreaming. While the aforementioned is critical for the Malian agricultural sector, policymakers have expressed the challenge of identifying, valuing (cost-benefit), and prioritizing climate-smart options and portfolios (groups of CSA options) for investment. Bringing together experts with the intellectual capacity to help integrate CSA into the NDCs and NAIPs was one viable option.

In recognition of the composition of the platform with government ministries and agencies such as AEDD involved in their activity, the platform was called upon to undertake a critical stocktaking of ongoing and promising CSA practices in Mali. Following this, a series of workshops were organized by the platform with the participation of key national and international stakeholders for the co-development and prioritization of two CSA portfolios and related action plans for the Malian Sudanese zone. They identified CSA practices that potentially increase productivity, resilience, and mitigation, while also being profitable to farmers and society (Sogoba et al., 2014). This initiative resulted in the implementation of

prioritized practices in research and development programs in Mali. In response to the request by the Ministry of Agriculture and the Parliament, the platform is presently playing instrumental role in the CSA mainstreaming process (Andrieu et al., 2017). As a step forward, the platform was able to use these prioritized CSA options to collaborate with selected government departments in developing a US\$ 1 million bankable proposal that has been submitted to the GCF. Successful fund acquisition will contribute to leveraging local funding sources to successfully meet the budgets for NDC implementation.

3.4.3 Senegal

In Senegal, the CCAFS platform engaged with policymakers using workshops as means for sharing knowledge on the climate change implications for the agricultural sector and rural sector development programs. Considering their embeddedness within the National Agricultural Directorate and recognition by the Ministry of Agriculture and Rural Equipment from whose decree the platform was established, they were asked to conduct an in-depth analysis of the level of climate change mainstreaming into activities defined in the country's major Program for Accelerated Agricultural Development (PRACAS). The PRACAS is the agricultural component of the presidential plan for an emerging Senegal by 2035 (PSE). Recommendations from the analysis were discussed during a high-level policy event organized in 2016 with attendance of national elected officials such as Parliamentarians, members of the Social, Environmental and Economic Council (https://www.Integration_cc_au_senegal). Following the event, the recommendations have been integrated into the PRACAS. In recognition of the immense contribution of the platform to CSA promotion in Senegal, the platform received a state-funding support of about US\$ 200,000 in 2016, which has allowed the downscaling of the national platform into 13 district-level platforms. Activities of the district-level platforms are not included in this paper.

4. Discussion

4.1 How did the platforms' operations contributed to improved science-policy decision making?

With CSA becoming a prominent approach to tackling climate change issues in agriculture and food security sectors while at the same time countries have now committed to reduce their greenhouse gas emissions through their NDCs, the platforms were expected to be the springboards for the mainstreaming of climate change and CSA into countries agricultural development strategies, plans and policies (Robinson and Crane, 2016). However, what actually were the elements of success? First, the results provide clear indications that institutionalizing the platforms and embedding them within existing national institutions was relevant for improving their credibility, saliency and legitimacy within the countries. In the three countries,

the national platforms were recognized as crucial entities regarding climate change matters for the agriculture sector because of their composition and institutional affiliation. In the literature, lack of recognition is considered a major barrier to influencing policy at the science-policy interface (Weichselgartner and Kaspersen, 2010). As policymakers consider the appeals and advices of advocacy groups, they appraise the legitimacy and credibility of such groups. By embedding the NSPDP-CSA into already functional and recognized institutions, it allowed policymakers to have confidence in their mission, research methodology and results. Besides recognition by policymakers, institutionalization of the platforms was key to benefiting from funding support, as this has been for instance the case of the Senegal and Ghana platforms. This institutionalization also becomes crucial when the platforms decide to lead a project proposal that is of cross –sectoral nature. The Mali platform is an illustrative case with the development of a bankable proposal on CSA promotion, which was submitted to GCF (Andrieu et al., 2017). Moreover, it appeared that most platforms adopted more or less a balanced chairmanship between agriculture and environment sectors, and the overall coordination and facilitation of the platform activities by a core team encompassing public and private stakeholders. The balanced leadership scheme certainly facilitated the institutionalization of the national platforms and their embeddedness within existing national climate change organizational frameworks. When institutionalized, platforms have the capacity and power to shape what kinds of questions to be asked, the kinds of knowledge to generate, the kinds of analyses to make and communicate and the kind of policy options to consider (Robinson and Crane, 2016).

