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MASTER PROGRAM ON CLIMATE CHANGE AND HUMAN SECURITY

KNOWLEDGE EXCHANGE BETWEEN POLICY MAKERS AND EVIDENCE GENERATING INSTITUTIONS IN POLICYMAKING PROCESS TO ADDRESS CLIMATE CHANGE IN GHANA

Thesis N°……

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DEDICATION

To the MOST IMPORTANT PERSON all over the Earth

To my DELIVRER, CONFORTER, HELPER

Some call YOU power, others call YOU breathe or wind, others even call YOU dove but for me, YOU ARE beyond all these names. YOU ARE a FULL PERSON with eyes to see, ears to hear, heart to feel, hands to intervene and feet to walk before us.

Surely, YOU HAVE BEEN before me to guide me, behind me to protect me, by my sides to advice, instruct and reveal great things to me.

YOU HAVE FULFILLED what YOU SAID in YOUR WORDS (Zachariah 4:9)

Receive this work as first fruit of greater works and symbol of my thanksgivings for all YOUR GOODNESS towards me

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ACRONYMS

Acronyms	Meanings
ACF	Advocacy Coalition Framework
AU/NEPAD	African Union/New Partnership for Africa's Development
CAADP	Comprehensive Africa Agriculture Development Programme
CBD	Convention on Biological Diversity
CDKN	Climate and Development Knowledge Network
CEGENSA	Centre for Gender Studies and Advocacy
CIHR	Canadian Institute of Health Research
COP	Conference of the Parties
CSIR	Council for Science and Industrial Research
CSO	Civil Society Organization
DRUSSA	Development Research Uptake in Sub-Saharan Africa
ECOWAP	Economic Community of West African Agricultural Policy
ECOWAS	Economic Community of West African States
EPA	Environmental Protection Agency
ESRF	Economic and Social Research Foundation
FAO	Food and Agriculture Organization
FCCCU	Forestry Commission Climate Change Unit
FEG	Friends of the Earth-Ghana
FORIG	Forestry Research Institute of Ghana
FSSD	Fisheries Scientific Survey Division
G-CAN	Ghana-Climate Adaptation Network
GDP	Growth Domestic Production
GECCA	Ghana Environmental Conventions Coordinating Authority
GFDRR	Global Facility for Disaster Reduction and Recovery
GMA	Ghana Meteorological Agency
GSGDA	Ghana Shared Growth and Development Agenda
GSS	Ghana Statistical Services
GWP	Global Water Partnership
HFA	HYOGO Framework of Action
IAST	Institute for Applied Science and Technology
IESS	Institute for Environment and Sanitation Studies
IIED	International Institute for Environment of Development
IMWI	International Water Management Institute
IRSC	Institut de Recherche en Santé du Canada
Linking RTA or LRTA	Linking Research to Action

LPRC	Livestock and Poultry Research
MDA	Ministries, Departments and Agencies
MESTI	Ministry of Environment, Science, Technology and Innovation
MMDA	Metropolitan/Municipal/District planning Authorities
NAMA	Nationally Appropriate Mitigation Action
NCAS	National Climate Adaptation Strategy
NCCC	National Climate Change Council
NCCP	National Climate Change Policy
NDPC	National Development Planning Commission
NGO	Non-Governmental Organisation
RAPID	Research and Policy In Development
RD&U	Research Dissemination and Utilization
REDD	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
RIPS	Regional Institute for Population Studies
RIU	Research Into Use
SAS	Statistical Analysis System
SPSS	Statistical Package for the Social Sciences
STEPRI	Science and Technology Policy Research Institute
TCP	Town and Country Planning
UL	University of Legon
UN	United Nations
UNU/INRA	United Nations University/ Institute for Natural Resources in Africa
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
WACCI	West Africa Centre for Crop Institute
WASCAL	West African Science Service Center on Climate Change and Adapted Land Use
WHO	World Health Organisation

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ABSTRACT

Science-based policies constitute for climate change issue an important and effective weapon that can be used by policy makers to improve conditions of local populations. In order to improve the knowledge exchange process that leads to the formulation of such policies, this study was undertaken in Ghana, particularly in Accra. It aims to describe climate change policy process, assess the transfer and use of scientific knowledge and determine perceived barriers to knowledge exchange. Data were mainly collected from policy documents and evidence generating institutions. They include policy actors, coalitions and beliefs, occurrence and purpose of using scientific evidence in policy documents, push efforts towards policy makers, and barriers to knowledge exchange. They were mainly analysed through descriptive statistics using SPSS 16.0.

The climate change policy-making process was participatory with research and academic institutions mostly involved at the validation stage. However, at the formulation stage, scientific evidence has been highly used to prioritize strategies to address climate change. The content analysis has revealed that scientific input is the most frequent (48%), followed by input from ministries and input from NGO/CSO. This knowledge input generated by evidence generating institutions is transferred to policy makers through printed materials (60%) and meetings (50%). About 37% of them believe that policies and directions in the document are relevant and can lead to climate change adaptation and mitigation. Nevertheless, there are some barriers to climate change knowledge transfer and use. They range from lack of research funding (55%) to wrong perceptions of policy makers about scientists' work (55%) and differences between scientists and policy makers in terms of too advanced knowledge produced (85%) with too technical approaches and methods (60%).

Among others, we suggest the collaboration of all evidence generating institutions to collect, centralize, and co-produce policy briefs in an accessible language to policy makers, the resourcing of existing science policy institutions to act really as boundary organizations where policy makers can consult researchers.

Keywords: Knowledge Transfer, Knowledge Use, Policy Process, Science-Based Policies, Barriers, Ghana.

RESUME

Les politiques fondées sur la science constituent une arme importante et efficace qui peut être utilisée par les décideurs politiques pour améliorer les conditions de vie des populations locales. Afin d'améliorer le processus d'échange de connaissances qui conduit à la formulation de ces politiques, cette étude a été réalisée au Ghana, en particulier à Accra. Il vise à décrire le processus d'élaboration de la politique de lutte contre les changements climatiques, évaluer le transfert et l'utilisation des connaissances scientifiques et déterminer les obstacles à l'échange de ces connaissances. Les données ont été collectées principalement dans les documents de politiques et auprès des institutions génératrices de connaissance. Elles ont trait aux acteurs politiques, coalitions et narratives, la fréquence et le but de l'utilisation des concepts scientifiques dans les documents de politiques, les efforts de dissémination vers les décideurs et les obstacles à l'échange de connaissances. Elles ont été analysées principalement par le biais des statistiques descriptives en utilisant SPSS 16.0.

Le processus d'élaboration de la politique de lutte contre les changements climatiques était participatif avec l'implication des institutions universitaires et de recherche au stade de validation. Cependant, au stade de formulation, les résultats de recherche scientifique ont été très utilisés, et ce pour prioriser les stratégies pour lutter contre le changement climatique. L'analyse de contenu a révélé que la contribution de la science est la plus élevée (48%), suivie de celle des ministères et des ONG/OSC. Cette connaissance générée par les institutions génératrices d'information est transférée aux décideurs politiques au travers des documents imprimés (60%) et des réunions (50%). Environ 37% de ces institutions croient que les politiques et les instructions du document ghanéen de lutte contre les changements climatiques sont pertinentes et peuvent conduire à l'adaptation et l'atténuation des changements climatiques. Néanmoins, il y a des obstacles au transfert et à l'utilisation des connaissances sur le changement climatique. Elles vont de l'absence de financement de la recherche (55%) aux perceptions erronées des décideurs politiques sur le travail des scientifiques (55%) et les différences entre les scientifiques et les décideurs en termes de production de connaissances trop avancées (85%) avec des approches et méthodes trop techniques (60%).

Entre autres, nous proposons la collaboration de toutes les institutions génératrices de connaissance afin de collecter, centraliser et co-produire des notes d'orientation dans un langage accessible aux décideurs, l'équipement des institutions de politique scientifique en ressources afin d'opérer véritablement comme des plateformes où les décideurs politiques peuvent consulter les chercheurs.

Mots-clés: Transfert de connaissances, Utilisation des connaissances, Processus politique, Politiques fondées sur la science, Barrières, Ghana.

Chapter 1: Introduction

1.1 Problem Statement

Climate change and related risks are real in the entire world. Ghana has experienced an increase of 1°C over the past 40 years (1960–2000) and projected estimates of average temperature rise are 1.0-3.0°C by 2060, 1.5°C to 5.2°C by 2090 (EPA, 2015). Precipitation may increase, or is most likely to decrease (MESTI, 2013; EPA, 2015). These projections indicate potential changes in terrestrial and aquatic ecosystems, affecting natural resources and associated productivity, which has an indirect impact on the livelihoods, food and health security of communities (MESTI, 2013). Many studies and research projects/programmes are being implemented to adapt to climate change and reduce its related risks. However, the situation has not much improved. According to Pielke in Miller and Neff (2013:7), "decades of scientific research and investment have resulted in little progress in social and political arenas on substantive climate policy." This evidence may be due both to scientists and policy makers. In fact, climate change scientists are motivated by the goal to increase knowledge rather than increasing social outcomes and achieving desirable policy goals. They focus generally on classifying uncertainties and specifying consequences for various sectors (Rayner, in Miller and Neff, 2013). According to Longino and Toulmin (in Miller and Neff, 2013), scientists interpret science policy goals and social values using their own value systems and assumptions. They frame climate change issues as a global concern that science alone can predict and manage. This scientific framing of climate change has made it difficult to integrate alternative understanding into policy discourse. On the other hand, decision-makers formulate their decisions based on their own experiences or other secondary sources of knowledge rather than scientific evidence (Cvitanovic et al., 2015). There is a prevailing concern in Africa that public policy making process is not adequately informed by science and is not reflective of research-based evidence (ESRF, 2011). This is largely due to limited interface between researchers, on one hand and public policy makers in the government, on the other hand.

Many scholars have underlined the necessity to improve the knowledge-exchange among scientists and decision-makers to support adaptation and sustainable development (de Jonge and Giebels, 2014). According to Miller and Neff (2013:7), "a more nuanced understanding of the interaction between science policies and scientists' interpretations of those policies and conduct

of research will enable policy-makers to construct improved science policies." This study is an attempt to explore the linkages between scientists and policy makers and particularly the role of science in making effective policies that can address climate change in Ghana. It aims at answering this main question: How is knowledge on climate change transferred and used in policy making process? This study will contribute to the understanding of the effectiveness of science based policies, the factors that hinder the knowledge exchange process and strategies to overcome them.

1.2 Objectives

The overall objective of this study is to analyse the exchange process of knowledge between evidence generating institutions and policy makers to formulate science-based policies in Ghana. These following objectives will contribute to achieve this primary objective:

- To examine the climate change policy formulation process, its actors, their beliefs and their use of scientific evidence;
- To describe ways used by evidence generating institutions to transfer such evidence to policy makers;
- To determine the perceptions of evidence generating institutions on effectiveness and barriers to climate change knowledge exchange and implementation of science-based policies.

1.3 Research questions

This thesis attempts to answer the following questions:

- How do policy makers involve scientific institutions in the policy process and make use of climate change evidence?
- How are evidence generating institutions translating and disseminating evidence on climate change to policy makers?
- What are the perceived effectiveness and barriers to climate change knowledge exchange and implementation of science-based policies?

