# Integrating climate-smart agriculture in regional policy through a fast-track process

Working Paper No. 381

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

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CCAFS

Working Paper

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## Experience from Central America and the Dominican Republic

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# Abstract

Transforming agriculture to respond to the challenges of climate change requires the appropriate integration of solutions into public policy. While the role of science in mainstreaming climate change is recognized at the international and national level, especially for raising awareness and agenda-setting, the role of science for policy construction has been less analyzed. We analyze the successful case of the prompt formulation and adoption of the regional strategy for climate-smart agriculture for the SICA region (Central America and Dominican Republic), as a way to address both adaptation and mitigation issues while promoting food security and agricultural development. Mobilizing an analytical framework derived from policy process and science-policy interaction literature, we identify key factors that enabled this process. These factors encompass a combination of institutional and political long- and short-term characteristics of the regional policy arena, science-policy interactions, engagement relationships as well as methodological features. Our findings contribute to the discussion on science-policy engagement strategy to encourage agricultural transformation in a climate change context.



### Keywords

Science-policy interface; policy processes; agriculture; climate-smart agriculture; climate change; Central America; Scenarios

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# Contents

# 1. Introduction

Transforming agriculture to respond to the challenges of climate change requires the appropriate integration of solutions into public policy (Campbell, Hansen et al. 2018). During the last decade, there has been a strong process of mainstreaming climate change issue into agricultural sector and policy. However, so far few regional strategies and policy documents has been elaborated for agriculture sector to face climate change issues. The pace of regional policies adoption is lagging compared with the urgency to reduce greenhouse gases emission and dealing with adaptation to climate change challenges.

To address climate change issue in agriculture, the FAO and research community, including CCAFS,  proposed to mainstream the concept of Climate Smart Agriculture (CSA) to address in a synergic way adaptation and mitigation to climate change and food security (Lipper, Thornton et al. 2014). While CSA concept has gaining space in international arena and national policymaking, there are so far few policies, which set the scaling of CSA as an overarching objective.

In this context, the Climate-Smart Agriculture regional strategy of the Central American Integration System (EASAC for its acronym in Spanish) (CAC reference (CAC 2017), adopted in June 2017 by the Central American Agricultural Council (CAC in Spanish), is an original achievement of elaboration of a CSA conducive policy.

This working paper examines the formulation and adoption process of EASAC to understand what has been the factors allowing the rapid formulation and adoption of this strategy. It also captures the role of science and the CCAFS program activities in this process.

To do so, we propose to integrate the science-policy interaction frameworks with policy process literature to identify the key factors that enabled the rapid success in the formulation and adoption process of the EASAC. We argue that the success of prompt EASAC formulation and adoption process is due to a combination of factors related to political opportunity, methodological characteristics of the formulation, an established science-policy dialogue among the actors involved in policy formulation.

The first section set the analytical framework and methodology derived from policy-oriented research and policy process analysis. The second section describes the process of EASAC formulation and adoption. The third section then analyses and discusses the main factors that enabled the EASAC to be rapidly formulated and adopted.

# 2. Analytical framework and methodology

To analyze the EASAC prompt formulation and adoption process, we mobilized policy process analytical frameworks and specific frameworks related to science-policy interactions.

## 2.1. Toward an framework integrating policy processes and science policy interactions

### 2.1.1. Policy change frameworks

Various frameworks have been developed to explain policy change (Sabatier 2007, Capano and Howlett 2009). The most common and used model is the ***policy cycle*** which originated from early policy analysis scholars (Laswell 1956, Gordon, Lewis et al. 1977). The core idea of this framework is that the policy process is a succession of steps. While many versions exist, there are differences in the number of steps considered, the more popular version includes 5 steps, which include: agenda setting, formulation, decision, implementation, evaluation. This framework has been used and popularized with a problem-solving orientation perspective (Jones 1970, Brewer 1974, Anderson 1975). While it received many critiques for its oversimplification and lack of causal theories (Sabatier 2007), it is still largely used in policy science and public administration as it provides a first step guide in the amid complexity of policy process analysis, and for public administration an easy guidance to structure policy making process (Bridgman and Davis 2003). While aware of these limitations, we use this analytical framework to describe the policy process that led to EASAC adoption.

To complement our approach, we also rely on more heuristic frameworks to identify the explicative factors of policy change corresponding to EASAC formulation and adoption. We consider specifically ***the multiple stream framework (MSF)*** proposed by (Kingdon 1993, Kingdon 1995) that focus on policy agenda definition and occurrence of policy change in time. This framework postulates that policy change is the result of the convergence of three streams, namely policy, political and problem streams, which occurs during “windows of opportunity” (or “policy windows”) thanks to the action of “policy entrepreneurs”. A “policy windows” is thus defined as a moment in time when the 3 independent streams are converging, creating a unique moment conducive for a policy change. Policy entrepreneurs are actors in or out of government, in elected or appointed positions, in interest groups or research organizations, which have the willingness to invest their resources - time, energy, reputation, money,… - in the hope of a future return (Kingdon 1995). While many actors and organizations participate in policy-making or seek to influence decision makers, policy entrepreneurs distinguish themselves through their desire to significantly change current ways of doing things in their area of interest (Mintrom and Norman 2009) and get policy outcomes.

### 2.1.2. Science and policy-making processes

The role of science in policy making has been long analyzed in literature, e.g. (Ness 2010) (Spruijt, Knol et al. 2014). Regarding climate change agenda and policies, the role of information and science has been highlighted in the international climate agenda (Keller 2010), and also as a key factor in the adoption of climate policy (Norse and Tschirley 2000, Leith, O’Toole et al. 2014, Massey, Biesbroek et al. 2014). Various research analyzes the role of science in climate issues (e.g. framework for science for solution for adaptation to climate change (Huggel, Scheel et al. 2015). Science affects the different stages of the decision-making process (Vogel, Moser et al. 2007). First science facilitates the awareness raising regarding a public problem, providing insights to understand and frame the problem, and then contributing to the agenda setting of the problem (Pralle 2009) (Ingram, Brinton Milward et al. 1992). Science may also provide inputs for policy formulation and policy adoption. Finally, science can contribute to monitoring the results of policies.

