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Learning by Doing: Co-Benefits Drive National Plans for Climate and Air Quality Governance

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Abstract: What drives countries to realize more integrated policymaking? The co-benefits concept highlights the win–win situations that can arise if one policy measure addresses two or more policy goals, e.g., air quality and health benefits resulting from a climate policy. Scholars have suggested that decision makers, if confronted with the evidence of co-benefits, would update their beliefs and adopt stronger or more ambitious climate policies. In other words, a learning process takes place. This paper looks at the policy processes in two countries, Mexico and Nigeria, as part of the Supporting National Action and Planning (SNAP) initiative under the Climate and Clean Air Coalition (CCAC). The SNAP initiative supports governments with policymaking and implementation for a reduction in short-lived climate pollutants (SLCPs). This paper seeks to reveal how learning processes and their outcomes are influenced by co-benefits as a specific type of information. Looking at an example of how the co-benefits concept is applied in political practice offers valuable insights into how learning is part of the policymaking process and can shape its outcomes, such as national (climate) action plans.

Keywords: co-benefits; climate policy; air quality policy; integrative policy; learning; governance; co-impacts; SLCPs

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1. Introduction

The world has entered the so-called decade of action on climate change. The next 10 years will be decisive in preventing a temperature increase of over 2 °C vis-a-vis pre-industrial levels. Despite scientists' warnings about the catastrophic consequences of inaction, ambitious climate policies are often blocked by concerns over negative consequences for the economy or disadvantages for constituents in other areas, such as the mobility sector. The co-benefits concept may help alleviate such concerns, highlighting the win–win situations that can arise if one policy measure addresses two or more policy goals, e.g., air quality and health benefits resulting from a climate policy measure. As an integrated approach to policymaking, the co-benefits concept can maximize synergies and minimize tradeoffs, mobilize support, and enhance environmental ambition.

Nevertheless, the interpretation of the term 'co-benefits' and its application in policy are rarely looked at by scholars. Science has focused on the measurement and quantification of economic and air quality benefits [1–3], but only a handful of articles on co-benefits are rooted in social science. Very few studies analyzed the role that the conceptualization of co-benefits plays in governance [4]. Why and how is the concept of co-benefits used in policymaking? How does it influence the learning process that leads to more integrated climate policy measures?

This paper approaches the described research gap by providing two case studies that elucidate the usage of co-benefits in a policymaking process. Specifically, it examines how the application of the co-benefits approach developed by the Climate and Clean Air Coalition (CCAC) triggered a learning process that led to integrated short-lived climate pollutant (SLCP) policy plans in Mexico and Nigeria. With this analysis, the paper can further offer valuable insights into how new evidence is digested in policy processes

and how an international transnational initiative—the Supporting National Action and Planning (SNAP) initiative by the CCAC—can trigger and amplify climate policymaking through its co-benefits-based methodology. It contributes to gaining a more practical, case study-based knowledge on co-benefits and learning processes.

The paper starts by offering an overview of the co-benefits concept and briefly introduces the literature on learning. It then presents a framework that specifies the conditions that enable learning for policymaking in epistemic contexts, with a specific focus on identifying co-benefits. The practical part of this paper introduces the CCAC, its approach to co-benefits, and its SNAP initiative, and then applies the learning framework to the cases of Mexico and Nigeria. This research ultimately scrutinizes and discusses how co-benefits, as a particular type of information, amplify or attenuate the conditions enabling learning in policymaking.

2. Co-Benefits Can Lead to a Learning Process for Policymaking

2.1. The Development of a Co-Benefits Concept

Integrated policymaking or integrated policy approaches focus on the interconnectedness of the many areas of sustainable development. They stand for the idea that many policy instruments can be made more effective when not only tackling one goal but also taking into account the concerns of other policy fields. The assessment and information on co-benefits can be seen as one way toward more integrated policy making. The term 'co-benefits' first appeared in academia and official policy documents in the 1990s. It implies a win–win strategy where one single policy measure can address two or more policy goals [5–7]. The Intergovernmental Panel on Climate Change (IPCC) defines co-benefits as the 'positive effects that a policy or measure aimed at one objective might have on other objectives, thereby increasing the total benefits for society or the environment' [8] (p. 546). The discussion surrounding co-benefits is part of a more comprehensive mindset shift in the international community, where the focus has shifted from who should reduce emissions to how to align and integrate policies on development and climate change.

Despite the concept's prevalence, neither is there a fixed definition of what counts as a 'co-benefit' nor does the concept have clearly identifiable boundaries [6]. Substantial methodological complications remain, including difficulties in monetizing several types of co-benefits [9], accounting for different beneficiaries and avoiding double counting [10], and establishing a causality between policy programs and co-benefits [6]. The concept is often claimed to be linked to incremental measures that do not address the root causes of climate change and are, therefore, labeled as insufficient to effectively respond to the climate crisis [5,6]. As the concept is not sufficiently defined, Dubash et al. identified the risk that co-benefits could motivate and sell opportunistic policies [11].