Secondly, the adoption of a two-way communication approach contributed to effective interaction between the platforms and policymakers. Traditionally, the interactions between scientists and policy actors have been based on a one-way approach, involving the scientists as the producers of knowledge and the policymakers as the users (Lopez-Rodriguez et al., 2015). Under this model, expert scientific advice is believed to make a direct contribution to the increased effectiveness and rationalization of political action. This linear thinking fails to support effective policy-oriented research plans as it considers science and policy advice/decision-making as separate domains, with science perceived as a uniquely neutral provider of objective knowledge (Young et al., 2014). From the results obtained, it was evident that the platforms' activities were grounded in a more concerted process, with two-way communication approach that allows scientists and policymakers to work together towards identifying agricultural priorities and proposing consensual solutions (Wardekker et al., 2008; Burnside-Lawry et al., 2017). Thereby, scientists gain awareness of the variety of directions in which research can impact policy, and policymakers note the fields where more applied research is required (Lopez-Rodriguez et al., 2015). The science-policy dialogue platforms were actually formed to demonstrate this culture of communication - bringing together groups of actors, including research and policy actors who share common interests, knowledge and experiences

through a collaborative interaction that strengthens trust and mutual understanding (Vermeulen et al., 2012). The rationale was to facilitate interactions in order to provide knowledge and advice that may achieve many and varied eventual influences, not necessarily immediate and direct use (Young et al., 2014; Pieczka and Escobar, 2012). In the development of the CSA action plan for Ghana and the CSA prioritization framework for Mali, this two-way communication were useful for scientists and policymakers in the development of a better understanding as to why CSA must be mainstreamed into agricultural policies and development plans to meet security and development goals in the countries.

Thirdly, the development of credible, relevant and salient communication products was key in the engagement of the platform with policymakers. As shown from the country examples, the platforms developed easily accessible and readable materials with evidenced-based information on climate change impacts, CSA options, etc., which were used by policymakers. With climate change becoming topical on the agenda of global concerns, the need for robust science to inform policy design has increased (Dilling and Lemos (2011). In the context of this paper, demonstrating evidence of climate change impacts and the potentials of CSA to contribute to climate change adaptation and mitigation was evident in the platforms' engagement with policymakers. In addition, packaging scientific evidence on climate change and CSA and aligning them with country priorities was crucial for the uptake of proposed solutions. In part, the platforms' participation in national, regional and global level events on climate change and CSA as well as their own internal knowledge sharing and capacity enhancement may have contributed to their ability to produce relevant and timely knowledge products found usable by policymakers.

Generally, knowledge creation seemed to have combined the strengths of the science-push, demand-pull and co-production models described by Dilling and Lemos (2011). In the event leading to the development of the CSA action plan in Ghana, the platform shared knowledge on climate change and its implications to food security in Ghana. The communication products used in the discussion were developed exclusively by the platform for use by decision-makers. This followed the science-push approach. However, the documentation of the CSA options which guided the development of the CSA action plan benefitted from the contributions of heads of agricultural departments at the Ministry of Agriculture who make critical decisions for agricultural policies in Ghana. In the case of Mali, stocktaking of CSA options was recommended by policymakers which followed the demand-pull model while the prioritization of CSA options had the involvement of policymakers. On the basis of the above lessons learnt from the 3 platforms' operations and achievements, we synthesized a general framework of operation of the platforms to informing policy and decision makings on CSA (Figure). It suggests the different steps and relationships through which the platforms were able to operate

to (1) identify countries' needs of knowledge and information, (2) generate knowledge and scientific evidence on promising CSA options, (3) Engage and communicate for effective science-policy interaction and policy advocacy.

Indeed, through regular interactions and networking among members, the platforms helped identify countries' priorities and needs for successful climate change adaptation and mitigation actions. The ultimate vision was to contribute enabling millions of farmers to adapt to a changing climate while boosting food security under low-emissions development. As platforms on CSA, they were keen on providing evidence and knowledge on promising agricultural innovations that deliver on the three pillars of CSA: productivity/food security, adaptation and mitigation. All scientific evidences on climate change and CSA options are published by the platforms as easily accessible communication products such as working papers, policy briefs, Info Notes which are shared and discussed with policymakers. Also, by the way of engaging with policymakers in the co-development of solutions, the mode of operation of the platforms has also exhibited elements of both the modern model and consensus model of science-policy interaction described by Udovyk (2014). This framework sounds a relevant tool by which science can be used to influence policy through analyzing and understand the local contexts.