Scientific information is integrated as an input variable in the policy process (Weible 2008). Science can bring recommendations that are incorporated into policy streams (Howlett et al 2016), and can also contribute to link problem, policy and political streams through argumentative coupling (Blum 2018).

Specific relationships between science and policy have been addressed by three streams in literature. The first stream refers to the ***science-policy interface*** (SPI), defined as social processes that encompass relations between scientists and other actors in the policy process, and which allow for exchanges, coevolution, and joint construction of knowledge to enrich decision-making processes (van den Hove 2007). This literature focuses on the institutional setup, the mechanisms of information exchange between researcher and policy-makers, the flow of scientific information between research and policy-making arena, and the effectiveness of the interaction process (Hinkel 2011). (Heink, Marquard et al. 2015) proposed three criteria to evaluate SPI: credibility, relevance, and legitimacy, highlighting the presence of trade-offs among these three dimensions.

A second stream of analysis of science policy relationship is the ***science-policy engagement literature***, which has been developed from researchers' perspective to define research strategies to better influence policy (Cramer, Thornton et al. 2018, De pinto, Loboguerrero et al. 2018, Dinesh, Zougmore et al. 2018). Relying on key components of knowledge systems for sustainable development proposed by (Cash, Clark et al. 2002), (Dinesh, Zougmore et al. 2018) propose a framework for science-policy engagement pathway to enhance credibility, salience and legitimacy of research in a policy perspective. This pathway relies on three pillars: engagement (participatory and demand-driven research processes), evidence (building scientific credibility while adopting an opportunistic and flexible approach) and outreach (effective communication and capacity building).

Finally, a third stream in the literature on science-policy relationships refers to the ***Policy-oriented research (POR)*** (Béné 2015) defined as the body of research that aims at understanding and influencing governments (at national or subnational levels) and/or (international) institutions' policies agenda (Raitzer and Ryan 2008). (Walker, Ryan et al. 2010) (p. 1454) define POR more formally as research that "aims (…) at affecting choices made by governments or other institutions whose decisions are embodied in laws, regulations, or other activities that generate benefits and costs for people who are affected by those governments or institutions''. In this research stream, research is only one element of the policy decision process and policy outcomes, while research outputs (knowledge creation) is one of influencing factors, aside from non-research based influences such as ideology, interests, inertia (Renkow and Byerlee 2014). POR literature identify different types of impact of research on policy process (Barnett and Gregorowski, 2013) according to the (i) types of policy influence (Steven, 2007), (ii) types of policy processes (Pollard and Court 2005), and (iii) types of policy impacts (Sumner et al. 2009).

### 2.1.3. An integrated analytical framework

Relying on policy process analytical frameworks and POR and SPI frameworks, we developed an integrated analytical framework to capture the key factors of prompt formulation and adoption of a policy, the EASAC, and the specific role of science and scientist in this process (Figure 1).

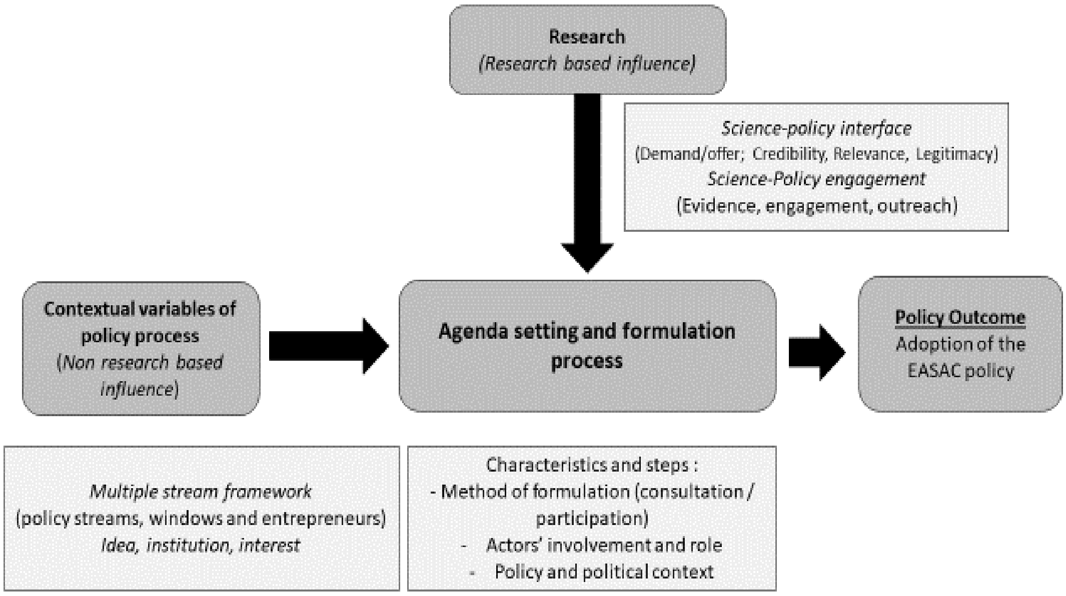


**Figure 1. Integrative analytical framework to analyze the policy formulation and adoption of EASAC and the role of science in the process.**

Source: Authors adapted from Renkow and Byerlee, 2014

## 2.2. Methodological process

To analyze and evaluate the role of science (and researchers) in the EASAC formulation process, and identify the factors of its prompt adoption, we rely on a causal policy tracing approach (Kay and Baker 2015, Beach and Pedersen 2019). The advantage of this approach is that it is well suited to the theoretical pluralism common in frameworks employed in policy studies research, and it enables identifying and testing causal variables to explain complex policy processes. Based on this approach, we carry out the following research protocol.