1.4 Organization of the thesis

This thesis is structured around four chapters. The first chapter is the introduction. It states by the problem statement, defines the objectives and frames the research questions. Chapter II exposes the current state of concepts, theories and studies in climate change policy arena. The third chapter describes methods used to analyze knowledge exchange between policy makers and evidence generating institutions and climate change policy process in Ghana. The fourth chapter presents related to the findings of this study and their explanation. The last section of the thesis gives a summary of the whole work and formulates some suggestions and recommendations to different actors for the improvement of the interface climate science and climate policy in Ghana.

Chapter 2: Literature review and theoretical background

The study of the climate change policymaking process in Ghana and the knowledge flow in this process is based on a review of existing literature in the area of climate change, policy and knowledge exchange. This chapter summarises the understanding of concepts, the review of studies and theories. The literature review starts by the overview of climate change situation in Ghana. Then, it exposes the context of policy on climate change and it ends with the process of knowledge translation. The last part is devoted to the presentation of frameworks chosen to guide the work.

2.1 Climate Change Effects at Continental and National Levels

2.1.1 Climate Change Effects in Africa

Climate change has become an important global source of vulnerability that requires urgent attention in order to ensure sustainable human development. Over the last century, a rise in temperature of 1°C higher than the global average was observed in Africa (Müller-Kuckelberg, 2012). Risk factors such as explosive population growth, overdependence on environmental resources, poverty, lack of climate risk awareness and low adaptive capacity make the African continent even more susceptible (IPCC, 2007; Golam et al., 2010; Stanturf et al., 2011). Though changes in the climate may affect the whole continent, its distribution may vary across it and per sector (Thornton et al., 2008*)*. Regional climate change impacts assessments indicate that most of the vulnerable countries and societies in Africa are located south of the Sahara (Müller-Kuckelberg, 2012).

The heightened vulnerability of Africa to small changes in temperature and precipitation is due to the fact that its ecosystems and societies are adapted on the whole to only a small range of climate changeability (Müller-Kuckelberg, 2012). For example, climate change in the arid northern sub-region would enhance desertification and a gradual reduction in forest cover, while the predicted drop in rainfall of the northern regions would result in soil degradation and increase in dust storms. The nature of the socio-economic environment also contributes to Africa's vulnerability. Within the socio-economic sector, agriculture, the most important sector in the economies of most non-oil exporting African countries, is expected to be the worst hit from climate change. The highly rainfall dependent and subsistent agricultural sector constitutes about

30% of Africa's GDP, 50% of export value and provides a source of livelihood for 70% of the continent's population (UNFCCC, 2006, IIED, 2008). There are predictions of a 2.9°C increase in temperature in sub-Saharan Africa by 2060 (Müller-Kuckelberg, 2012). The warmer temperatures have far-reaching consequences for food security on the African continent. For example, predictions show a 50% decrease in rain-fed agriculture and the number of the population suffering from water stress will increase from 15 to 250 million by 2020 (UNFCCC, 2006).

Projections further indicate that climate change could increase the number of people facing water scarcity by 2080 by 1.8 billion, majority from Africa (Müller-Kuckelberg, 2012). Increased exposure to coastal flooding and extreme weather events are equally threatening Africa, additional constraints (disease burden, debt burden, political instability, and conflict) further conspire in reducing the adaptive capacity while increasing the vulnerability of rural populations (Stanturf et al., 2011).

2.1.2 Assessment of Ghana's Vulnerability to Climate Change

In Ghana, vulnerability to climate change is largely defined by exposure to various impacts (e.g. high dependence on rain fed agriculture), low adaptive capacity and the reactionary nature of adaptation measures. Across the country, vulnerability varies spatially and socially with each ecological zone having its peculiar physical and socio-economic characteristics defining sensitivity and resilience (MESTI, 2012)**.** Ghana's vulnerability to climate change and the lack of capacity to adapt is devastating to the high rain dependent agriculture sector, which is the main source of livelihood for the majority of the population. The most affected sectors include the economic (agriculture, water resources, natural resources and energy), social and infrastructural sectors (MESTI, 2012). The country's susceptibility is further exacerbated by the lack of adapting strategies due to the lack of institutional, economic and financial capacity (Agyeman-Bonsu et al., 2008).

Droughts, floods and sea erosion are the main drivers of adaptation to climate change. Scientific evidences point to rising temperatures, increased rainfall variability, rising sea levels and high incidence of weather extremes and disasters of significant impacts (MESTI, 2013). In the agricultural sector, climate change marked by prolonged drought is one of the most serious climatic hazards particularly for the northern regions of Ghana and the coastal savannah areas

(MESTI, 2012). Temperatures in all the ecological zones are rising with low rainfall levels that are increasingly erratic. Frequent and longer dry periods also threaten crop failures; the staple maize is particularly susceptible. Over the period 1960–2000, an increase of 1°C in temperature has been observed, while average rises are projected at 0.6°C, 2.0°C, and 3.9°C by the year 2020, 2050 and 2080, respectively (MESTI, 2013).

Based on a 20-year baseline climate observation, it is anticipated that staples such as maize and other cereal crop yields in Ghana will reduce by 7% by 2050 (Agyemang-Bonsu et al., 2008). Cocoa, which is the major agricultural export commodity, would be significantly affected as its ecological range is expected to shrink substantially (Agyemang-Bonsu et al., 2008). Subsequently, investments in the largely subsistent and rain fed agricultural sector has become more expensive, risky and less profitable (MESTI, 2012). The climate-related drivers of change including temperature, precipitation, sea level rise, atmospheric carbon dioxide content and the incidence of extreme events are expected to affect Ghana's agricultural sector through reduced crop yields and agriculture production (Agyemang-Bonsu et al., 2008). Increased occurrence of pest attacks, limited water availability, intense droughts, declined soil fertility, low livestock productivity and high production cost and human resource availability (Baffoe-Bonnie et al., 2008) will lead to food insecurity and malnutrition. The effects of climate change, particularly in the agricultural sector affects the underlying vulnerabilities of the population who react to the effects of climate change by movement, including rural urban migration and environmental refugees.

The sea-level has been rising at 2.1mm per year over the last 30 years and projected at 5.8 cm, 16.5 cm and 34.5 cm by 2020, 2050 and 2080 respectively (Agyemang-Bonsu et al., 2008). Impacts on infrastructure are already visible as many cities and towns along the coast suffer the loss of homes and other infrastructure such as roads resulting from effects of storm surges, sea level rise and the accompanying coastal erosion.

The risks associated with climate change vary from one region to another one within the country. The coastal Savannah is mainly affected by sea level rise, while in the high forest zone, people are subject to climate variability (early cessation and late start of rains). Rainfall extremes characterize the zone of transition and the Guinea and Sudan Savannah record, among others, high risk of frequent flooding. Climate change is also expected to exacerbate health conditions

through increased incidence of disease, reduced access to water and food (MESTI, 2013). Epidemics of vector borne diseases such as malaria, pest infestations, and heat stress effects (such as meningitis) are expected to increase (Craig *et al,* 2004*;* Baffoe-Bonnie *et al.,* 2008; GFDRR, 2015).

2.2 Global and Regional Policies on Climate Change

Efforts at incorporating climate change action into development mechanisms have been put in place through global and regional frameworks, commitments and resolutions, among others. There are among others:

- The *United Nations Framework Convention on Climate Change* (UNFCCC): its fundamental role is to ensure that climate change issues are considered in national development planning of governments.
- *The Cancun Adaptation Framework*, that includes National Adaptation Plans, work programme on Loss and Damage, and the establishment of the Adaptation Committee to coordinate implementation of adaptation;
- *The Technology Mechanism* to increase design, development and dissemination of climate-friendly technologies;
- *A Green Climate Fund* to manage financing support for developing countries' actions on climate change; developed countries broadly agreed to the mobilization of an annual amount of USD100 billion for adaptation and mitigation by 2020.
- *Mitigation Pledges* from all industrialized nations towards low-carbon development plans or strategies while a significant number of developing countries have initiated the development of nationally appropriate mitigation actions (NAMAs) as an opportunity for low carbon growth development strategies.
- *The HYOGO Framework of Action (HFA)* that serves as the guideline for countries and stakeholders to contribute to the achievement of the internationally agreed goals through 2015. It is a global framework for international cooperation on disaster risk reduction and a foundation for national, regional and international development agendas. The HFA implementation is to result in a substantial reduction of disaster losses, in lives and in the social, economic and environmental assets of communities and countries, and is supported by three strategic goals, five priorities for action, and four cross-cutting issues (MESTI, 2013).

Consultations on a post-2015 framework for disaster risk reduction (or HFA2) are supported by the international community's commitment for disaster risk reduction and the building of resilience to disasters within the context of urgency, sustainable development and the elimination of poverty.

There are other deep-rooted inter-governmental agreements besides climate change and disaster risk reduction policy processes that support and deliver disaster risk reduction and adaptation results (co-benefits). These include, among others, the UN Convention on Biological Diversity (CBD), the UN Convention to Combat Desertification, the Ramsar Convention, the Beijing Declaration and Platform for Action, the Committee on World Food Security, among others.

On the African continent, various efforts are being undertaken to support climate change mitigation and adaptation across various sectors of development. Supporting Integrated and Comprehensive Approaches to Climate Change Adaptation in Africa (AfricaAdapt) (Sova et al., 2014), various agro-based adaptation initiatives exist to improve productivity and enhance food security such as the Comprehensive Africa Agriculture Development Programme (CAADP), an initiative by AU/NEPAD governments to accelerate growth and eliminate poverty and hunger in African countries, and the ECOWAS Agricultural Policy (ECOWAP). The ECOWAS/CAADP has a vision of a modern and sustainable agriculture, based on the effectiveness and efficiency of family farms and the promotion of agricultural enterprises through the involvement of the private sector. It has six components: improvement of water management, improved management of other shared natural resources, sustainable development of farms, development of agricultural value chains and the promotion of the markets, prevention and management of food crises and other natural catastrophes and Institutional strengthening. In Ghana, this policy supports the successful implementation of the Ghana Food and Agriculture Sector Development Policy (Sova et al., 2014).

2.3 Climate change Institutions and Policy in Ghana

2.3.1 Climate Change Political Institutions

The issue of climate change is receiving high political attention at the national level and across sectors. Climate change advocacy promotion and integration into development planning is undertaken by formal government agencies (and their implementing agencies) and two principal multi-stakeholder platforms; the Climate Adaptation Network (G-CAN), and the Ghana Climate Change, Agriculture and Food Security Platform.

The Ministry of Environment, Science, Technology and Innovation (MESTI) is in charge of Climate change. It houses the Ghana's National Climate Change Council (NCCC), which is responsible for leading the inter-ministerial process of developing Ghana's National Climate Change Policy (NCCP). The Environmental Protection Agency (EPA) is the technical implementing agency of the MESTI that serves as Ghana's focal point for regional and international United Nations Framework Convention on Climate Change (UNFCCC). It coordinates climate change conventions and initiatives (Sova et al., 2014). The Ghana Environmental Conventions Coordinating Authority (GECCA) ensures synergy between Ghana's Climate change efforts and the nearly 35 international conventions to which Ghana is signatory by coordinating the Rio Conventions (desertification, climate change, and biological diversity). The National Development Planning Commission (NDPC) coordinates all climate change related policies and ensures its mainstreaming into national development frameworks, e.g. the Ghana Shared Growth and Development Agenda (GSGDA) (MESTI, 2013).