Several scholars have produced comprehensive reviews of the co-benefit literature [5,6,12]. The different concepts and approaches can be broadly summarized into three varying strands of understanding the term 'co-benefit': climate co-benefits, development or climate policy co-benefits, and benefit synergies or co-impacts [5,6]. Climate co-benefits arise from policies that do not prioritize climate mitigation or adaptation. Climate policy co-benefits are additional benefits resulting from climate policies, such as improvements in air, soil and water quality, biodiversity, economic and organizational performance, and energy security. Benefit synergies or co-impacts result from policies that are specifically designed to reach two goals simultaneously. The difference in these three understandings is related to the specifics of the agenda [6]. Overall, the term 'co-benefits' is understood and applied quite broadly, for example, when focusing on climate policy, with respect to its scope (mitigation, adaptation), time frame (short-, mid-, long-term), and whether the benefits are intentional or not.

In more recent political practice, policymakers seem to refrain from prioritizing climate change, instead choosing a more neutral term, as can be observed in international initiatives working on co-benefits. For example, the CCAC defines them as 'multiple benefits' (Interview 1, Interview 2). The literature on co-benefits shows that, in particu-

lar, air pollution reduction through climate change mitigation is of substantial economic value [3] and could save up to 1.82 million lives annually [2]. Co-benefits resulting from improved air quality and human health are in many cases equal to or even larger than mitigation costs [5]. In a global modeling study, Xie, Weng, and Cai argued that integrated assessment models that do not take co-benefits into account unavoidably belittle the real benefits of climate policies [3]. Therefore, proponents of the co-benefits concept conclude that, by including co-benefits in cost–benefit analyses, the decision based on these analyses becomes more balanced [5]. One often-emphasized appeal of the co-benefits concept is that it functions as a counterweight to the usual cost-based argument blocking climate change policies [1,5,6]. Economic concerns over mitigation costs and the bias to perceive environmental protection as a zero-sum tradeoff with economic development [13] are usually key obstacles for the adaptation of climate policies. The co-benefits concept is supposed to alleviate such economic concerns, highlighting the win–win situations that can arise if one single policy measure addresses two or more policy goals.

Some researchers have argued for the use of the more neutral term 'co-impacts' rather than 'co-benefits' to indicate that the expected impacts of a policy can also be negative [4]. For example, a climate policy that focuses on diesel-fueled cars may lead to lower CO_2 emissions, but have an additional negative impact on air quality. In this paper, we use the term 'co-benefits', as it was this positive and gains-orientated narrative that pushed the policy processes in the two analyzed cases.

The positive framing of the co-benefits concept, its evidence-based approach, and its advocacy potential can strengthen climate change mitigation by presenting substantial empirical evidence with a persuasive price tag [6,14]. Theoretically, co-benefits can also facilitate decision making and overcome ideological divides [15], improve the resonance of climate policies with local priorities [16], and open up possibilities for decisions and policies that are socioeconomically sound and rooted in science [5].

2.2. Learning as Part of the Policymaking Process

While the concept is very appealing from a theoretical viewpoint, the question remains of how information on co-benefits enters and impacts the policymaking process. Scholars have argued that decision makers go through a learning process when presented with new or updated evidence (e.g., on co-benefits). This process can also be triggered by personal–organizational experience, social interaction with other actors, or the influence of international actors. During the process, decision makers update their knowledge and assumptions about public policy [17], e.g., about ambitious climate policies. In other words, information on co-benefits can act as a trigger or an amplifier of learning processes in policymaking.

Over the past decades, social science-based literature on learning has produced a broad variety of learning taxonomies, concepts, and methods and reviews [17,18]. Two types of learning are specifically of interest for policymaking: instrumental learning and political learning. Instrumental learning refers to problem-solving-oriented learning and the use of professional and scientific standards to update and reform policy instruments [19]. Political learning captures the idea that policymakers may also learn in a way that assists political strategies and power-oriented goals [19], e.g., re-election.

The identification and usage of co-benefits is mostly a knowledge-driven endeavor. Therefore, this work concentrates on learning in what Dunlop and Radaelli described as an epistemic context [20]. Experts are perceived as technically skilled and competent, whereby they must have authoritative knowledge that is policy-relevant and possess soft skills (communication, leadership, and entrepreneurship). Additionally, decision makers are in a 'ready-to-learn' state, and experts can accommodate timelines of policymaking [20].

2.3. A Framework to Analyze the Role of Co-Benefits in Learning Processes

Combining Dunlop and Radelli's context specific mechanisms [20] and Trein's insights into the different learning types [19], this paper frames the following three variables as

characteristics for a learning process in policymaking: (1) problem pressure, a variable taken from Trein's study [19], (2) the political institutional setting and procedures, which combine Trein's findings [19] with Dunlop and Radaelli's observations [20], and (3) policy entrepreneurship, which was added in this paper to take into account the role of individuals and small groups in the learning process. Particularly in epistemic contexts, experts and their involvement in the policy process can have a significant influence on the learning process. All three variables are interdependent and mutually influence each other.