### 2.2.1. Description of each step of the process of formulation and adoption

This first research phase consisted of describing each step of the formulation process of the EASAC. For each step from inception of formulation to EASAC adoption, we identified the actors involved and their respective roles, the activities and methodology undertaken, and the source of information mobilized (including science and non-science information). To do this, we rely on the authors' knowledge, as they were part of the process from different perspectives;as scientists supporting the process, as civil servants of the Central American System of Integration (SICA) in charge of formulating the policy. As such, they participated in key meetings and workshops of the formulation process, which enabled a participatory observation process (Kawulich 2005), to gather information on actors' perceptions and strategies. Additionally, a desk review of internal unpublished and web accessible documents issued during the process (minutes and reports of meetings and workshops) to refine process analysis were carried out to validate information of authors observations. Additionally, interviews with civil servants of the SE-CAC (3) were carried out from September to October 2020 to complement information, and identify the key explicative factors for the rapid formulation and adoption of the EASAC. We used this process to elicit a sequence of key activities and events, which occurred during the formulation process. From the interviews, we also identified the empirical factors of success according to three generic categories: institutional, methodological, and political factors. Institutional factors refer to the pre-existence of institutions (as organizations and rules) that affect political changes as mobilized in the 3-I policy analysis framework (e.g. Heclo, H., 1994) and historical institutionalism (e.g. Thelen, 1999). Methodological factors refer to the content and processes of the knowledge generation during the process of formulation (Sumner et al, 2009), the steps and methods used to run this process. Finally political factors related to political will, involvement and leadership from high level decision makers in policymaking processes.

### 2.2.2. Identification and interpretation of explicative variables

To evaluate the process and identify the explicative variables, we put in perspective the process description with the theoretical hypothesis derived from literature on policy change and science policy relationships (Table 1).

**Table 1: Variables and hypothesis regarding policy change and policy-science interface**

| Type of variable | Hypothesis of regarding factor of success | Reference |
|---|---|---|
| Policy process contextual variables | | |
| Policy stream and policy windows | Convergence of problem, policy and political stream | (John W. Kingdon, 1995) |
| Policy entrepreneurs | Policy entrepreneurs coupling the policy stream with others, creating policy windows | (Roberts and King 1991) |
| Science - Policy interactions variables | | |
| Science-policy interface | Use of scientific information in policy process depends on Credibility, relevance and legitimacy | (Heink, Marquard et al. 2015) |
| | Trust is a key factor for scientific information use in policy process | (Lacey, Howden et al. 2018) |

Source: authors

Based on the multiple stream framework, the first hypothesis is that the agenda setting of climate smart agriculture and EASAC adoption correspond to a converge of a policy window (the issue of climate change in agriculture), a policy stream (the need for a specific CSA policy is a solution) and a political stream (the political will to have such a policy).

In this process, policy entrepreneurs (Roberts and King 1991) have facilitated the coupling of these three streams. We hypothesize that the policy entrepreneurs were the scientists involved in the diffusion process of the CSA concepts (especially scholars of the CCAFS programs) in alliance with civil servants of the CAC.

In line with SPI literature (Heink, Marquard et al. 2015), we considered that  a science policy interface on climate issues in agriculture in Central America was existing between the research community (CCAFS researchers and other research and cooperation agencies) and civil servants of CAC. In this context, the EASAC formulation benefited from the credibility, relevance and legitimacy of the science information developed by CCAFS research activities in Central America.

These hypotheses were tested through interviews with the CAC civil servants (3) and CCAFS actors (3) involved in the process.

# 3. Results: The policy process of EASAC formulation and adoption

This section describes the policy process of the EASAC. It provides key elements of the context in which the formulation process took place, as well as the steps of the formulation and adoption process of the policy.

## 3.1. Formulation context of the EASAC

### 3.1.1. Climate change and agriculture in Central America: the problem context

Central America is a vulnerable region highly exposed to climate variability (Magrin, Marengo et al. 2014). Extreme climate events have resulted in a food crisis in the past. The region is considered an early recipient of the impacts of climate change. The Fifth Report of the Intergovernmental Panel on Climate Change (IPCC (Intergovernmental Panel on Climate Change) 2014) reported a significant increase in temperature since the mid-70s (close to 1°C), together with an intensification in extreme weather events. Since the 50s, the beginning of the rainy season in Central America has been delayed, with increased intensity and erratically. Projections indicate that temperature will continue to rise with a decrease in rainfall, which would result in a drop in agricultural productivity in the short term (2030), threatening food security (Magrin, Marengo et al. 2014). Models indicate that both coffee and staple food (corn and beans) are expected to have negative impacts, mainly affecting small farmers and poorer households (Imbach, Beardsley et al. 2017).

In response to these challenges, SICA developed a Regional Climate Change Strategy 2010-2030 (ERCC for its Spanish acronym). Some sectoral strategies also included orientations to address climate change, such as the Agro-environmental and Health Regional strategy (ERAS 2009-2014) andthe Regional Rural Territorial Development strategy (ECADERT 2010-2030). However, these strategies were not specific in addressing climate change in the agriculture sector, while it is one of the most important sectors in the region and one of the most vulnerable to climate change and variability.

Additionally, while the main policy for sectoral development at the regional level, the Central American Agricultural Policy 2008-2017 (PACA in Spanish), acknowledged the climate issue, it poorly addressed it, apart from mentions of insurance and agroclimatic information needs (CAC 2007), and was also about to expire in 2017. Hence, from the standpoint of the Executive Secretariat of the CAC (SE-CAC), there was an opportunity to integrate climate change and variability issues in the agricultural sector through a regional strategy, which would serve as an input for the overall agriculture regional strategy to be formulated in 2018.

Finally, there was also the need for a policy with a systemic approach for development, in line with recent global frameworks; namely, the Paris Agreement, the Sendai Framework, and the Sustainable Development Agenda, within the same time frame (2030).

### 3.1.2 Governance of the regional integration system of Central America and the Dominican Republic: the institutional context

Central America and the Dominican Republic are part of a regional integration mechanism, which is in force and active since the Tegucigalpa Protocol (1991). The Central American Integration System (SICA), was initially formed by Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama. Belize and the Dominican Republic joined in 2000 and 2013, respectively. The fundamental objective of SICA is to achieve the integration of Central America into a region of peace, freedom, democracy, and development.