2.3.2 Climate Change Policies in Ghana

Sova et al. (2014) identified five key documents comprising Ghana's portfolio of climate plans and programmes in recent times: (i) Supporting Integrated and Comprehensive Approaches to Climate Change Adaptation in Africa (AfricaAdapt, 2009); (ii) Integrating Climate Change and Disaster Risk Reduction into National Development, Policies and Planning in Ghana, 2010; (iii) Ghana's Second Communication to the UNFCCC, 2011; (iv) National Climate Change Adaptation Strategy (NCAS), 2012 and (v) the National Climate Change Policy (NCCP), 2013. Table 1 summarises the objectives and priorities of the key climate change documents.

Table 1: Summary of the major climate change policy objectives and priorities in Ghana

	Supporting Integrated and Comprehensive Approaches to Climate Change Adaptation in Africa (AfricaAdapt), 2009	Integrating Climate Change and Disaster Risk Reduction into National Development, Policies and Planning in Ghana, 2010	Ghana's Second Communication to the UNFCCC, 2011	National Climate Change Adaptation Strategy (NCAS), 2012	National Climate Change Policy (NCCP), 2013
Awareness raising and capacity building		X	X	X	X
Improved land use management		X	X	X	X
Develop drought/flood, pest/disease tolerant varieties, and climate-resilient livestock breeds		X	X	X	X
Promote research (in climate-smart agriculture)			X	X	X
Establish environmental sanitation strategies			X	X	X
Improve water resource management			X	X	X
Promote agricultural diversification			X	X	X
Improve access to healthcare			X	X	X
Promote fisheries resource management			X	X	X
Invest in post-harvest storage systems			X	X	X
Promotion of alternative livelihoods			X	X	X

Source**:** Sova et al., 2014

While other policies target technical aspects of climate change and disaster issues, the Africa Adaptation Programme in Ghana aims at mainstreaming climate change adaptation into its national and subnational development processes, and to leverage additional adaptation funding and use this effectively (Sova et al., 2014).

2.4 Knowledge Exchange

2.4.1 Definition

Knowledge exchange encompasses all facets of knowledge production, sharing, storage, mobilization, translation and use (Best and Holmes, in Cvitanovic et al., 2015). Various terms are used to refer to the same concept: knowledge translation, knowledge transfer, research utilization, evidence-based decision-making, knowledge uptake, research implementation, research uptake, and research transfer (Graham et al., in WHO, 2012). A widely accepted definition of knowledge translation, for instance, comes from health research institutes particularly the Canadian Institutes of Health Research (CIHR). Accordingly, "Knowledge translation is the exchange, synthesis and ethically-sound application of knowledge - within a complex system of interactions among researchers and users - to accelerate the capture of the benefits of research for Canadians through improved health, more effective services and products, and a strengthened health care system" (CHIR, 2008)[1]. When done successfully it is believed that knowledge exchange increases the likelihood that knowledge and evidence will be used in policy and practice decisions, thus increasing the success of those decisions in meeting their objectives (Cvitanovic et al., 2015).

2.4.2 Knowledge Translation Frameworks

There are various frameworks to describe knowledge translation process. Most of them have been developed by health researchers and are described below.

2.4.2.1 Knowledge-to-action Process Framework

Knowledge-to-action is a complex and dynamic process, which starts by the creation of knowledge as the first component of the framework and ends with its application by stakeholders as the second component of the framework (WHO, 2012). They are summed up in ten phases (figure 1). The knowledge cycle consists in carrying out research (knowledge inquiry), making a synthesis of the results in order to make it useful to stakeholders (knowledge synthesis). This synthesis is made available to stakeholders through the production of specific knowledge tools/products. The action cycle contains identification of the problem, identification of the appropriate knowledge to resolve the problem, application of this knowledge to the local context, assessing barriers to knowledge use, developing, tailoring and implementing interventions,

[1] www.irsc.gc accessed in January 2016

monitoring the knowledge, evaluating the outcomes, and sustaining the knowledge use (WHO, 2012).

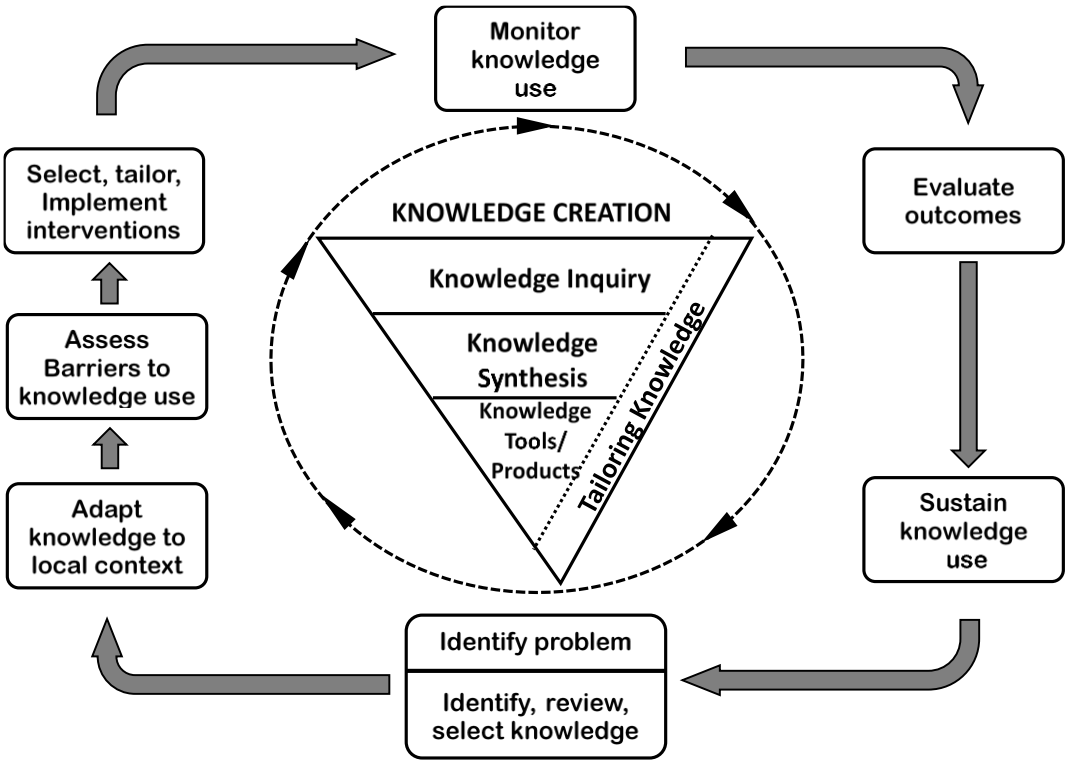

Figure 1: Knowledge-to-action process framework (WHO, 2012)

2.4.2.2 Framework for Research Dissemination and Utilization (RD&U)

The Research Dissemination and Utilization Framework was developed by Dobbins et al. in 2002 to support health policy and clinical decision-making. They depicted this process as a progressive process containing five major stages: knowledge, persuasion, decision, implementation and confirmation (figure 2). It starts by dissemination activities of the knowledge and highlights all the factors that can persuade stakeholders to make evidence-based decision (environmental, organizational, individual, innovation characteristics). Based on the type of decision made, they can either adopt or reject the knowledge in their decision-making, what will result in different outcomes.

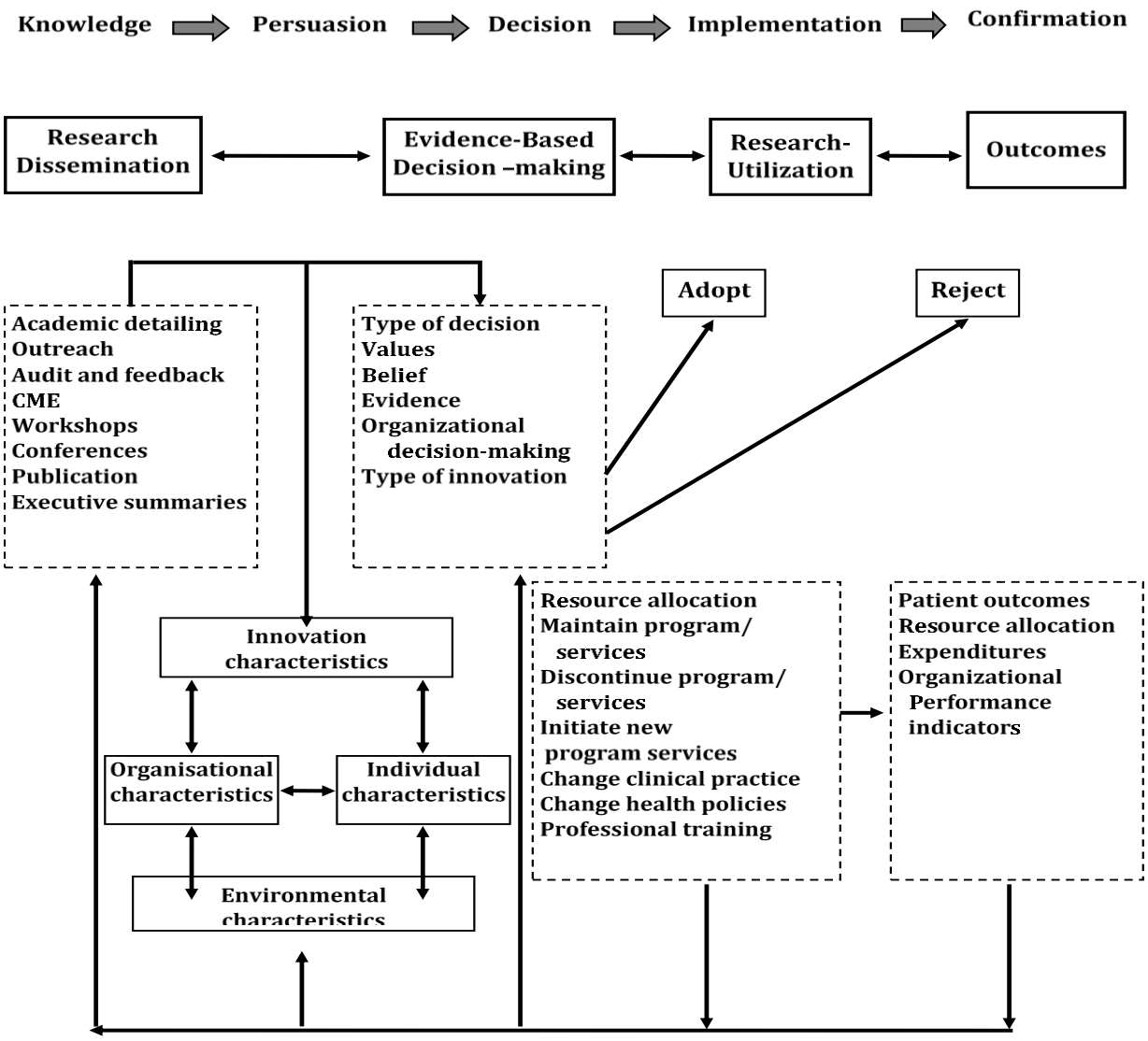

Figure 2: Framework for Research Dissemination and Utilization (WHO, 2012)

2.4.2.3 Research and Policy in Development (RAPID) Model

The RAPID model was developed by the Overseas Development Institute to describe research and policy in developing countries (WHO, 2012). According to this model, the success of knowledge exchange *process* depends on the political context, the characteristics of the evidence, the links between policy makers and researchers, and external influences (figure 3). It is appropriate for large scales of intervention such as national level. It has been tested and there are many examples and tools associated with this model (WHO, 2012).