Problem pressure is a key factor in the decision-making process [19,21]. It entails the demands for reform in a policy domain allocated by the environment of the political system in which it takes place [19]. The literature on environmental policies, for example, identified carbon dioxide (CO_2) emissions, levels of air pollution, or energy use as problem pressure [22]. Trein argued that problem pressure can be low, median, and high and that higher problem pressure attracts greater attention from the public and interest groups [19]. Under median problem pressure, the political system is ready to absorb new knowledge. Yet, problem pressure is highly dependent on its perception by policymakers [19] and that they perceive the problem as real [21]. Because co-benefits are applicable to a wide range of policy goals and effect sizes, information on co-benefits helps to link a policy proposal to other important problems, enhancing its prospects for moving up on the agenda. Under high problem pressure, time might not suffice to quantitatively assess the co-benefits. Yet, co-benefits might be used as a narrative, increasing the chances of political learning.

The political institutional setting and procedures condition the way in which policymakers learn. They can, thus, drive or inhibit a learning process and represent the context for policymaking. For example, the structural characteristics of governmental agencies are important. Clear responsibilities and good cooperation and coordination among the different governmental agencies will benefit a learning process and facilitate policymaking in general. In epistemic contexts, learning is enabled by consensual decision making [19] and cooperative informal institutions [20], where the policy process is usually long and incremental, including negotiations with many different stakeholders (e.g., governmental actors, science, civil society, and private sector). The presence of statutory rights of consultation ensures that experts are included, consulted, and listened to by policymakers [20]. Additionally, stakeholder involvement, which includes a broad range of activities, such as informal and formal exchange meetings, dialogues, negotiations, informative sessions, and virtual and in-person consultations, can have a significant influence on the learning process. Many countries have established stakeholder consultations into their policymaking cycles. The regular exchange with diverse stakeholders may be more time-consuming for policymaking but can lead to a more sustainable learning process and, moreover, increase a policy's chances of being adopted and implemented effectively. Such processes, where stakeholders tend to defend their interests and positions in order to gain the most favorable outcomes, can be facilitated by a co-benefits-based narrative. Co-benefits can couple different interests [14], thereby driving cooperation and consensus making. Identifying co-benefits can allow for a more complete comprehension of the effects of the proposed policies and build up support for mitigation measures [5].

Policy entrepreneurs are individuals or small teams that advocate for policy change and act as drivers for a learning process. In an epistemic context, experts as policy entrepreneurs can trigger successful instrumental learning if they have authoritative knowledge which is policy-relevant and exhibit soft skills in communication, leadership, and entrepreneurship to hold the attention of powerful elites [20]. They are most influential when they manage to uncover win–win opportunities [23] when redefining the problem. For example, instead of depicting environmental protection efforts as posing a zero-sum tradeoff, they can emphasize opportunities for economic development arising from the development of new green technologies [13]. Overall, policy entrepreneurs can bring learning from an individual to a collective or organizational level [24].

Following this framework, the paper examines how these three characteristics manifest themselves in practice and examines how information on co-benefits influenced the learning

process. The methodological approach is based on qualitative research triangulating different data sources. Seven interviews, carried out with governmental experts from Mexico and Nigeria, research institutions, and the CCAC Secretariat (see Appendix A), complement reports and other material published on the organizations' websites. The main purpose of these interviews was to gain detailed insight into and expert knowledge on the integrated policy and learning processes that took place in Mexico and Nigeria. They were realized using a semi-guided, explorative method, based on a common questionnaire with open questions giving the interviewee room for personal opinions and detailed descriptions, e.g., their personal perception of the idea of co-benefits and lessons learned. Mexico and Nigeria joined the CCAC in 2012; thus, they have worked with the CCAC since the early foundation of the partnership. Through participating in the CCAC's SNAP program, they launched their respective National Action Plans in 2019 and are now working on the implementation of these policies. The two countries have established a new SLCP planning process rather than integrated SLCPs into an existing planning process. Even though they started from a similar point of departure, Mexico and Nigeria chose two different strategies in the planning process. This research setup not only enriches the analysis but enables a comparison that may lay the groundwork for building more general assumptions for the role of co-benefits in learning and policymaking processes.

3. The Climate and Clean Air Coalition Provides the Setting for Using the Co-Benefits Approach

The CCAC can be seen as the epistemic context that enables learning through the identification of co-benefits. The CCAC is a voluntary transnational partnership that is aimed at mitigating global near-term warming through a reduction in SLCPs, namely, black carbon, methane, hydrofluorocarbons (HFCs), and tropospheric ozone. It was founded in 2012 on a set of 16 'win–win' measures for climate and clean air benefits identified by the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO) [25,26] (Interview 3). Since its inception, co-benefits have been at the core of CCAC's mission.

One of the CCAC's key objectives is to enhance and develop national, regional, and local action on SLCPs. Therefore, in response to requests for support by its member states, the coalition initiated the Supporting National Action and Planning (SNAP) initiative (Interview 4, Interview 5). SNAP has been one of the central thematic activities of the CCAC, and it is aimed at strengthening countries' capacities to undertake an integrated analysis of greenhouse gases (GHGs) by providing a mix of technical assistance and financial support [27]. Figure 1 shows an overview of how the CCAC is structured and where the SNAP initiative fits in.