SICA has established mechanisms to coordinate efforts to address regional economic, social, and environmental issues (Figure 2). Through sectoral ministerial councils, SICA prioritizes the regional agenda to support and facilitate its implementation at the national level to strengthen the country's actions. SICA has seven Secretariats addressing the following topics: i) Environment and Development (CCAD), ii) Social Integration (SISCA), iii) Tourism (SITCA), iv) Economic Integration (SIECA), v) Education and Culture (SG-CECC), vi) Agriculture (SE-CAC), vi) Health (SE-COMISCA), and vii) Woman affairs (SE-COMMCA).

The Central American Agricultural Council (CAC) is an example of these mechanisms. CAC articulates with international cooperation to strengthen the regional agricultural sector as an engine of growth and economic development of its member countries through its technical groups. One of the technical groups is the one on Climate Change and Risk Management (GT-CC&GIR by its acronym in Spanish), which is technically supported by the CAC Inter-Agency Support Group (GIA for its Spanish acronym). The GIA brings together and articulates international organizations[1] to support the policy dialogue with science and research inputs so that both formulation, implementation and evaluation processes. The GIA, as a science policy interface, started in 2015 to articulate its efforts in response to issues prioritized in the regional agenda and provide inputs to cover gaps making more robust the policy-science dialogue.

Policy formulation and particularly, planning process at a regional level promotes articulation among countries and facilitates the discussion of common problems and solutions. However, such discussion and alignment processes might be challenging due to national priorities and interests.

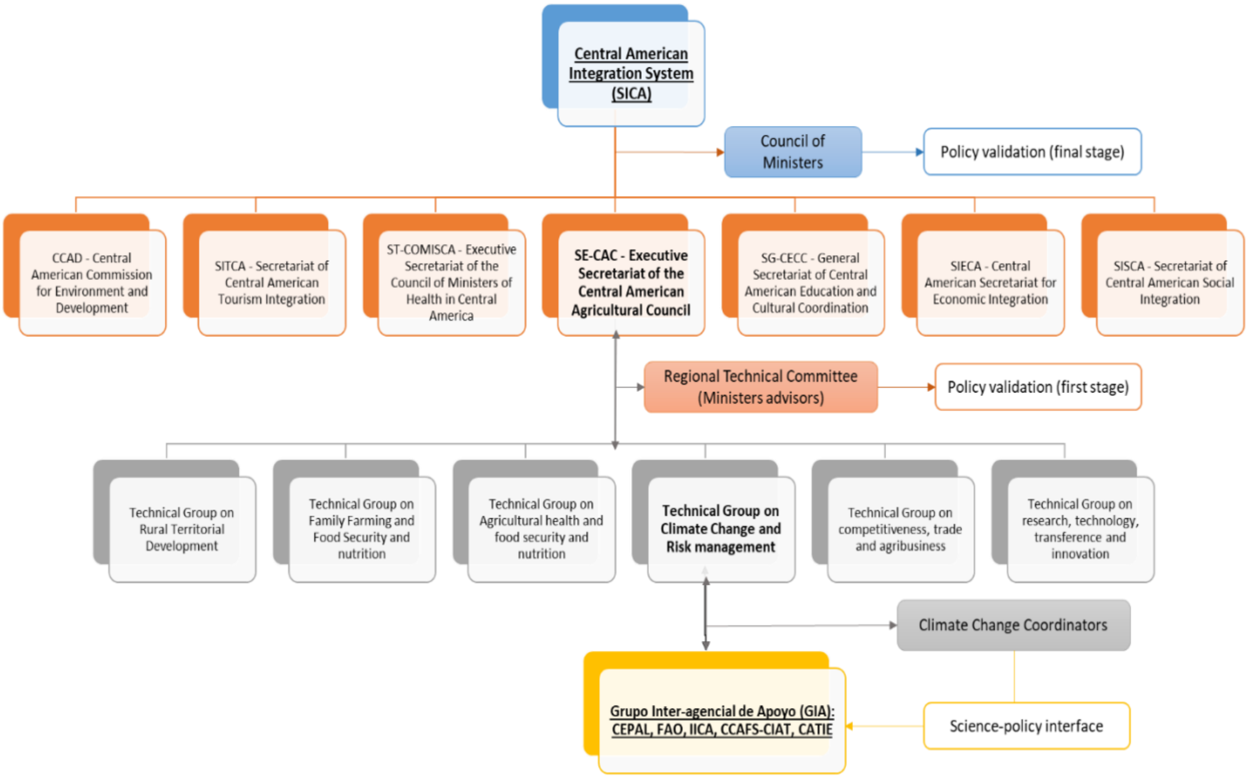


**Figure 2. Governance structure of the Central American Integration System (SICA)**

Source: authors

[1] The GIA integrates actors such as the Economic Commission for Latin America and the Caribbean (ECLAC), the Inter-American Institute for Cooperation on Agriculture (IICA), the Tropical Agricultural Research and Higher Education Centre (CATIE), the Food and Agriculture Organization of the United Nations (FAO), the CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS), the International Center for Tropical Agriculture (CIAT) and the University for International Cooperation (UCI), among others.

### 3.1.3. International agreements: the political context for the EASAC agenda-setting

The political context in Central America that preceded the formulation of the EASAC was framed by the global agreements that defined the regional environmental agenda in the first half of the 2000s, culminating in 2015 with the adoption of the Sustainable Development Agenda 2030, the Sendai Framework for Disaster Risk Reduction and the Paris Agreement within the UN Framework Convention on Climate Change (CAC 2017).

The Agenda 2030 for Sustainable Development, adopted at the United Nations Summit in September 2015, defined 17 Sustainable Development Goals (SDGs) and 169 related targets aimed at ending poverty, eradicating hunger, combating inequality and tackling climate change, among others. The agriculture sector and food security are linked to virtually every SDGs, but it is closely linked to SDG2 to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture, while SDG13 explicitly calls for climate action. Additionally, in line with the Sendai 2015-2030 Framework, the update of the Disaster Risk Reduction Action was approved in March 2015, which also includes actions regarding climate variability and change.

A key milestone in the decision to build the EASAC was the 21st Conference of the Parties (COP21) of the United Nations Framework Convention on Climate Change (UNFCCC) and the adoption of the Paris Agreement in December 2015. While agriculture was a marginal part of the negotiations, it began to take on a greater role in 2011, and the Paris Agreement clearly highlighted the links between climate change, agriculture, and food security. Additionally, the nationally determined contributions (NDC) highlighted the role of agriculture in confronting climate change (Hönle, Heidecke et al. 2019), especially in the Central American region.