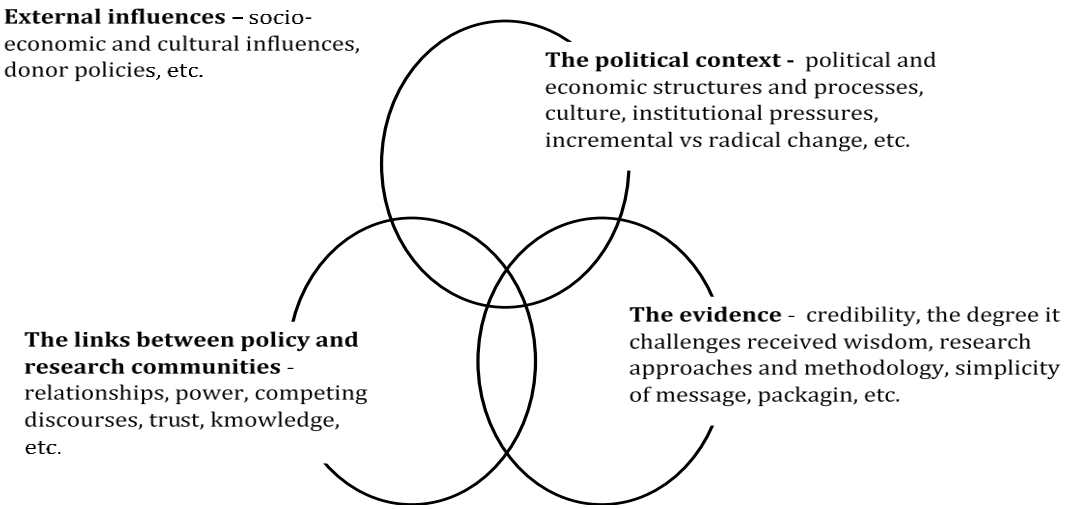

Figure 3: Research and Policy in Development (RAPID) Model (WHO, 2012)

2.4.2.4 Assessing Country Level Efforts Linking Research to Action (Linking RTA)

Lavis et al. (2006) developed a framework to assess efforts made by researchers to link their research to action in health sector. It contains four components: the climate for research use, the production of research and appropriate synthesis of research for policymakers, efforts used to link research to action, and evaluation of these efforts. These efforts correspond to four models they have developed to inform policy decisions (figure 4).

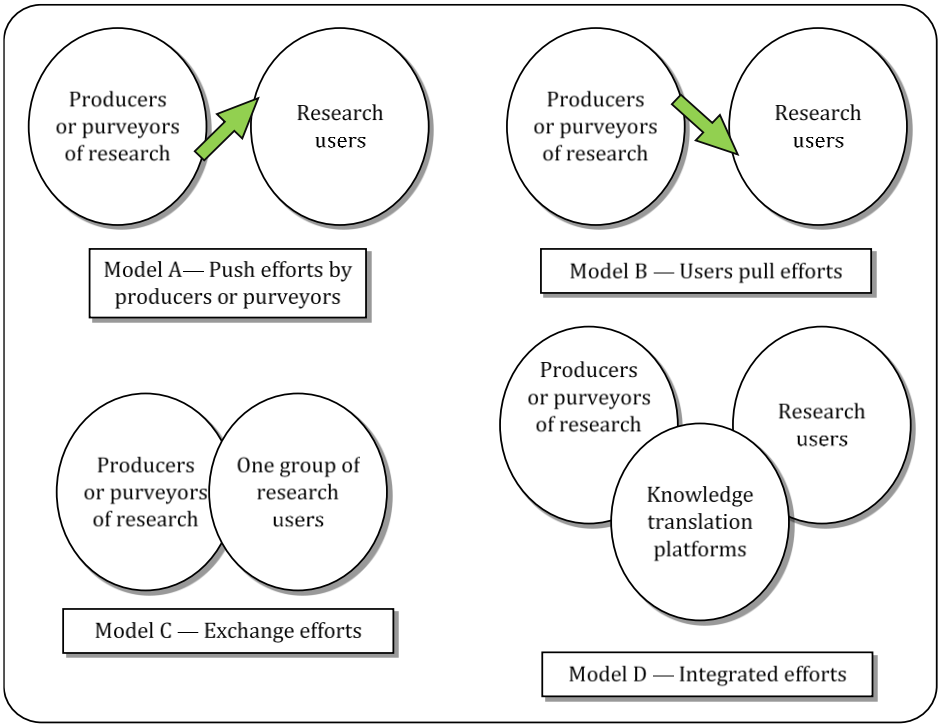

Figure 4: Linking RTA Framework (WHO, 2012)

The strengths and weaknesses of these frameworks are briefly shown in the table 2.

Table 2: Strengths and weaknesses of some knowledge translation frameworks

Frameworks	Strengths	Weaknesses
Knowledge-to-action	• Detailed picture of actions/strategies to undertake for research use in practice	• Lack of details on knowledge synthesis phase • Lack of linkages between knowledge creation and action
Framework for Research Dissemination and Utilization (RD&U)	• Takes into consideration factors that can influence research dissemination and use	• Does not include knowledge creation phase • Not empirically tested and relationships that have yet to be proven
Research and Policy in Development (RAPID) Model	• Focus on political, socio-economic and cultural factors that can influence research and policy process in developing countries	• Lack of details on research dissemination activities • Necessity of macro-level indicators in order to understand the science policy process
Assessing country level efforts linking research to action (Linking RTA)	• Give details on various activities constituting research dissemination • Take into account the knowledge creation, knowledge action, context that can influence research policy process • Has been tested through semi-structured interviews and surveys with healthcare leaders across Canada and 41 countries	• Lack of details on the biggest influence on research dissemination and use

Source: adapted from WHO (2012)

Two frameworks fit this research study because they are suitable at national level: Research and Policy in Development (RAPID) model and Assessing country level efforts linking research to action (Linking RTA). Because the RAPID Model is specifically for developing countries, the Linking RTA has finally been chosen. It almost includes the strengths of other frameworks with additional components on interactions between science and policy actors and evaluation of translation efforts.

2.5 Conceptual Frameworks Used in this Study

To achieve the research objectives stated in the introductory chapter the following are the conceptual framework that will guide the methodological part of this research.

2.5.1 Linking Research to Action (Linking RTA)

To examine ways by which evidence generating institutions produce and transfer evidence to policy makers, the conceptual framework of assessing country level efforts linking research to action (Linking RTA) of Lavis et al. (2006) has been used (figure 5). It has been chosen among existing frameworks because it gives a large overview of all the possible ways used or activities undertaken by researchers to disseminate knowledge to policy makers. Moreover, it is applicable at national level; it has been already tested (used in a research study) and tools to use the framework are available.

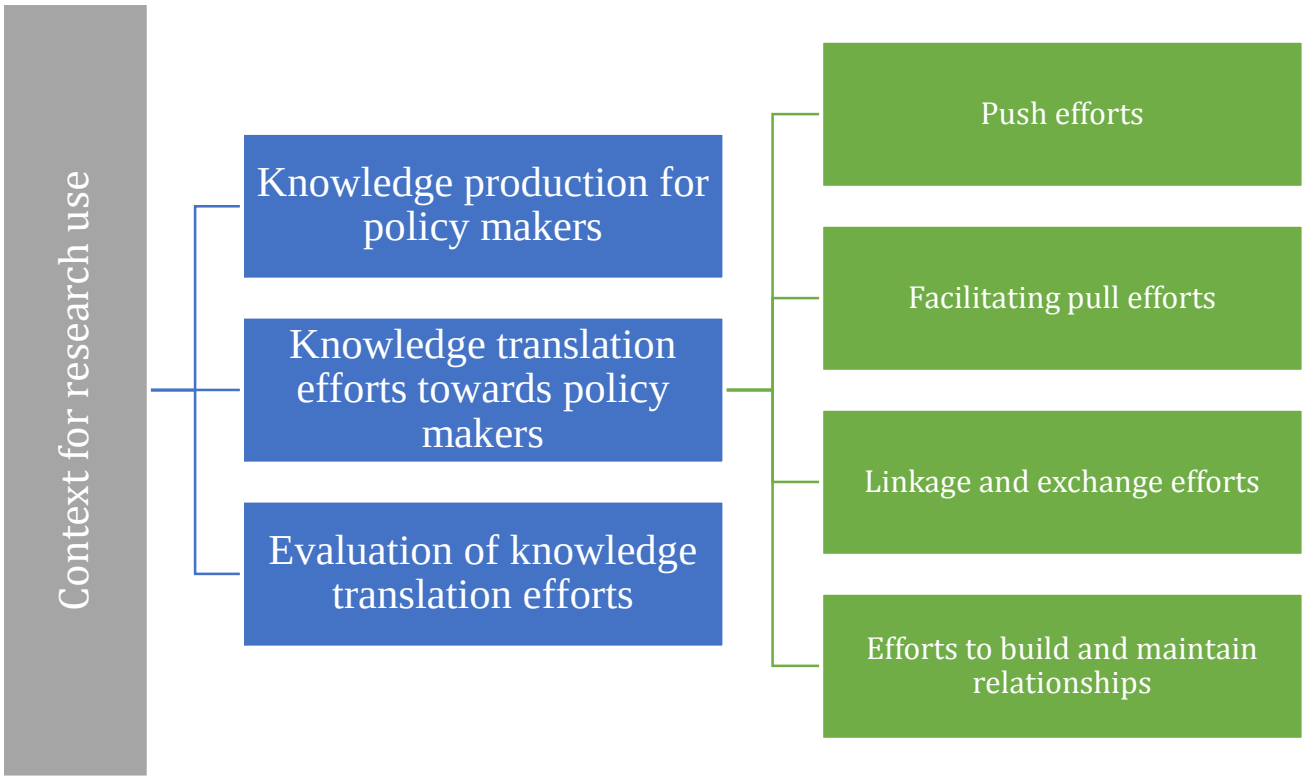

Figure 5: Linking research to action (LRA) framework (Lavis et al., 2006)

The meaning of these components is explained in the table 3, which will be used in presenting the results.

Table 3: Definition of the components of the Linking research to action (LRTA) framework

Domains	Definition
Context for research use	Climate in which the research on climate change is translated into use, political will and desire of policy makers to want to use research evidence…
Knowledge production	Creation of relevant and timely knowledge and research on climate change
Push efforts	Activities undertaken and means used by evidence generating institutions to bring climate change evidence to the attention of policymakers and inform the policy process
Facilitating pull efforts	Activities aimed at making it easier for policymakers to identify and obtain relevant research evidence on climate change
Linkage and exchange efforts	Relationships/partnerships between evidence generating institutions and policy makers for knowledge production and flow
Evaluation of efforts to link research to action	Ways to evaluate various activities carried out by evidence generating institutions towards policy makers

Source: WHO, 2012

2.5.2 Advocacy Coalition Framework (ACF)

To examine the climate change policy formulation process (its actors, their views and the uptake of evidence in the process), interviews with relevant policy actors and content analysis of policy documents have been used. Policy actors, beliefs systems, advocacy coalitions were determined based on the Advocacy Coalition Framework (Sabatier, 1993).