All projects under the SNAP initiative comprise an institutional strengthening component, a national SLCP planning phase, and a phase concentrating on implementation. Taken together, these three phases constitute the SNAP program. The initiative provides three different learning opportunities on the multiple benefits of SLCP mitigation: new evidence, experience sharing with other countries, and influence by the CCAC as an international actor [17]. With the SNAP initiative, the CCAC tries to not only communicate but also practically implement the idea of multiple benefits or co-benefits into policymaking to unlock the broader benefits of SLCP mitigation measures. The CCAC uses the idea of co-benefits both as quantified evidence and as a narrative and communication strategy (Interview 4). In this sense, it follows what has been proposed by experts as a more opportunity-oriented and, therefore, more effective strategy for climate change mitigation [28]. The role that co-benefits play in the CCAC can also be seen in two of its core tools: the Multiple Benefits Pathway Framework and the Long-Range Energy Alternatives Planning–Integrated Benefits Calculator (LEAP–IBC).

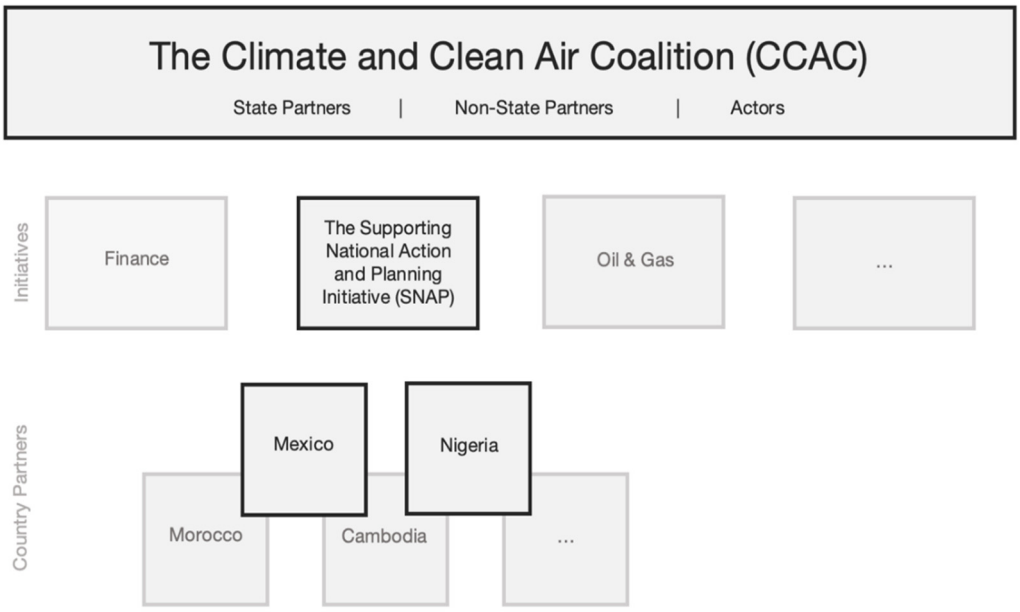

Figure 1. The structure of the Climate and Clean Air Coalition (CCAC). Source: the authors.

3.1. The Multiple Benefits Pathway Framework

The Multiple Benefits Pathway Framework is the CCAC's approach to co-benefits. It was developed by the CCAC scientific advisory panel in 2017 to support governments in integrating air quality and climate policies and to design policies that focus on people's needs, as well as the global climate and development goals [29]. This approach aims to provide information on the co-benefits that can be achieved with SLCP mitigation measures to decision makers. The CCAC's idea of multiple benefits fits the description of the third type of usage of co-benefits identified by scholars [6], as the SLCP mitigation measures are a priori designed to achieve two or more goals simultaneously: climate, air quality, and development goals. The CCAC refrained from the term co-benefits to not imply a superiority of climate over other goals; indeed, most of its members prioritize gains in human health or job creation over global climate change mitigation (Interview 3).

3.2. The Long-Range Energy Alternatives Planning—Integrated Benefits Calculator

To translate the idea of multiple or co-benefits into practice and to identify concrete pathways to achieve these benefits, the CCAC makes use of the LEAP–IBC tool that was developed by the Stockholm Environment Institute (SEI). LEAP–IBC comprises two parts: the Long-Range Energy Alternatives Planning (LEAP) and the Integrated Benefits Calculator (IBC). LEAP is a scenario planning software tool, which is broadly used for climate change mitigation assessment and energy policy analysis [30]. Building on the emission scenarios from LEAP, the IBC estimates the amount of avoided premature deaths and crop losses on a national scale [30]. The LEAP–IBC supports countries in developing their own assessments of the co-benefits of SLCP mitigation measures at the national level (Interview 3). Overall, the LEAP–IBC provides quantified evidence on potential co-benefits, while the Multiple Benefits Pathway Framework builds up a narrative that links different policy goals with one another.

4. Mexico—Integrating Air Quality and Climate Change Policies

Mexico is one of the six founding members of the CCAC and has played a key role in the establishment of the SNAP initiative [31]. The SNAP program in Mexico concentrated on connecting its parallel workstreams on air quality and climate change, as well as complementing existing GHG inventories with air pollutants inventories (Interview 4, Interview 5). The process is situated in the epistemic context of the CCAC and led by the

National Institute of Ecology and Climate Change (INECC), which is supported by CCAC partners such as the SEI, the Molina Center for Energy and the Environment (MCE2), and UNEP with technical assistance and funding [31].