In this context before COP21, the Council of Central American Ministers of Agriculture, in an extraordinary meeting held in Nicaragua (23/09/2015), agreed on a common declaration setting the goal of "Promoting climate smart agriculture, as an option to increase agricultural productivity, fisheries, aquaculture and forestry, and support adaptation to climate change, to improve food and nutritional security" (CAC 2015). They also declared their intention to promote the adaptation of agriculture to climate change as a regional public good. During COP21, the Ministers of Agriculture of Guatemala and Costa Rica then made a declaration on behalf of the Central American Agricultural Council pledging to promote Climate-Smart Agriculture in the region. This political signal set the ground for the formulation of a regional strategy to promote CSA in the region.

Taking into account this political signal, the technical bodies of the CAC assumed the responsibility of formulating a regional instrument with the technical support of the GIA. Particularly relevant was the leadership of Costa Rica and its Minister of Agriculture in promoting the formulation of EASAC, during the Pro-tempore presidency of the CAC[2]. The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) also played a strategic role offering to provide methodological support in the design of the formulation process.

## 3.2. Formulation process

The formulation of the EASAC for the SICA region has been conceived as a co-building process among the eight countries of SICA. It was formalized by an agreement of the Regional Technical Committee and led by the Technical Group on Climate Change and Integrated Risk Management (GT-CC&GIR), both instances of the Central American Agricultural Council (CAC) in coordination with other technical groups and coordinated by the Executive Secretariat of the CAC (SE-CAC). The formulation process was supported by the GIA.

The Strategies´formulation process was born within the CAC council of Ministers in September 2015 through the proposal on productivity and climate (CAC 2015), and the decision to draw up a joint declaration of the SICA countries at COP21 on climate-smart agriculture (CAC 2015) (CAC, 2015). CAC's Regional Technical Committee then takes the lead in the formulation of the EASAC through the GT-CCGIR in 2016.

The main characteristic of the formulation process is the inclusion of the various actors directly and indirectly linked to such a regional policy instrument, amongst others through an open consultation with civil society in the region for feedback on a draft version of the

[2] According to SICA governance rule, a member country assumes the presidency of the SICA for 6 months. This rotating system creates an impulse for leading country to achieve outcomes during their limited period of presidency.

policy (Table 2). The formulation process includes four steps: i) A regional workshop to draft a first version of the strategy; ii) a regional workshop on future scenarios to confront and validate strategic axes and line of actions, iii) an open online consultation, and iv) a final review of the strategy document by the technical bodies of CAC.

**Table 2: Steps in the formulation process of EASAC, actors, products and knowledge sources**

| Date (year/month) | Leading actors | Activities (including participants precision) | Products | Knowledge source integrated (experts and scientific information) |
|---|---|---|---|---|
| 2015/09 | SE-CAC + GIA | Political decision of designing the regional strategy for CSA in the SICA region (EASAC) | Agreement between GT-CC&GIR and CAC | |
| 2016/12 | SE-CAC, GT-CC&GIR, GTR, GIA (CCAFS CIAT) | Regional Workshop on strategic axes and lines of actions (held in San Jose, Costa Rica) | The first draft reviewed including strategic axes and lines of action | Agricultural experts from the GT-CCGIR (n = 13) including 1 representative of public administration per country, 2 civil servant of SE-CAC), 2 researchers (CIAT, Catie), 2 representative of regional cooperation body (IICA) and 3 public administration of Costa Rica<br><br>Analysis of impact of climate change on agriculture and vulnerability, and priority for adaptation for Centro American countries (e.g. Bouroncle et al, 2015a, b, 2016*; Eitzinger, et al, 2012*, 2016*; Bunn et al, 2015*, Flores, et al , 2014*) |
| 2017/02 | SE-CAC GT-CC&GIR, GTR, GIA (CCAFS CIAT, UCI) | Regional future scenarios workshop (held in San Jose, Costa Rica) | The second draft of the Strategy and strategic axes and lines of action validated, tested and robusted in multiple regional future socioeconomic and climate scenarios | Agricultural and Environmental experts from public administration (51%), academy and research center (23%), NGOs (21%) and private sector (2%)<br><br>Climate change impacts in Central American countries and Dominican Republic on productive and socio economic features and options for adaptation practices (Cepal 2014*, 2015a*, 2015b*, Cramer 2017*) |
| 2017/03-04 | SE-CAC GT-CC&GIR, GTR, GIA (CCAFS CIAT, UCI) | Open online consultation to 836 representative of academy, administration, civil society, in Latin America | Formal feedback from 7 actors : a, | Civil society, civil servants and scholars from Centro America and Latin America: Univ. of Costa Rica; CDAH, Panama; Univ. de los Llanos, Colombia; Corpoica, Colombia; ministry social development, Argentina, Agroforis, Venezuela;… |
| 2017/05 | SE-CAC GT-CC&GIR and GTR, | Revision phase: Consultation to civil servants of SICA countries | EASAC Final draft | Civil servants and experts of the technical bodies of the CAC |

| | | | | |
|---|---|---|---|---|
| 2017/06 | SE-CAC, Council of Ministers of Agriculture of SICA (CAC) | Formal approval of the EASAC by the Central American Agricultural Council (CAC) in a meeting held in San José, Costa Rica on 28 and 29 June 2017. | EASAC approved by CAC | |

Source: authors

* References cited in the EASAC (CAC, 2017)

### 3.2.1. Strategic Planning Workshop

The workshop was held in December 2016, in San José, Costa Rica. It gathered agricultural experts from the GT-CCGIR and other technical groups from the CAC to identify the strategic axes and lines of action, as well as the main activities to promote, encourage or articulate at the regional level to increase sustainability and adaptation to climate change and variability in the agricultural sector of the SICA countries. The discussion was based on a preliminary draft proposal previously developed by three experts: a climate policy expert, the head of SE-CAC and CCAFS coordinator for Latin America. The workshop finalized with a revised first draft of the strategy, to be used as an input for the next formulation step.