The Advocacy Coalition Framework (ACF) focuses on interactions among actors that share the same set of policy beliefs and conditions under which actors can learn from one another (Sabatier, 1993). It also focuses on explaining policy change within a given political system. Following these reasons, the ACF has been chosen to study the policy subsystem (figure 6).

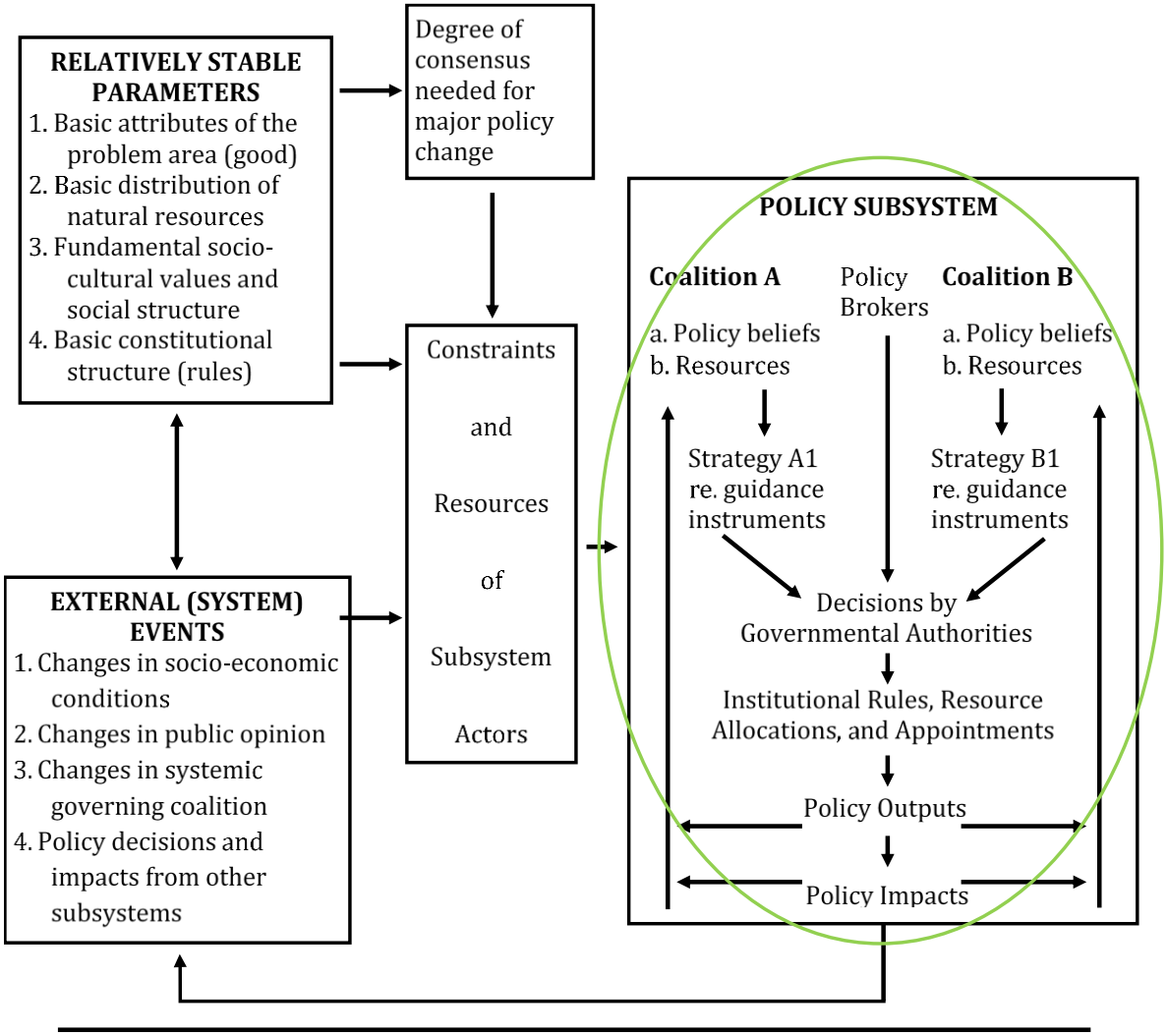

Figure 6: Advocacy Framework Coalition (Sabatier, 1993)

Chapter 3: Materials and Methods

This chapter describes the method, data collection and data analyses used to address the research questions/objectives of this study. Table 4 presents methods used to address each objective.

Table 4: Overview of methods and approaches

Objectives	Participants	Data collection	Data analysis
Objective 1: To examine the climate change policy formulation process, its actors, their beliefs and their use of scientific evidence	Stakeholders of the policy process (NGO, ministries, agencies, academia)	Literature review Informal interviews (10)	Content analysis of policy documents
Objective 2: To describe ways used by evidence generating institutions to transfer such evidence to policy makers	Evidence generating institutions Key informants (MESTI, EPA, CSIR, University of Legon)	Semi-structured interviews (20) Informal interviews	Descriptive analysis
Objective 3: To determine the perceptions of evidence generating institutions on effectiveness and barriers to climate change knowledge exchange and implementation of science-based policies	Evidence generating institutions Key informants (MESTI, EPA, CSIR, University of Legon)	Questionnaires (20) Informal interviews (10)	Descriptive analysis

Source: Field work, 2015

3.1 Study Area

This study has been carried out in Ghana, particularly in the capital city (Accra) where most of the climate change science and policy institutions are located. The choice of Ghana can be explained by these following criteria:

- Ghana is one of the pilot study area of the West African Science Service Center on Climate Change and Adapted Land Use (WASCAL) program;
- It disposes of a national climate change policy as well as plans and regulations in related vulnerable areas (MESTI, 2013; EPA, 2015);
- It is one of the forthcoming country in Africa to implement UNFCCC framework, proof of the political commitment and willingness to address climate change issues; and
- It has institutions involved in science policy interface (EPA, 2015)

3.1.1 Geographic, Climate, Environmental and Socio-economic Profiles

Located in West Africa, along the Guinea Coast, Ghana covers an area of 239,460km^2 and lies close to the equator between latitude 11.50N and 4.50S and longitude 3.50W and 1.30E (EPA, 2015). It has seven distinct ecological zones: Sudan Savannah, Guinea Savannah, Coastal Savannah, Transitional zone, deciduous forest, rain forest and wet evergreen. The climate is tropical and strongly influenced by the West Africa Monsoon winds. The total population of Ghana estimated in 2010 is 24,658,823 with 12,633,978 females and 12,024,845 males (GSS, 2012). According to projections based on an annual growth rate of 2.4% per annum, Ghana will reach 49 million people by 2040. More than half of Ghanaians (56.2%) live in urban areas (EPA, 2015), exacerbating access to services in these areas. In terms of economic profile, a quarter of Ghanaians are poor, while a tenth of them live in extreme poverty (EPA, 2015). According to the Ghanaian Statistical Services, Greater Accra is the least poor region, while the Upper West in the dry savannah is the overall poorest (GSS, 2014).

3.1.2 Government Profile

Ghana is a democratic country with sovereignty residing in the Ghanaian people and established over the concept of power sharing among the executive headed by the president, legislature (national parliament) and the judiciary (Supreme Court) (EPA, 2015). It is divided in ten administrative regions and 216 metropolitan/municipal/district planning Authorities (MMDAs) headed by chief executives. It has a decentralized national development structure comprising Ministries, Departments, Agencies (MDAs) at national level, coordinating councils at regional level, district assemblies and national house of chiefs at lower level.

3.1.3 Description of the Study Area: Accra

Accra Metropolis represents one of the 10 assemblies of the Greater Accra region (figure 7). It shares boundary with the Gulf of Guinea in the south, the Ledzokuku-Krowor Assembly on the east and with the Ga east, Ga west, and the Ga south districts in the north and west. It lies between latitude 05°35'N and longitude 00°06'W with a total land area of 173 km^2.

Accra is the location of many public institutions such as the ministries, parliament and judiciary. Moreover, it hosts public universities, research institutions, private institutions, industries, international organizations, non-governmental organizations…etc. The figure 8 shows the location of some of these institutions in the town.

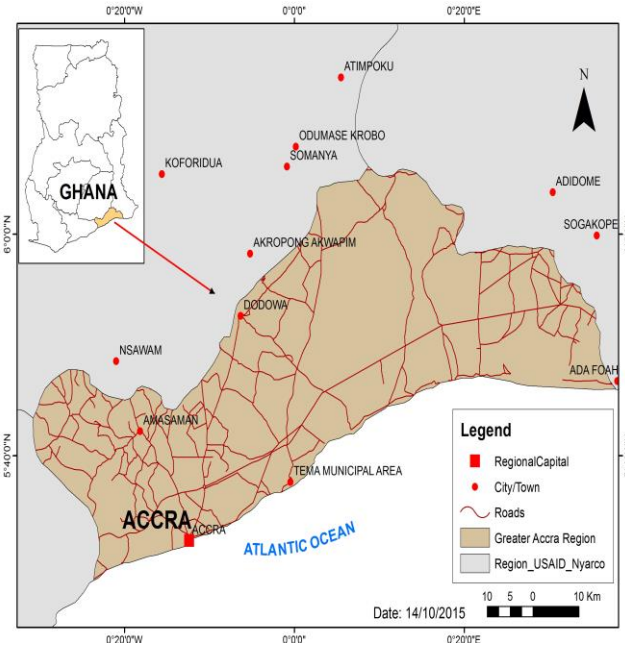

Figure 7: Map showing the study area (Field work, 2015)

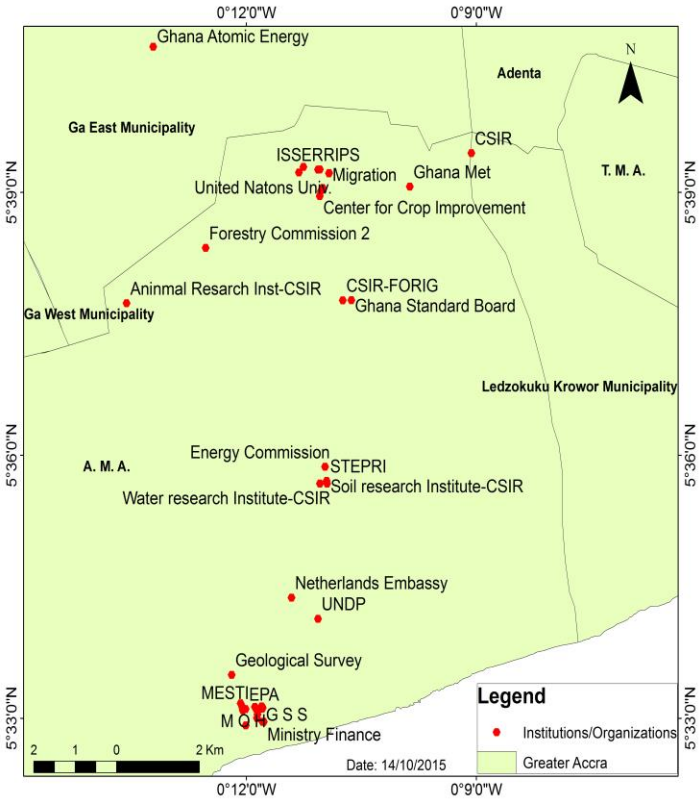

Figure 8: Map showing some institutions located in Accra (Field work, 2015)

3.2 Participants and Sampling

Participants are institutions generating evidence on climate change and vulnerable areas identified by the climate change policy document such as agriculture and natural resources management. First of all, a list of 71 academic, research institutions, implementation agencies and NGOs was established based on literature review and informal interviews. Then, further investigations in some of these institutions allowed us to remove institutions not located in Accra and those which are not involved in production of knowledge on climate change and related areas. This led to a new list of 48 institutions. Out of this list, thirty institutions were randomly selected for interviews.