In 2013, Mexico concluded the first SNAP phase, institutional strengthening, and published the "National Planning Document for Short-Lived Climate Pollutants" [32]. However, according to a member of INECC's air quality department, the National Planning Document was not followed by the recommended actions on SLCPs (Interview 5). Therefore, during the second SNAP phase, INECC reviewed the National Planning Document and used the data for the application of a new tool, the above-described LEAP–IBC. With the updated knowledge obtained from the LEAP–IBC, INECC evaluated the climate change mitigation pathways in key sectors including potential reductions in atmospheric pollutants such as black carbon and greenhouse gases, e.g., methane [33].

This *learning process* led to an integrated policy output, the "Integrated SLCP Strategy to Improve Air Quality and Reduce the Impact of Climate Change" published in 2019 [33]. The strategy outlines nine mitigation measures in eight key sectors to reduce SLCPs. It also includes a section on the co-benefits of these measures, e.g., for health, energy efficiency or air quality, and a communication strategy. The proposal aims at facilitating the dialogue among decision makers, researchers, the private sector, and the public through communicating a vision to achieve both climate change and air quality goals through a reduction in SLCPs. Yet, the strategy is not of a binding legal character and, thus, requires a connection to other processes that are binding, such as the development of the National Determined Contributions (NDC), to be implemented. In a third phase, Mexico is now undertaking this task of implementing the strategy.

Overall, it can be said that, in the Mexican case, the first criterion, *problem pressure*, clearly existed and was amplified by information on co-benefits. In Mexico, the political awareness of the problem of climate change has clearly increased within the last decade. Evidence for this is that, in 2013, Mexico adopted the "General Law on Climate Change", which lifted environmental topics to the top of the political agenda of the government (Interview 5). With this political milestone, the country acknowledged the urgency of climate action and created momentum for more ambitious climate policies.

Another indication that not only the threat of climate change in general, but also the problem of SLCPs specifically gained more attention was the development of Mexico's NDC for the Paris Agreement. By including a target to reduce black emissions by 51% by 2030 in its NDC, Mexico decidedly acknowledged the necessity of including SLCPs in climate change mitigation plans, such as the aforementioned General Law on Climate Change [31]. Mexico has taken its participation in the CCAC's SNAP program as an opportunity to better understand its emission sources and to contribute to policies such as the national climate commitments under the Paris Agreement (Interview 4). The assessment with LEAP–IBC not only provided evidence and data on problems such as GHG and other pollutants, but also highlighted the multiple benefits that could be reaped from immediate action. Hence, the information on co-benefits and co-impacts contributed to convincing policymakers of the salience of SLCP mitigation and assisted in moving the issue up on the political agenda.

The second criterion, the political institutional setting and procedures, also played an important role in the learning process that Mexico underwent, when it developed the SLCPs strategy. First and foremost, the lack of political power and authority of the responsible agency INECC represents a challenge to political decisions and the implementation of the SLCPs strategy. Yet, the updated knowledge on co-benefits also provides a better ground for more support for the SLCP strategy.

INECC, which became an independent institution under the aforementioned General Law of Climate Change in 2013, is responsible for the development and coordination of scientific research projects on climate change mitigation and adaptation to support the Ministry of Environment and Natural Resources (SEMARNAT) in the planning and evaluation of public policies [34]. The institute is tasked, among other goals, with establishing

information on GHG emissions and supporting the development of Mexico's NDC (Interview 5). Its mandate includes the facilitation of technical and scientific assistance from foreign entities and, therefore, is the focal point of several international organizations, such as the IPCC and the CCAC [35]. Nevertheless, INECC has no political authority and is, therefore, not in charge of the implementation of policy measures. Policy development and implementation is the responsibility of SEMARNAT (Interview 5). Scholars have argued that the institutional setting influences a learning process [20]. In order to drive a policy development process such as that realized under SNAP, experts from SNAP argue that it is necessary that the institution in charge has convening power over other stakeholders (Interview 4). This convening power could, for example, be grounded in an institution's mandate. INECC's lack of convening power was especially challenging because, within the institution in charge, SEMARNAT, there appeared to be little support for the development of the strategy (Interview 3).

Yet, the information on co-benefits might have had some counterbalancing effect. The gained information and assessments on co-benefits did support INECC in the communication and discussions on the SLCP strategy with SEMARNAT and other stakeholders to get the policy a binding status and to foster its implementation. Subsequent to the development of the National Strategy on SLCP reduction, INECC developed mitigation implementation pathways through a series of workshops and meetings with stakeholders [31]. In these consultations, INECC used the LEAP–IBC evidence of the positive impacts of SLCP mitigation action to explain the necessity of reduction measures to the stakeholders. A researcher from INECC reported that, during the discussions with SEMARNAT and other key stakeholders, the evidence generated by the LEAP–IBC tool appeared to have been convincing to policymakers (Interview 5). As previously mentioned, the LEAP–IBC and the idea of multiple benefits were adopted by SEMARNAT in the current NDC update process.