### 3.2.2. Workshop to probe the strategy against future scenarios

A second workshop was held in San José (Costa Rica) in February 2017 in order to test the strategy using a future scenarios methodology (Veeger, Mason-D'Croz et al. 2019), which contributes to the strengthening of policy-making processes. The methodology was developed by CCAFS and the Environmental Change Institute of the University of Oxford, and is implemented in Latin America by the University for International Cooperation (UCI) in collaboration with the Copernicus Institute of Sustainable Development of the University of Utrecht. This workshop involved 34 actors from different countries to nurture and strengthen the draft strategy document (Veeger et al, 2017).

The methodology includes the participatory construction of four imaginary but plausible and diverse future scenarios. The scenarios take into account socioeconomic modeling results and show different possible development paths of socioeconomic, environmental and political aspects of the region, relevant to the region's agrifood system under the effects of climate change (CCAFS UCI CAC, 2017).

The exploration and analysis of these different possible futures and the uncertainties they could entail allowed participants to have a broader perspective of the circumstances necessary to prepare the region for the challenges posed by each scenario. Based on this analysis, improvements in the strategy were recommended that would increase its likelihood of success. Among these, the long-term vision and importance of protected areas and other environmental regulations were highlighted, which will help protect water sources and other ecosystem services.

A transversal analysis of the scenarios also showed the need for small producers to have greater government support for investment and access to technology, as well as the need for food production for the domestic market (national and regional). It finally pointed out the necessity of further coordination and collaboration between the countries of Central America and the Dominican Republic in agro-climatic risk management, food production, trade, and water resource management.

### 3.2.3. Open online consultation

The formulation process of the Strategy ended with a period of open online consultation aimed at a broad audience of agrifood stakeholders in the region. The open consultation was divided into three sections in order to validate the options of strategic lines and measures set in the EASAC draft document. The first section refers to the EASAC strategic orientations, the second section refers to the vision of EASAC and its link with the Sustainable Development Objectives (SDGs) and the last section refers to the strategic axes of EASAC.

The consultation was sent to 836 people in 20 countries of Latin America based on a list of contacts generated by the CAC, CCAFS and GIA actors. The consultation was opened for 2 months. However, the answer rate was limited, as the on-line consultation process generated only 7 responses, mainly from research centers and academies outside Central America[3]. To overcome this limit, a specific consultation was organized directly by the SE-CAC formulation team to the members of CT-CCGIR to receive feed-back on the proposal from experts of the SICA countries. This direct consultation received a stronger response

[3] The seven responses were from University of Costa Rica, university of the llanos (Colombia), the ministry of social development (Argentina), Agroforis (Venezuela), the center of environment and human development (Panamá) and a national agricultural research center (Corpoica-Colombia).

rate. Based on the online responses and the CT-CCGIR expert consultation, an updated draft of the strategy was prepared by the SE-CAC secretary with the support of a consultant and a CIAT researcher. However, according to interviews of these actors, no major changes were introduced at this stage.

### 3.2.4. Final review and adoption

The EASAC proposal version after the consultation phase was then officially sent by the SE-CAC officer for official review to the main technical instances of the CAC. It was also presented to the regional technical committee (RTC) which is composed of Ministers Advisors of all Central American countries. Once the CTR approved it, then it was sent to approval to each Minister of Agriculture.

During this finalization of the process, no major changes were introduced, only wording and editing. In this last phase, the only opposition comes from Nicaragua, which did not agree on the Paris conference agreements. While it represented a diplomatic issue, and a formal hurdle for regional official adoption, as regional strategies had to be approved by all the member countries according to SICA rules, the position of Nicaragua did not affect the content of the final document of the strategy at this stage. This opposition was solved thanks to the protagonism of Ministers of agriculture of other countries in the region, especially from Costa Rica that was assuming the pro tempore presidency of the SICA, arguing for the interest of having a regional strategy to support agriculture which not only deal with mitigation but also strongly focussed on adaptation and food security.

Finally, the CAC in a meeting held in San José, Costa Rica, on 28 and 29 June 2017 approved the EASAC as the key instrument to “promote a more competitive, inclusive and sustainable agriculture adapted to the effects of climate change and climate variability, and which increases productivity through the conservation and sustainable and efficient use of water, biodiversity, soil and forest, in order to ensure food and nutritional security” (CAC 2017).

## 3.3. Facilitating factors for rapid formulation and adoption of a new policy

The analysis of the EASAC formulation and adoption process and the interviews conducted to involved actors, enables to point out three critical factors that facilitate the policy process and the rapid adoption at different stages of the policy process.

### 3.3.1. Institutional factors

The first factors are institutional ones. The success of the EASAC formulation and adoption process rely on two pre-existing institutional set ups. First, the pre-existence of CAC technical committees involving professionals representing the agricultural sector of the SICA countries facilitated the active participation and feedback during the whole formulation process, which lent technical credibility and political legitimacy to the whole process. These professionals had known each other for a long time, worked regularly to discuss issues related to agriculture and climate change, and had a good knowledge base on the needs of the region and its countries to advance the climate agenda. Second, the preexistence of the GIA as an institutionalized Science policy interface. The existence of the GIA enables a constant dialogue between research and cooperation agencies community on one side and the CAC technical group on Climate Change and Risk Management (GT-CC&GIR by its acronym in Spanish) which is the institutionalized consultative and technical organ for policy building for climate issue within the SICA system. The preexistence of the GIA and institutional dialogue with GT-CC&GIR enable trust building among the research and policy communities.

### 3.3.2. Methodological factors

A second set of facilitating factors are methodological. First, the methodological approach of elaboration of the EASAC combines a sequence of face-to-face and virtual consultations. This participatory approach to build the EASAC enables the coproduction of knowledge and contributes to credibility and legitimacy of the outputs (the EASAC document). The face-to-face meetings and workshops were much more effective for knowledge co production, than the virtual consultation. However, virtual consultation, despite low rate of answer, ensured inclusiveness and contributed to the credibility and legitimacy of the document. Second, the methodological approach combines scientific inputs (for example research results on climate scenarios and climate vulnerability in the region), to experts' perceptions on the issue and possible futures through the Future Scenarios methodology. This combination contributes to credibility and legitimacy of the process.