In each institution, interview has been carried out with the director or a relevant person working on climate change-related issues. First of all, general information about the study has been provided to them. Secondly, their consents have been received and finally semi-structured interviews have been carried out. This technique has been used because we do not expect to have

details of individual points of view but in-depth and qualitative insight into these institutions through a representative view of each of them.

Out of the thirty institutions, ten could not return their questionnaires or be interviewed due to administrative procedure, availability, willingness, time constraints (refer to the section related to limits of the study). The sample size is finally twenty evidence generating institutions. Their names and some of their features are described in table 5.

Table 5: Some features of institutions interviewed during the field work

No	Name of the institution	Date of creation	Main mandate	Focus Areas	Infrastructures
1	Centre for Gender Studies and Advocacy (CEGENSA)	2006	Teaching Research	Gender	Library, People attending political meetings
2	Centre for Agricultural Bioscience International, West Africa Center, Ghana	1995	Policy oriented Research Science Advisory Implementation	Agriculture	Library, Knowledge brokers, People attending political meetings
3	Council for Scientific and Industrial Research (CSIR)	1942	Research	Agriculture, climate change, environment	Library, Formal unit interacting with policy makers
4	Environmental Protection Agency (EPA)	1973	Science Advisory Coordination Implementation	Energy, climate change	Library, Knowledge brokers
5	Fisheries Scientific Survey Division (FSSD)	2002	Policy oriented Research Implementation	Fishery	Formal unit interacting with policy makers
6	Food and Agriculture Organization (FAO), Ghana	1978	Policy oriented research Coordination Implementation	Agriculture, climate change, environment	Library, Knowledge brokers
7	Forestry Commission Climate Change Unit (FCCCU)	1999	Policy oriented research Implementation	Environment Gender climate change	Library, Formal unit interacting with policy makers
8	Friends of The Earth-Ghana (FEG)	1986	Policy oriented research Coordination Implementation	Agriculture Environment Gender energy development	Formal unit interacting with policy makers
9	Ghana Meteorological Agency (GMA)		Research Science Advisory	Agriculture Environment Climate change Health Development	Formal unit interacting with policy makers

10	Ghana Statistical Service (GSS)	1985	Policy oriented research	Socio-economy, Agriculture	Formal unit interacting with policy makers
11	Global Water Partnership (GWP)	2002	Coordination implementation	Water, sanitation	Library, Knowledge brokers
12	Institute For Applied Science And Technology (IAST)	2012	Teaching Research	Agriculture (food processing)	-
13	Institute for Environmental and Sanitation Studies (IESS)	2008	Teaching Policy Oriented Research Coordination	Agriculture Environment Climate change Health Development	Formal unit interacting with policy makers
14	International Water Management Institute (IMWI)	1985	Policy Oriented Research Science Advisory Coordination	Agriculture Water, sanitation	Library, Knowledge brokers
15	Livestock and Poultry Research Centre (LPRC)	1953	Teaching Research	Agriculture	Library
16	Regional Institute for Population Studies (RIPS)	1972	Teaching Policy Oriented Research Coordination	Agriculture Water, sanitation Health migration	Library, Formal unit interacting with policy makers
17	Science and Technology Policy Research Institute (STEPRI)	1987	Policy Oriented Research	Agriculture	Library, People attending political meetings
18	Town and Country Planning (TCP)	1945	Planning	Development	Library
19	United Nations University (UNU)	1986	Policy Oriented Research	Agriculture Water, sanitation, energy, climate change Environment,	Library, Formal unit interacting with policy makers
20	West Africa Centre for Crop Institute (WACCI)	2007	Teaching Research	Agriculture	Library

[2]Source: Field work, 2015

[2] The websites of these institutions were also consulted

3.3 Data Collection

A combination of different methods was used to achieve the research objectives. They are described below:

3.3.1 Semi-structured Interview

Data on methods of knowledge translation and data on perceptions were collected through semi-structured interviews with evidence generating institutions (see 3.2). Some of these interviews were face to face interviews, while other respondents filled the questionnaires. These questionnaires have been developed based on preliminary information on dissemination activities received from key informants through informal interviews. The questionnaire incorporated six domains of the Linking Research to Action (LRTA) framework namely:

- Context or climate for research use (perceptions on the role of science in policy making, appetite for use of evidence by policy makers, evolution of dissemination efforts in the country, support of knowledge translation by policy makers; existence of relevant infrastructures and human resources in evidence generating institutions);
- Knowledge production process (areas of climate change research, relevance of research findings on climate change, involvement of policy makers in knowledge generation);
- Push efforts (perceived amount of evidence transferred to policy makers, infrastructures and channels used to disseminate evidence to research users in general and particularly to policy makers, importance of these channels);
- Facilitating pull efforts (existence of competences on climate change, programs and trainings to help policy makers to use research);
- Exchange/linkage activities (contribution of policy makers to knowledge translation, purpose and appreciation of partnerships between policy makers and evidence generating institutions, collaboration between evidence generating institutions);
- Evaluation of efforts to link research to action (methods of evaluation, time and part of research budget allocated to knowledge dissemination activities, perceptions on the use of research by policy makers and contribution of scientific evidence to improvement of climate change policies).

Equally, the questionnaire has questions concerning their perceptions on:

- The climate change policy document (susceptible effectiveness in addressing climate change, barriers to implementation),
- Barriers to knowledge exchange between scientists and policy makers: seven types of barriers have been assessed, based on the literature review and our informal interviews. These are cultural differences (differences between policy makers and scientists in terms of objectives and methodologies), institutional barriers (political unwillingness to address the issue and use scientific evidence, low commitment of scientists to transfer their evidence, lack of financial, human resources), inaccessibility of policy makers to science (delay in publication, difficult access to sources of evidence), conventional approaches to knowledge exchange (knowledge exchange viewed as the single role of scientists), personal perceptions and worldviews (decisions taken based one's personal knowledge and past experiences), characteristics of the research output, communication with policy makers; and
- Perceived solutions to improve knowledge exchange between scientists and policy makers.

Other questions focused on the identification of the respondents and the description of the institutions.

3.3.2 Content Analysis

❖ ***Data collected and secondary sources of data***

The uptake of evidence by policy makers has been assessed using content analysis. Informal interviews were carried out with about ten policy actors from the Ministry of Environment, Science and Technology, the University of Legon, the Council of Scientific and Industrial Research. Data collected were related to:

- Policy actors and policy stages;
- Stages of scientists' involvement in the process;
- Beliefs or concerns of policy actors;
- Coalitions of policy actors;
- Use of scientific evidence, advocacy notes and ministerial papers;
- Number and types of printed materials used in the process: this is done through an analysis of references in the policy document. It started by an identification of the

different types of references. Then, we determined the frequency of each of them in the section related to the bibliography/references;

- Purpose of using scientific evidence: Scientific knowledge/evidence can be used for many purposes:
    - Tactical use: Evidence is used to justify or lend weight to pre-existing decisions and courses of action relating to the issue. This type of use has been assessed in the policy document by counting the number of times scientific concepts appear in section related to the vision, objectives, missions, policy orientations of the policy document;
    - Conceptual use: Evidence is used to provide new ideas, understanding, or concepts to clarify thinking about the policy issue without directly influencing one's decision. It has been assessed by counting the number of times scientific concepts appear in section related to policy context;
    - Instrumental use: Evidence is used to directly influence what issues to prioritize and/or what action should be taken to deal with the identified issue(s). It has been assessed by counting the number of times scientific concepts appear in section related to focus areas/strategies.

Apart from these informal interviews, some specific questions have been included in the questionnaire administrated to the twenty evidence generating institutions to capture their awareness of the policy process, involvement of various stakeholders in the policy process, types of evidence used in this process, challenges and solutions.

Besides these interviews, a number of policy documents were collected and used as primary data source in order to capture the beliefs systems and advocacy coalitions in climate change policy subsystem. A list of the names of these policy documents is given in table 6.

Table 6: List of policies used for the content analysis

Sectors	Names of the policies	Year
Policies on climate change	Ghana National Climate Change Adaptation Strategy	2009
	Ghana National Climate Change Policy	2013
Frameworks on Climate change	First National Communication of Ghana to the United Nations Framework Climate Change Convention	2000
	Second National Communication of Ghana to the United Nations Framework Climate Change Convention	2011
	Third National Communication of Ghana to the United Nations Framework Climate Change Convention	2015
Disaster	Integrating Climate Change and Disaster Risk Reduction into National Development, Policies and Planning in Ghana	2010
Energy	National Energy Policy 2	2010
Sanitation	National Environmental Sanitation Strategy and Action Plan	2010

Source: Field work, 2015

Policy coalitions, beliefs and uptake of evidence in climate change policy process were determined using these documents on climate change and related areas such as energy, disaster, sanitation. This choice is founded on the list given as legal and regulatory framework for climate change (MESTI, 2013).

- ***Conceptual Analysis of Policy Documents***

According to Villamor (2003), "conceptual analysis is one the major types of content analysis" and it consists in looking at the occurrence of selected words, terms or concepts in a text. The steps used in conducting the conceptual analysis of policy documents are presented in the figure 9.

Steps of conceptual analysis of policy documents

Step 1: Identifying research questions

To analyze the concepts in these documents, we start by identifying questions to understand beliefs of stakeholders, discover major discourses in the policy process and advocacy coalitions. These questions are:

- What are the actors of the policy process? (influential actors, opponents, supporters)
- What are the various institutions involved in the process?
- How has the policy been developed? (stages of the policy process, methods used in the policy process)
- How were research/academia involved in the policy process?
- What are the policy coalitions and their beliefs on climate change?
- What types of evidence appear in these policies?
- What is the purpose of using each evidence in the policy?
- What is the importance of scientific evidence in policies?

Step 2: The choice of level of analysis

The concept chosen to analyse the policy documents can be a single word or sets of words or phrases. In this study, the level of analysis chosen is mainly single word used as a concept.

Step 3. Deciding the number of concepts to code for

There was not a definite number of concepts to code for. Rather, it is an iterative process that was used. A first set of concepts was developed and reviewed in adding new or subtracting old concepts. This coding process was flexible and allowed us to get significant results.