Last but not least, Mexico's learning process benefitted from the push of several policy entrepreneurs. Experts from SEI acted as key policy entrepreneurs for the projects realized under the CCAC's SNAP initiative. They provided technical and general support to INECC. This assistance encompasses aiding in the establishment of the planning process, determining its key steps, identifying and engaging with stakeholders, and holding workshops and trainings for personnel in INECC and beyond (Interview 3). Both the CCAC staff and the country partners describe the SEI researchers as the experts on the LEAP–IBC tool and the planning process who exhibit soft skills in communication (Interview 5, Interview 6). Furthermore, the SEI experts as policy entrepreneurs possess authoritative knowledge on the benefits of SLCP mitigation, which is policy-relevant. This increases their influence on the policy process and increases the opportunities for instrumental learning.

Within Mexico, the air quality team at INECC, who is coordinator of the SNAP program, is another important policy entrepreneur. The air quality team coordinated the work with SEI and developed the "Integrated SLCP Strategy to Improve Air Quality and Reduce the Impact of Climate Change" [33] (Interview 5). Facing the difficult task of convincing air quality and climate change experts to integrate their emission inventories, the team increasingly made use of the co-benefits idea and LEAP–IBC (Interview 5). With the LEAP–IBC tool, the air quality experts managed to solve perceived conflicts by uncovering win–win opportunities.

5. Nigeria—Multistakeholder Engagement through the Lens of Co-Benefits

Nigeria joined the CCAC's SNAP initiative in June 2015, 3 years after becoming a member of the CCAC. The planning process is led by the National SLCP Coordination Office domiciled in the department of climate change at the Federal Ministry of the Environment. It is supported by the CCAC secretariat, the UNEP Africa Office, the International Union of Air Pollution Association (IUAPPA), and SEI, who provide technical assistance and funding.

The Nigerian SNAP process is characterized overall by a formal two-phase setup with a clear focus (Interview 3). The first phase, institutional strengthening, created awareness

among stakeholders and mobilized their support during the development of the National Action Plan (NAP) to reduce SLCPs (Interview 7). Subsequently, the NAP was developed and presented to stakeholders; at the end of this phase, the plan was approved by the Federal Executive Council of Nigeria in May 2019. It contains 22 mitigation measures that cut across five key sectors [36,37]. The Federal Executive Council of Nigeria is chaired by the Nigerian president and includes all the Nigerian ministries (Interview 7). After its approval, the SNAP planning process entered its second phase, implementation, which is still ongoing at the time of writing.

In Nigeria, the development of the NAP is closely tied to several other international policy processes, the first of which is Nigeria's NDC. The National SLCP Coordination Office worked on aligning the measures in the NAP with the country's NDC to strengthen their implementation (Interview 7). SEI is tasked with incorporating the measures identified in the NAP into the countries' revised NDCs due this year. This activity enabled the application for funding under the NDC support program by the UNDP. Furthermore, the SNAP program supports Nigeria in the Green Climate Fund's (GCF) Readiness Project, which finances countries' institutional capacity building under the UNFCCC [38] (Interview 7). Furthermore, the SLCP abatement activities are coordinated with the UN's Sustainable Development Goals (SDG) (Interview 7). The adaptability of the NAP to other policy areas and to international climate change commitments is perceived as crucial, because by reducing SLCP emissions, the country also advances in the achievement of its national and international climate goals (Interview 7).

Even though Nigeria makes a rather small contribution to climate change globally (in 2019, 0.23% of global cumulative CO_2 emissions [39]), problem pressure is high because the country is very vulnerable to climate change. Millions of Nigerians are without access to electricity or air conditioning and are subsequently vulnerable to extreme heat. Changes in precipitation threaten Nigeria's largely rain-fed agricultural sector [40]. The problem pressure is higher on climate change adaptation than on mitigation. However, the international dynamic on climate change increased, and Nigeria committed to contributing to global mitigation efforts under the Paris Agreement. This development demanded stronger climate mitigation policies.

In this case, the link between co-impacts of climate and air pollutants and the promise of co-benefits that could be achieved with the proposed SLCP mitigation measures acted as an amplifier for the criterion of problem pressure. By quantifying the impacts of SLCPs on health and agriculture through the LEAP–IBC, the National SLCP Coordination Office was able to further boost the perception of problem pressure by decision makers. For a small GHG emitter like Nigeria, co-impacts that benefit the local population, e.g., clean air or job creation, are of higher priority than GHG reduction (Interview 3). These development imperatives and the many benefits arising from SLCP reduction add to Nigeria's motivation to implement the NAP [36] (Interview 7).

In Nigeria, the political institutional setting and procedures, such as the decision-making process, benefitted the learning process, which was facilitated by the CCAC's approach on co-benefits. First and foremost, the establishment of an authority that was explicitly responsible for the development and execution of the SLCP action plan was crucial for the success of this process. Here, a positive narrative on the achievement of co-benefits served as a tool for the National SLCP Coordination Office to gain the support from other governmental agencies for the SLCP National Action Plan (Interview 7).