### 3.3.3. Political factors

Two political factors facilitate the rapid formulation and adoption of the EASAC. First, the EASAC formulation and adoption process benefited from the political will and leadership of

Costa Rica ministries and presidency. As pro-tempore secretary of the CAC during the process, the Costa Rica government had the strategy to position the region in the climate international arena offered by the COP21 perspective. By announcing the intention to formulate the EASAC during its pro-tempore period, it motivated the other countries of the region and gives the high political impetus for the formulation process, as well as a clear time deadline. This high-level political commitment urged the process of formulation and adoption of the EASAC. Additionally, the leadership of Costa Rica facilitated the adoption of the EASAC by the other countries of the region. Indeed, using political and diplomatic resources, it enabled the initial reluctance of the Nicaragua government during the final adoption phase.

Second, the EASAC formulation process benefited from the leadership and support from the executive secretary of CAC. Indeed, assuming a technical and political high-level function, the executive secretary of CAC facilitated the process through his good relationship with SICA's ministers of agriculture, enabling a smooth communication between technical groups in charge of EASAC formulation and the high-level policy decision makers in charge of validating and approving it.

# 4. Discussion: Lessons learned from EASAC formulation and adoption process

In this section, we discuss the main lessons learned from the EASAC formulation and adoption process.

## 4.1. Science outputs or scientific methodological process

The role of science and experts in policy processes has been widely discussed and integrated in the policy process analysis framework (Weible 2008). Our results suggest that the science-policy interaction and the role of scientists were twofold. First, the contribution of scientists in this process were to provide scientific inputs to the process, such as background information on climate change issue in the region (Flores, Loboguerrero et al. 2014), the simulation of climate change in the region and its potential impacts on agricultural production (Bouroncle, Corner-Dolloff et al. 2015) (Bunn, Läderach et al. 2015) (Eitzinger, Schmidt et al. 2013), as well as lessons learned from existing policies (Huyer, Twyman et al. 2015).

But, whereas the literature insists on the nature and characteristics of the scientific inputs as a critical factor for success to science policy engagement processes (Cash, Clark et al. 2002, Cash, Clark et al. 2003), the key role of scientists in the EASAC formulation was to design the methodological process of formulation itself. They were not a mere provider of scientific information, but they framed the formulation methodology including the participation and actors' integration. Noteworthy is the used of participatory scenarios building (Magrin, Marengo et al. 2014, Vervoort et al. 2014, Veeger, Mason-D'Croz et al. 2019) which enable to create strengthen robustness of planning activities in anticipatory governance perspective (Quay 2010). Additionally, scientists were also funding the formulation process and were directly involved in the writing of the EASAC policy document. The experience of EASAC formulation confirms the critical factors evidenced by Dinesh, Zougmore et al. (2018) and Dinesh, Hegger et al. (2021) regarding the engagement dimension of science policy engagement strategy: the use of participatory approach to create legitimate products, and the interest of relying on a targeted and demand-driven approach, which consists in timely responding to the demand.

## 4.2. Policy windows matter

While science products and methods are key in science-policy interactions, political variables have to be considered in explaining the success of the science-policy interaction and the pace of the policy process. Indeed, the success of the formulation and adoption of the EASAC in the Central American context in a short term period can be explained by the occurrence of a policy window (Kingdon 1993, Kingdon 1995) that opened up in 2015. In the matter of fact, regarding the problem stream, the climate change issue in agriculture was already acknowledged by Central American actors, as agriculture was already suffering from climate change and facing tangible climate variability issues (stringent drought, flooding due to extreme event) and suffering from high vulnerability (Magrin et al, 2014). Regarding policy stream, the concept of CSA (ASAC in Spanish) was introduced in the region by the CCAFS research program and promoted as a frame to identify policy solutions to the climate change issue in agriculture. Additionally, a second element occurs in the policy stream with the new form of climate negotiation for the preparation of COP21, which gives more room to national and regional expression, through the definition of national determined contributions (Treyer 2015). Finally, in the political stream in the Central American regional arena, the pro-tempore leadership of Costa Rica was a key element as it gave the leadership to a political leader (the minister of agriculture of Costa Rica), with the political will to position Central America in the international climate arena. This is not surprising, as Costa Rica is known on an international level for its commitment to climate change issues (Flagg 2019). The convergence of the three streams (problem, policy and political) opens a policy window in 2015 to the process of formulation of the EASAC.

In the occurrence of this policy window, we can notice that scientists' contribution was not neutral i.e. only providing science outputs for the decision process, they were also involved as “policy entrepreneurs”. Within the GIA and along with technical staff of SICA, the CCAFS researcher team helps to frame the policy, identify the actors to be included in the process, contribute to the creation of the narratives as policy entrepreneurs do (Roberts and King, 1991; Young and Mendizabel, 2009; Shearer, 2015; Mintrom and Luetjens, 2017).

The experience of the EASAC formulation process illustrates the underlying principle of CCAFS program theory, join external processes (Dinesh, Zougmore et al. 2018), as the CCAFS research community takes advantage of the policy impetus and policy window which opened up in 2015. It also confirms a critical factor for successful science policy engagement strategy: the importance of opportunism and flexibility while conducting a policy oriented research program (Dinesh, Zougmore et al. 2018; Sumner et al, 2009) . Indeed, to take advantage of the policy window, the CCAFS program was in capacity to allocate human and financial resources which were not planned initially to support the EASAC formulation process. Additionally, the CCAFS engagement in the EASAC formulation process highlights the importance of the propitious timing of intervention (Cramer, Thornton et al. 2018).

## 4.3. Divergence of interests?

Policy processes depend on actors’ interplays and power. Policy change is supposed to overcome the divergence of visions and interests or the domination of a coalition or group of interest (Capano 2009). Hence, it is striking that our analysis of the EASAC formulation and adoption process does not reveal such issues.