Step 4. Choice of concepts and categories

Three categories and twenty six concepts were used for the content analysis. They have been chosen mainly based on:

- Policy objectives and focus areas identified in the climate change policy document;
- Systematic reviews of the Inter-Governmental Panel on Climate Change; and
- Other documents and publications on climate change issues in Ghana.

Step 5. Level of generalization

Concepts similar in definition but different in forms have been used to generalize the level of study. For example, green growth has been coded as same as green economy and as same as low carbon growth. In the same way, energy security has also been coded as same as energy efficiency.

Step 6. Frequencies of concepts

Concepts were counted in the policy document. The number of times they appear in the policy document defined the occurrence or frequency of concepts.

Figure 9: Steps in conducting Conceptual Analysis (Adapted from Villamor, 2003)

3.4 Data analysis

To analyze the data from the semi-structure survey, we first entered the data into a database conceived in SphinxME1. This is a software for entering survey data. Then, the data were analyzed, using two softwares: SPSS 16.0 and SAS 9.0. Proportions computed with SPSS 16.0 were mainly used to describe the ways through which institutions generate and transfer evidence to policy makers.

In order to develop the push efforts model used by evidence generating institutions, each push effort identified has been codified into a variable with two modalities (1=yes and 0=no). Then, these institutions have been categorized into clusters, using cluster analysis in SAS 9.0. Microsoft Excel 2013 has been used to draw various graphs.

Evidence generating institutions have been then assessed based on the various models of knowledge transfer process. According to WHO (2012), the best knowledge transfer model is the integrated model combining the three types of efforts: push efforts, pull efforts and exchange efforts. Evidence generating institutions which combine these various efforts have, therefore, a higher probability to reach out policy makers. Based on this assertion, an analytical framework has been suggested to assess knowledge transfer process (figure 10).

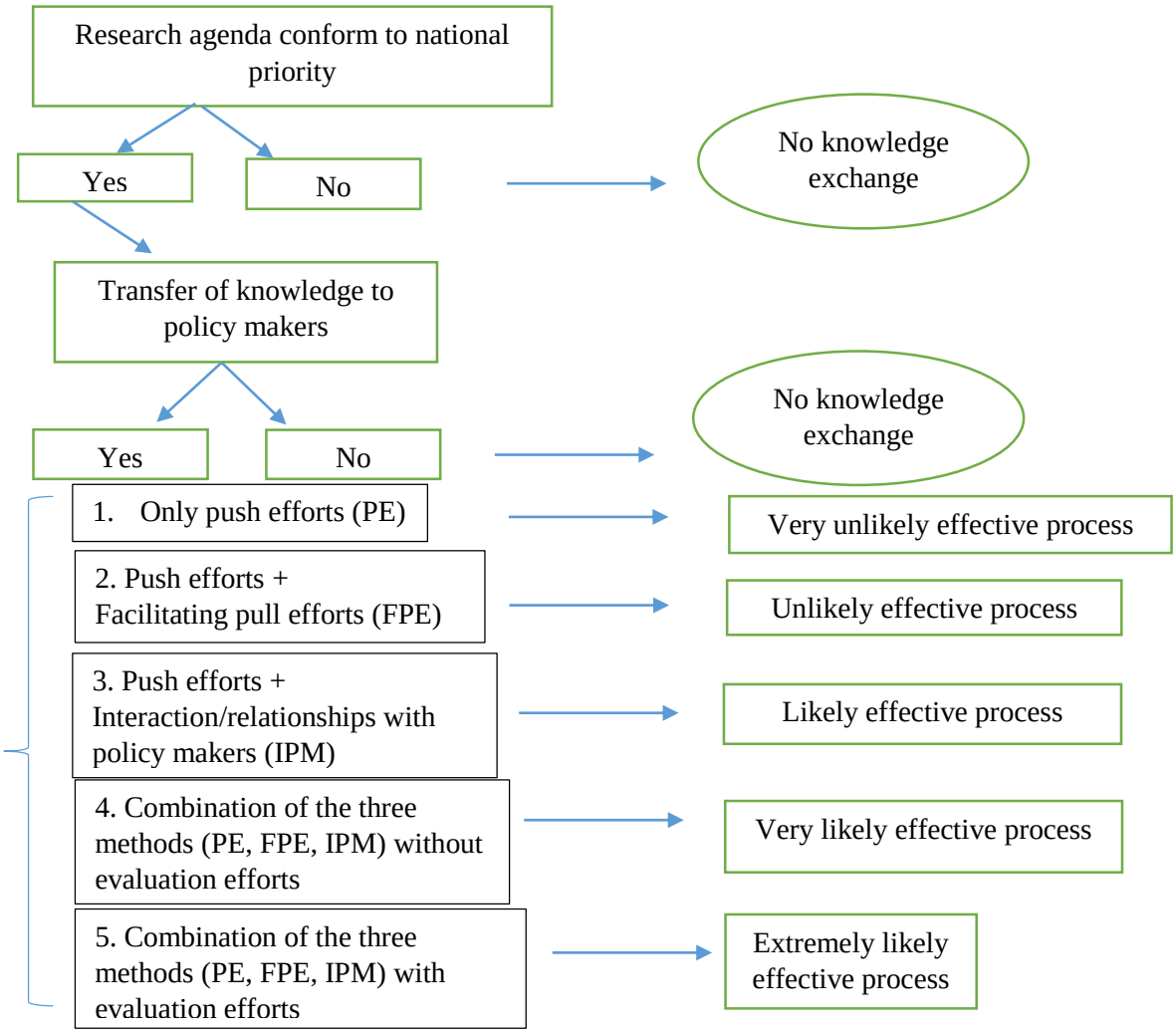

Figure 10: Analytical framework of knowledge transfer models (Adapted from WHO, 2012)

This framework suggests a three steps method to assess the effectiveness of knowledge transfer models of evidence generating institutions. At the first level, we find out whether their research agenda on climate change is conformed to the priorities of the country. In the case where there is conformity, we ask whether the evidence produced is transferred to policy makers. This is the second level. Finally, we look at the type and number of methods used to reach out policy makers. When the institution makes use of only push efforts, there will be a very low probability for them to reach policy makers; therefore it is very unlikely that the knowledge exchange process will be effective. The institution can add to the push efforts some facilitating pull efforts. However, the process is still unlikely to be effective because these two ways are not demand-driven. When in addition to the push efforts, they interact with policy makers, the process is likely

to be effective. If the institution makes use of the three methods (push efforts, facilitating pull efforts, interactions with policy makers), it is very likely to have an effective process. Moreover, when they add evaluation efforts to these three methods, the process becomes extremely likely to be effective.

For content analysis of policy documents (see table of policies), we used the following:

- The frequency of concepts constitutes the data used to describe the policy beliefs, identify advocacy coalitions, determine the integration of climate change concepts into sectoral policies, and assess the uptake and purpose of using scientific evidence in the policy process.
- Policy stages, methods used during the policy process, policy actors were determined through policy documents and informal interviews.

3.5 Limitations

The following are some limitations encountered during the conduct of the research study:

- ❖ Identification of institutions: The list has been reviewed many times because there was not an existing clear and exhaustive list of all these institutions; so we cannot assume that our list gives a good overview of all the institutions generating scientific evidence in Ghana;
- ❖ Reaching out with the identified institutions is the most difficult part of the research work. In fact, because we worked with institutions, we have to send introductory letters and wait to receive their consent before engaging in the interviews. In some cases, we could not get their feedbacks till the end of our due time. We tried to increase the size of the sample in choosing other institutions but we could not fully succeed in reaching them;
- ❖ Selection of policies: the policy documents selected are those listed in the legal and regulatory framework of climate change in Ghana. However, there are documents related to other sectors that could have been included for the content analysis; and
- ❖ Time constraints: The duration of data collection was limited to 1 month only.

Chapter 4: Results

The knowledge exchange process between evidence generating institutions and policy makers to formulate science-based policies and take effective decisions able to address climate change in Ghana is described in this section. It is outlined in four parts in relation to the objectives of the study. First of all, the climate change policymaking process is described. Following this description, ways of disseminating evidence on climate change to policy makers are exposed. Then, the use or uptake of climate change evidence in policymaking process is assessed. Finally, the perceptions of evidence generating institutions on the effectiveness of science-based policies and the barriers to knowledge exchange between the two communities are also exposed.

4.1 Climate Change Policymaking Process

4.1.1 Policy Actors

The policy arena to formulate climate change policy in Ghana is made up of five types of institutions:

- Strategic institutions
- Leading institutions
- Coordinating institutions
- Advisory board
- Consulting institutions

Strategic institutions constitute the influential body of the process. They are the ultimate reference or arbitrage that will lead to the policy approval. Their mandate is to define policy directions, to approve the policy document and to adopt it. They include three bodies:

- Parliamentary Selected Committee;
- The cabinet or the approval body, which includes 19 relevant public ministries appointed by the president of Ghana; and
- The president of Ghana

The Ministry of Environment, Science, Technology and Innovation (MESTI) and its agency, the Environmental and Protection Agency (EPA), constitute the leading institution of the process and overall coordinating board of climate change issues in the country. They are pushing forward the climate change policy agenda. They collaborate with the National Development Planning

Commission, responsible for the integration of climate change into national development and the Ministry of Finance, responsible for budget coordination.

They work through an advisory board which is a multi-stakeholder committee made up of 21 institutions, namely six ministries, six agencies, two research institutions, one private institution, four international organizations and two national non-governmental organizations (figure 10). Called National Climate Change Committee, the advisory board is a representative committee of all the stakeholders involved in the process. Their mandate is mainly to guide the process but also to approve the policy budget.

Figure 11: Composition of the national climate change committee (Field work, 2015)

To coordinate the process of formulation of the policy document, the Ministry of Environment, Science, Technology and Innovation (MESTI) recruited an academic institution from the University of Legon. This is the Institute for Environment and Sanitation Studies (IESS).

They acted as coordinating institution, assisting the Advisory board in drafting the policy documents, facilitating workshops and validation process. Many stakeholders were consulted in order to get their point of view about actions to implement to effectively address climate change in the country. There are eight types of stakeholders in all: ministries and agencies, academic and research institutions, civil society and non-governmental organizations, private sector and industry, development partners, international and inter-governmental organizations in Ghana and the high-level expert review panel members (annex 1). The figure 11 summarises the structuration of these policy actors.