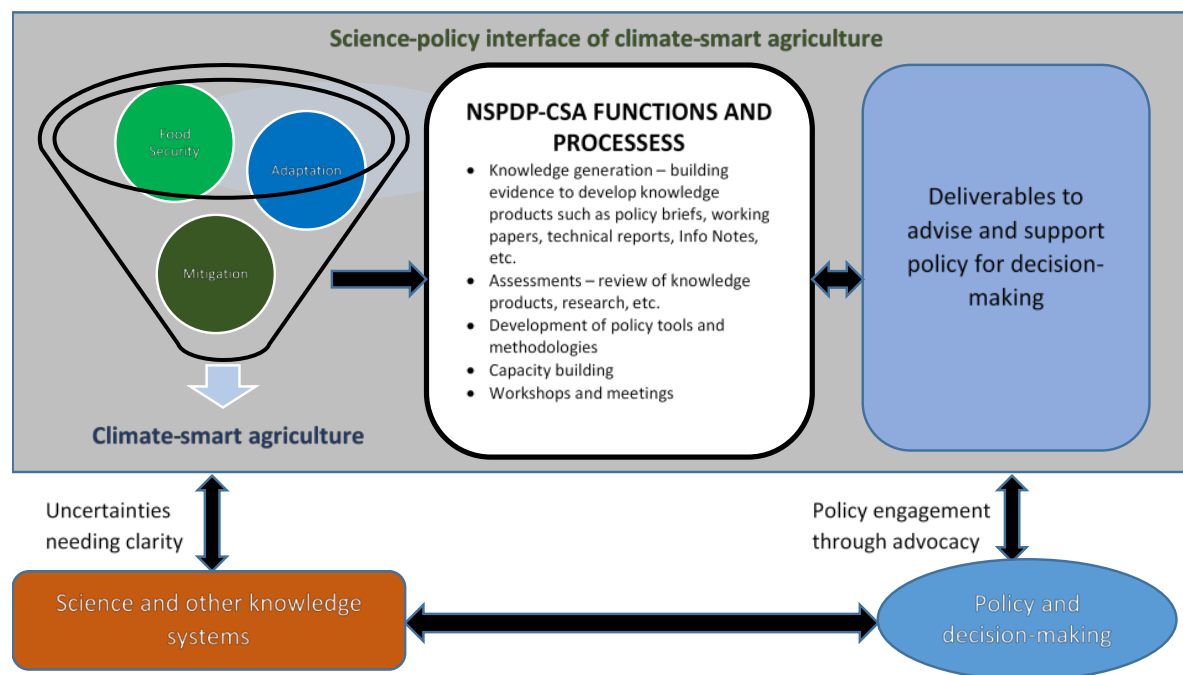


Figure 4: A framework of the operation of the NSPDP-CSA in Senegal, Mali, and Ghana

5. Concluding remarks

After 5 years, it was evident that using national science-policy dialogue platforms may be an innovative approach to engaging policymakers/decision-makers for climate change an CSA mainstreaming into agricultural development policies and plans in Ghana, Mali and Senegal.

Through effective interaction with policymakers, the Ghana platform was able to lead the development of a national CSA action plan in collaboration with the Ministry of Agriculture which is targeted at ensuring the ground-level operationalization of the eight program areas of the agriculture and food security focus areas of Ghana's National Climate Change Policy. In Senegal, the platform contributed to mainstreaming climate change into two key national policies (PRACAS and PSE). In Mali, the platform contributed to stocktaking and prioritization of CSA options which contribute to the development of a CSA investment plan and guide the mainstreaming of CSA into the nationally determined contributions and national agricultural investment plans of Mali. This study also demonstrated that institutionalizing such platforms by embedding them into national institutions improves their credibility, saliency and legitimacy among policy actors. For effective science-policy interaction, two-way communication may have a phenomenal advantage in the co-development of solutions that address climate change vulnerabilities and impacts. In addition, the results showed that using relevant communication products and packaging CSA and climate change with evidence to align with country priorities will facilitate readily uptake of proposed solutions. A framework of operation for the platforms was suggested based on lessons learnt from the 3 countries' experiences and achievements. Further studies on the barriers and boundary structures around the platforms will be crucial for developing an innovative advocacy group on agriculture that can be a model for other sectors.

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