Furthermore, the Nigerian SNAP process is characterized by an extensive multisectoral consultative process with key stakeholders, which is carried out by the National SLCP Coordination Team. These stakeholders come from various Ministries, Departments, and Agencies (MDAs) on the federal and subnational level, while they also include international development partners, nongovernmental organizations (NGOs), the private sector, and community-based organizations. They were selected to participate in advisory groups and taskforces on the basis of their mandates in SLCP-emitting sectors (Interview 7). Overall, the National SLCP Coordination Office interacted with all MDAs and NGOs

needed to achieve the multiple benefits from the implementation of the proposed SLCP mitigation measures (Interview 7). Before the publication of the NAP, stakeholders had the opportunity to comment on the proposed measures for SLCP reduction in a peer-review workshop [37]. A member of the National SLCP Coordination Office described this extensive stakeholder involvement as essential for enabling the implementation of the NAP because all the stakeholders were included in the development of the plan and were able to make recommendations or comments especially in view of the implementation of the proposed SLCP mitigation measures (Interview 7).

The National SLCP Coordination Office together with the SEI held workshops with the affected ministries to emphasize the co-benefits from the SLCP mitigation measures and ensure the development of robust proposals for the national budget (Interview 3). The CCAC's Multiple Benefits Pathway Framework played a key role in these efforts because it helped demonstrate the interlinkages of climate, air quality, health, agriculture, and others (Interview 7). Throughout the SNAP program, all MDAs received information on the CCAC's 'multiple benefits' approach, the specific multiple benefits that can be achieved through the implementation of the proposed SLCP mitigation measures in the respective sectors, and how these multiple benefits can assist their efforts in driving policies (Interview 7). Hence, the identified co-benefits of the proposed SLCP mitigation measures formed an essential part of the communication with the affected ministries.

The first step in the development of the NAP was building technical capacity and improving data availability in the Ministry for the Environment and other governmental agencies (Interview 3). As suggested by Dunlop and Radaelli, the learning process that took place at that moment was facilitated by conditions that characterize epistemic contexts [20]. As the coordination office is also responsible for coordinating the implementation of the NAP, it had a statuary right of consultation and moderated the policy process [41] (Interview 3, Interview 7). With the National SLCP Planning Office, the Nigerian SNAP planning process had the necessary institutional conditions for instrumental learning.

The National SLCP Planning Office used the information on potential co-benefits in addition to climate change mitigation as a vehicle to gain the support of the other governmental agencies, such as the Ministry of Budget and National Planning and the office of the Secretary of the Government of the Federation. Furthermore, the Ministry of Budget and National Planning is responsible for the allocation of the national budget; thus, its support was crucial to establish the approved NAP as part of the development process of the country. This ministry's consent was a precondition to the approval of the policy. The institutional cooperation was enhanced, because governmental agencies learned that, with the plan's measures, they would have the opportunity to achieve other national priorities, such as health, air quality, and the environment (Interview 7). The quantification of the co-benefits, e.g., the reduction in health costs, helped to advance the decision-making process (Interview 6). The mandate of the department of climate change is to reduce GHG emissions, and, through the co-benefits narrative, the department was able to connect its mandate to other national priorities, such as health, air quality and the environment (Interview 7).

In the case of Nigeria, experts from CCAC's SNAP and SEI, as well as personnel in the National SLCP Coordination Office, can be seen as policy entrepreneurs, as they advocated for policy change and actively sought the alignment of science, policy, and the public [20]. CCAC SNAP and SEI experts led the process through all phases and participated in all activities, ranging from technical assessments to stakeholder consultation (Interview 7). Here, their knowledge and technical support benefitted from the experience with CCAC SLCP mitigation projects in other countries (Interview 7). At the core of their work stood the calculation and revealing of co-benefits through the LEAP–IBC tool developed by SEI. It appears to have strengthened their authority as policy entrepreneurs. Nigeria also further adopted the CCAC's Multiple Benefits Pathway Framework and aims to approach the implementation along that line (Interview 7). CCAC experts requested all relevant MDAs to assign one desk officer per ministry to work on the SLCP planning process (Interview 3).

This clear structure and distribution of responsibility enabled an easy access to the people who needed to make decisions directly from the start of the program (Interview 3).

Furthermore, the personnel from the Ministry of Environment had a crucial role in the process. On the one hand, the members of the National SLCP Coordination Office fostered the translation of learning from the individual level into learning on the organizational level and provided a clear vision for the development and objectives of the project (Interview 3). The team worked on getting a national budget assigned to these projects. On the other hand, the project gained momentum when the responsibility shifted from the ministry's air pollution control department to the department for climate change. This shift acted as a success factor for the NAP development process in Nigeria (Interview 3). In particular, the role of the director of the climate change department was outstanding. His personal skills significantly contributed to engaging the other ministries and convincing them to contribute to the process (Interview 3). Overall, the SLCPS coordination office together with CCAC's SNAP initiative and other specialists functioned as the authoritative body of knowledge and experts [37].