Several factors can explain this finding. A first set of explicative factors are of methodological order. First, the choice of the scenarios method is prone to overcome short-term discrepancy among actors, since the focus of the exercise is on the future. Second, the choice of an open participatory process during formulation enabled the consideration of a divergence of point of views, a deliberative consensus by integrating a large set of expert knowledge.

The second set of factors is related to visions and interests of regional actors. It's worth noting that while debate and opposition regarding CSA could be strong (Newell and Taylor 2018), no such debate occurred during the EASAC formulation. In spite of the amplitude of the consultation process during the formulation, the use of the CSA concept as a guiding concept for the strategy was not challenged. This could be explained by the low mobilization of some actors usually more skeptical on this concept such as Via Campesina (Campesina 2015). Another explanation comes from the scientific leadership of CCAFS in the formulation process who is a champion of the concepts worldwide with FAO (Lipper, Thornton et al. 2014). Another explanation could be the rapid pace of the formulation process that does not enable a mobilization of opponents to the concept. Finally, a last explanation could be found in the actors' interests' analysis. The formulation of EASAC responds to the interest of the ministries of agriculture of Central America which wanted to be positioned on climate issues in the international arena, but also in their national arena as climate issues have been traditionally managed by environmental administrations.

In terms of SPE strategy, the experience of EASAC formulation highlights the absence of one of the current limiting factors for SPE: adverse power dynamic (Dinesh, Hegger et al. 2021). This could be explained by the strong alignment of interest between SE CAC and the research community including CCAFS.

## 4.4. Credibility, relevance, legitimacy, and…. trust

The success of the EASAC formulation and adoption process exhibit classical elements of functional science policy interface (Heink, Marquard et al. 2015) (Sarkki et al 2013): credibility, relevance and legitimacy. The credibility of the formulation process of the EASAC benefitted from the participatory and consultation process of large sets of experts (including scholars, civil servants). The participation of international organizations of donors (ECLAC, IICA) and applied research organization (CCAFS, CATIE) within the GIA, both with high reputation, favored the credibility of the formulation process. In turn, it is worth to note that according to interviews with SE CAC, the EASAC was a key process in the consolidation of the GIA and its alignment around the same regional public policy document, from the formulation process to its implementation with respect to climate change and agriculture issues in the region.

While conception of relevance may differ among authors (Heink, Marquard et al. 2015), we consider the relevance of information and scientific process as the capacity to influence a policy (Jones, Fischhoff et al. 1999). In that sense, support provided by scientists during the process in terms of formulation, methodological design and scientific inputs (vulnerability analysis, climate change modelling) were relevant. However, as expressed in previous sections, we argue that relevance is not a sole result of scientific inputs integrated in the policy process but rely more on the methodological design and the policy variables that facilitate the whole formulation process.

Legitimacy is a key factor for science uptake in policymaking and successful science policy engagement strategy (Dinesh, Zougmore et al., 2018;Dinesh, Hegger et al., 2021). In the EASAC formulation process, this legitimacy relied on the following factors: 1) the scientific basis of the baseline information and the methods used for formulation (e.g. the use of future scenario methodology), 2) the involvement of organizations with recognized technical and scientific skills and a long trajectory facilitated the acceptance of the formulation process; 3) the support of multiple actors from different sectors (public and private), and the open online consultation. In addition to these elements conducive to technical and scientific legitimacy based on transparency and rigor of the process, our study highlights the importance of political legitimacy, which has been granted by the mandate and political will of the ministers of Central American countries.

Additionally to these factors, in line with Lacey et al. (2018), the success of the EASAC formulation process highlights the importance of an additional factor, the trust between scientists and policy makers (public regional civil servants of SICA administration). Indeed, interviews confirm that engagement of scientists in dialogue with civil servants of CAC administration since the beginning of the CCAFS program in the central american region had generated mutual trust.

# 5. Conclusion

We analyzed the process of formulation and adoption of a regional strategy for climate smart agriculture in Central America and the role of science in this process. We evidenced that rapid formulation and adoption of this policy was enabled by the preexistence of an institutional set up which enabled a science policy dialogue, the political will and leadership of high-level mandatory, and direct involvement of scientists in the formulation process. The formulation process occurs during a policy window to  a new regional agriculture policy framework to tackle climate change which opened up in 2015. This policy window resulted from international factors (regional international commitment) and internal factors (political will of country political leaders). This policy window was used by the CCAFS program to generate jointly with the SE-CAC the overarching EASAC policy document to promote CSA in the region. Analysis of the EASAC formulation process confirms some critical factors for successful science policy engagement strategy, such as the flexibility and opportunism of research programs and the sound timing of involvement. It also highlights the importance of sound alliance with key administrations (the SE-CAC), which have institutional and political legitimacy. Additionally, although the EASAC formulation process analysis acknowledges the importance of integrating relevant and credible scientific inputs in the policy process, it also stresses the importance of direct involvement of scientists in the methodological design of the formulation process. This direct involvement of scientists and the choice of a participatory methodology, enabled to strengthen the legitimacy of knowledge integrated in the policy document and finally the legitimacy of the policy output (the EASAC itself). Finally, trust building between researchers and civil servants appears as a critical factor for successful process of formulation and effective science policy interaction. However, trust building requires a long-term process, it is not replicable and is person sensitive. Additionally, maintaining trust requires continuity of involvement of both parties (scientist and civil servants), this continuity can be jeopardized by the time frame of research programs, and by civil servants turn over in key administrations. Hence, further institutionalization of science policy interface could be a way to overcome this issue.

While the policy formulation and adoption of EASAC has been a critical achievement to foster CSA in the Central American region and a successful experience of science policy engagement, some issues remain. First, as with most climate-related policies, the main challenge is its implementation. Indeed, its implementation depends on steady commitments of Central American countries in charge of implementation, national political will and funds availability. Analysis of the EASAC implementation and outcomes constitute a further research topic. Additionally, while monitoring and evaluation has been included in the design of EASAC, it remains a challenge as it requires a consensus on the variables to be monitored and the setting of a transnational reporting system. This paves the way for further involvement of science and scientists to accompany the monitoring and evaluation process, to generate scientific evidence regarding implementation achievements and bottlenecks, and to propose solutions to overcome the limitations of implementation.

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