6. Conclusions

Information about co-benefits has triggered and amplified learning processes that led to integrated policy outputs: national SLCP policy plans in Mexico and Nigeria. Overall, the co-benefits approach pursued by the CCAC and its SNAP initiative helped to increase the problem pressure on SLCP reduction and supported the engagement with key stakeholders in both countries, building a strong motivation to design and implement an integrated policy. Furthermore, the identification and narrative of co-benefits supported the activities of policy entrepreneurs decisive for the success of the learning process. The findings of these case studies suggest that the type of information provided in a policymaking process influences learning. Co-benefits as a type of information have fostered a positive narrative that helped convince policymakers of the multiple gains to be expected when implementing integrative climate mitigation policies.

Even though Mexico and Nigeria faced similar starting points, the processes they designed under the SNAP initiative fundamentally differed. The Mexican process was very narrow and concentrated on integrating the know-how from the air quality department into national climate policy. By including a 51% reduction target for black carbon in its NDCs, Mexico set a very concrete and measurable goal. In Nigeria, the process was more all-encompassing. The large-scale stakeholder process benefitted both the development and the subsequent (ongoing) implementation of the NAP. Undoubtedly, a broader engagement with key stakeholders would have also generated more support for the national strategy on SLCPs in Mexico.

The case analyses of this paper show that information obtained through the co-benefits analysis can be both quantified evidence for environmental, social, and economic impacts and a powerful narrative with great advocacy potential. As such, it can help to solve a problem, e.g., SLCP emissions, as well as pursue political purposes, e.g., advancing specific policy goals such as climate action. Recognizing these appeals of co-benefits can play an essential role in international climate and environmental policy. The recognition of the concept's usefulness in governance is growing; in addition to the CCAC, several other international initiatives have embedded the concept in their activities, such as the Ambition to Action project or the COBENEFITS project [4,14].

This research demonstrated that the CCAC and its SNAP initiative provide an epistemic context in which a learning process can proliferate. Its tools and its core idea of connecting SLCP mitigation measures with policy areas such as clean air, health, and sustainable development through the co-benefits idea are very well received among experts and country partners alike (Interviews 1, 2, 4, 5, 6, 7). In addition to supporting the gathering of new evidence and experience sharing, the CCAC itself, as an international actor, exerts influence on countries to pick up SLCP mitigation efforts and, thus, promotes learning on SLCP mitigation measures [42] (Interview 4). The CCAC's work has achieved

stronger awareness on co-benefits in national and international contexts, which can foster a large-scale application of the concept in climate and environmental policy. For example, this could conceivably lead to an increased use of the co-benefits concept in countries' activities under the Paris Agreement, such as the updating of NDCs in 2020/2021. According to INECC, the vision of multiple benefits in air quality, climate change, and health have started to permeate the national environmental policy as a result of the SNAP program. The Mexican Ministry of Environment and Natural Resources has already started using some of the new LEAP–IBC features in their NDC updates [43] (Interview 5). The idea is to include co-benefits in the NDC update due this year (Interview 7). At the time of writing, the SNAP initiative is working on expanding its support for the development of NDCs to further countries (Interview 6).

This analysis of how the co-benefits concept is applied in political practice has offered valuable insights into how and for what purposes new evidence is digested in policy processes. The framework presented in this paper helped to structure the different characteristics of a learning process, and it allows for a more systematic analysis of what role co-benefits played in a policymaking process. The practical findings from the case studies can help to further develop the conceptual debate on co-benefits. The explorative research approach of this study enables the consideration of conditions of learning processes that are difficult to quantify, e.g., the impact of policy entrepreneurs or the perceived problem pressure.

Nevertheless, the use of the co-benefits concept also faces significant limitations. Our study confirmed that methodological ambiguities, which range from the very broad definition of the co-benefits concept to technical difficulties when accounting for or monetizing some co-benefits, represent challenges in the political practice. Furthermore, to function as an effective driver in policymaking, co-benefits require a strong communication effort, which requires significant knowledge capacity within the responsible agency and, often, external support (e.g., through an international experts). Further research on conceptual implications of co-benefits, as well on the concept's use in policymaking processes, is necessary to fill important knowledge gaps.

The learning process about multiple co-benefits of SLCP mitigation under the CCAC is a special case; nonetheless, its lessons can be useful to designers of public policy and the scientific community. Future research focusing on the governance implications of the co-benefits concept would also be valuable for informing policy processes. In addition, research could draw on insights from other countries that have implemented or are in the process of implementing the CCAC methodologies in order to gain a broader perspective on the political practice.

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Appendix A

Interview 1 was conducted with the research group leader of the COBENEFITS project at the Institute for Advanced Sustainability Studies (IASS) on 8 March 2021.

Interview 2 was conducted with a climate policy analyst from the Ambition to Action (A2A) project at the New Climate Institute on 12 March 2021.

Interview 3 was conducted with a research associate from the Stockholm Environment Institute (SEI) on 1 April 2021.

Interview 4 was conducted with the former head of the Supporting National Action Planning (SNAP) initiative by the CCAC on 11 March 2021.

Interview 5 was conducted with the CCAC focal point at the National Institute of Ecology and Climate Change (INECC) in Mexico on 6 April 2021.

Interview 6 was conducted with the current head of the SNAP initiative by the CCAC on 11 March 2021.

Interview 7 was conducted with two members of the SLCP Coordination Office in Nigeria on 1 April 2021.

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