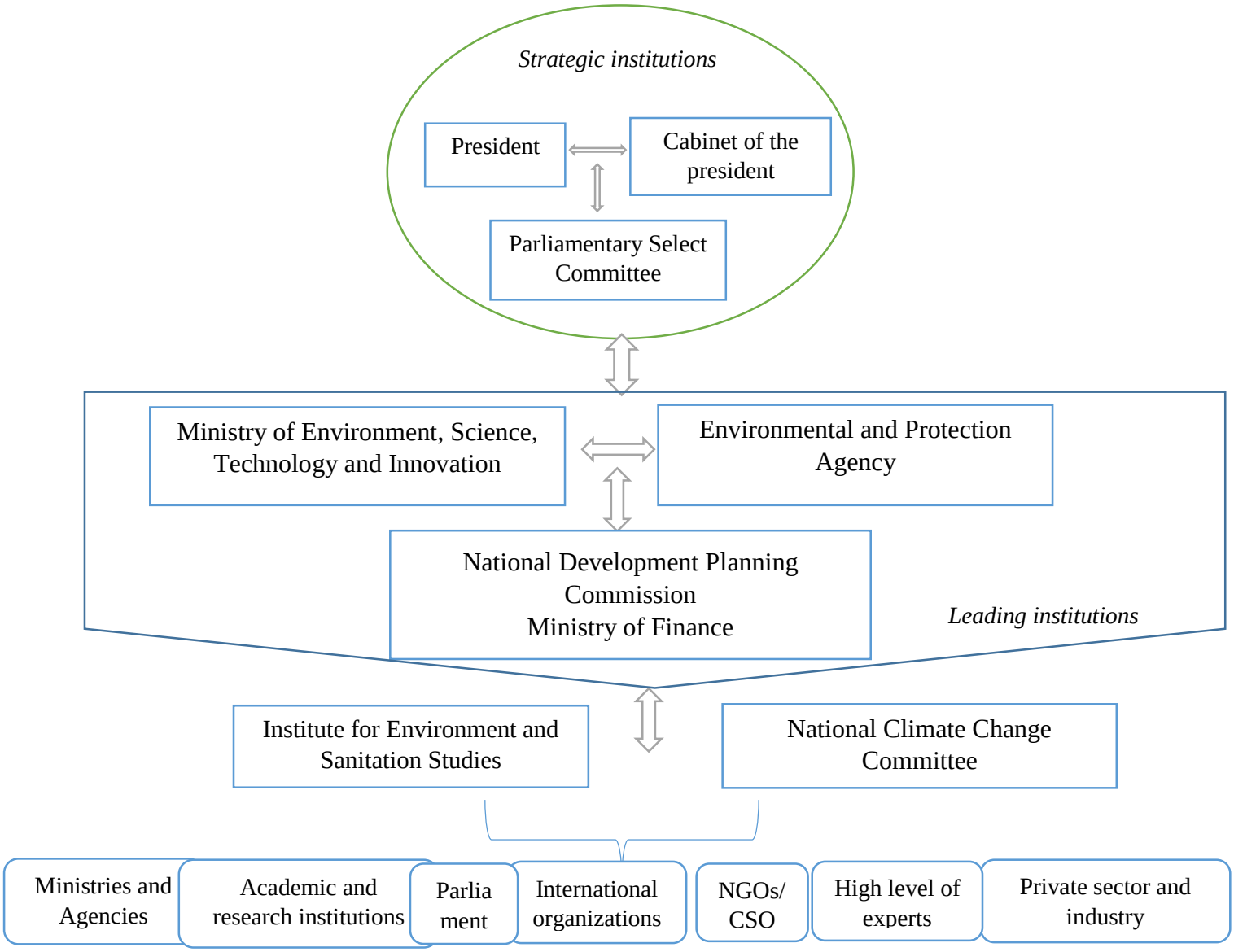

Figure 11: Policy actors (Field work, 2015)

It appears through this figure that academic and research institutions are mainly present at downstream level, mostly at consultation stage.

4.1.2 Policy Stages

The development of the Ghana climate change policy document has gone through a process of formulation and validation of three documents (figure 12)

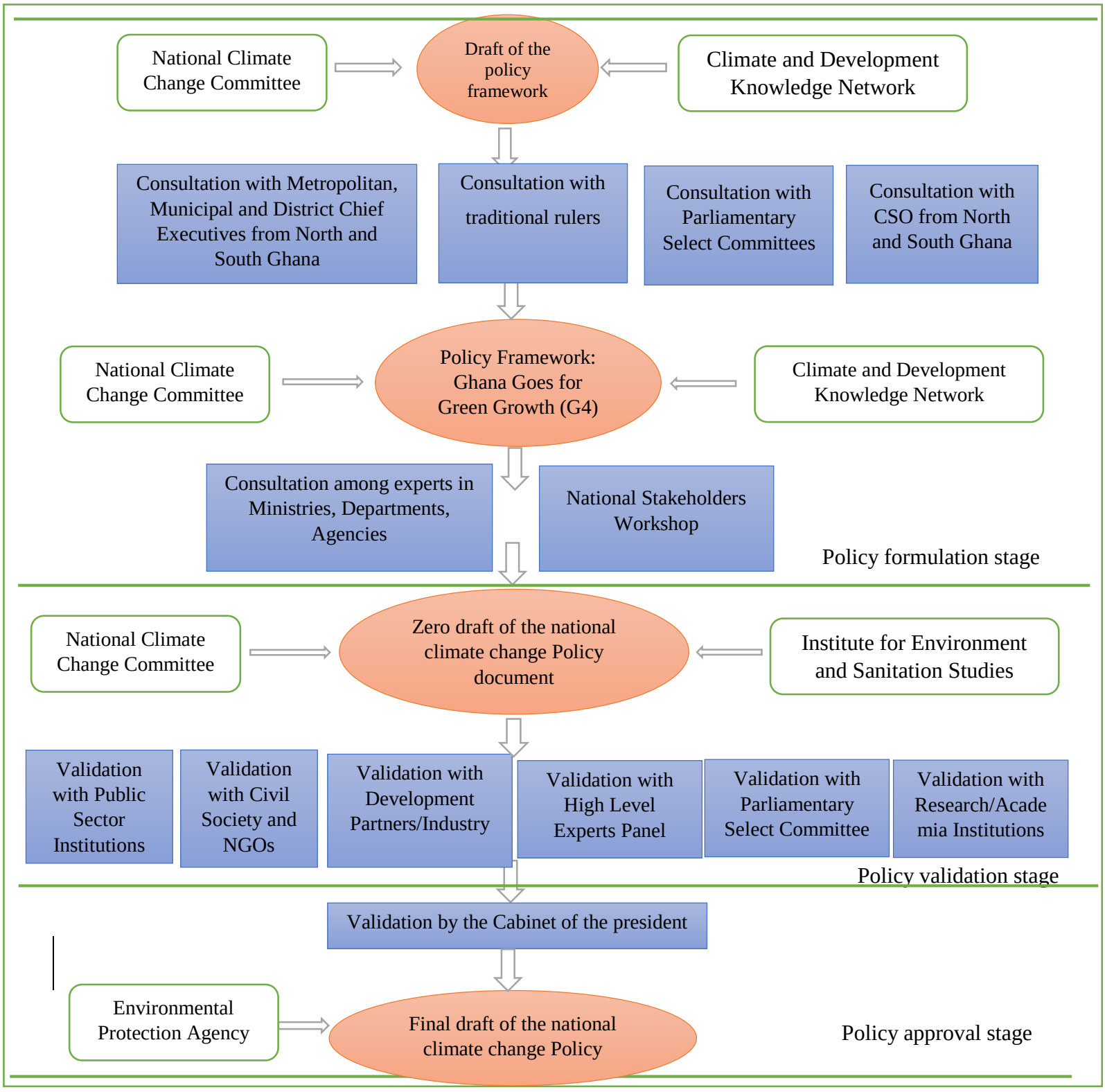

Figure 12: Policy stages (Field work, 2015)

- *From the zero draft of the policy framework to the policy document draft*

The draft of the policy framework exposes the state of climate change in Ghana and the probable actions to overcome its impacts. It was developed in 2011 after a national stakeholder's workshop in 2010 and submitted to various stakeholders' consultations (NGOs, CSOs, traditional headships, local governance and parliamentary select committees on environment) for validation from 2011 to 2012. At the end of this process, the Climate Change Policy Framework called *Ghana goes for green growth* was ready. It gives an overview of the vision and objectives of Ghana in addressing climate change as well as the pillars that will hold all the activities proposed to reduce the adverse effects of climate change on the country. These steps were coordinated by the National Climate Change Committee with the support of the Climate and Development Knowledge Network (CDKN).

The policy framework was, then, submitted to two consultations: a consultation among experts in Ministries, Departments and Agencies and a broad national consultation with Civil Society Organizations, Ministries, Departments and Agencies, Members of Parliaments. The comments were, then, used to refine and prioritise the key issues and the focus areas to tackle. The document which came out of this process led by the Institute for Environmental and Sanitation Studies in collaboration with the National Climate Change Committee was the policy draft or the zero draft of the climate change policy document.

- *Stakeholder validation of the policy document draft*

This policy draft was then taken through a wide and long process of stakeholders' validations in order to assess relevance, effectiveness and feasibility of the policy actions in reducing climate change impacts on the various sectors likely to be affected. Workshops, seminars and fora were organized jointly by the Ministry of Environment, and the Institute for Environment and Sanitation Studies to get feedbacks, views, suggestions, contributions from the stakeholders to improve the policy document. During the workshops, there were sometimes disagreements about priorities in terms of policy objectives and actions. Through consensus, they were able to come to agreement. The stakeholder groups involved in this validation process are: Public Sector Institutions, Civil Society and NGOs, Development Partners/Industry, High Level Experts Panel, Parliamentary Select Committee Research/Academia Institutions. After these specific validations

of the document, a national validation workshop was organized for an overall approval of the policy document by all the stakeholders.

- *Approval by the President Cabinet and launching of the policy document*

The improved policy document was taken by the Ministry of Environment, Science, Technology and Innovation (MESTI) to the Cabinet of the President for approval. Once it was done, the final policy document was taken up by the Environment Protection Agency and finally launched by the President himself in 2013.

The figure 12 shows that the climate change policy process is a wide, long and participatory process with a wide range of actors from public, private, social and international institutions. However, academic and research institutions were not represented at all the stages. They were consulted towards the end of the process and were not involved to guide and orient policy debate since the beginning.

4.1.3 Policy Coalitions and their Belief Systems

The coalitions and beliefs were determined using the conceptual analysis of climate change policy documents (table 7). Three concerns have been identified: green economy concern, social concern and environmental concern. The concepts that appear the most under the social concern are: Sanitation (38%), Education (25%), Women (10%), and Gender (8%). Under the green economy concern, the dominant concepts are: Greenhouse gas emissions (25%), Renewable energy (19%), Energy security (16%), and Sustainable development (15%). The environmental concern is formed by two major concepts: natural resources (46%) and reforestation/afforestation (45%).

Among the concerns, the social (64%) is the most frequent. It is followed by the green economy concern (27%) and the environmental concern (9%). Moreover, the policies on climate change and other related sectors focus on social concern, while the frameworks put emphasis on green economy concern. The environmental concern is mostly represented in the frameworks than the policies.

Table 7: Frequency of concepts used to determine policy concerns

		Ghana's communications to UNFCC			Ghana's policies and strategies on climate change		Ghana's policies on areas related to climate change			Total
		Ghana's First Communication to the UNFCCC, 2000	Ghana's Second Communication to the UNFCCC, 2011	Ghana's Third Communication to the UNFCCC, 2015	National Climate Change Adaptation Strategy (NCAS), 2012	National Climate Change Policy (NCCP), 2013	Energy	Sanitation	Disaster Risk Reduction	
Green economy concern	Green growth	0	8	6	0	9	0	7	0	30
	Energy security	7	21	36	0	18	9	0	1	**92**
	Sustainable development	12	21	25	2	15	1	2	6	**84**
	Green Technology	0	0	0	0	0	0	0	0	0
	Clean Development Mechanism	1	6	0	0	3	0	2	0	12
	Climate proof infrastructure	0	0	0	1	2	0	0	0	3
	Greenhouse gas Emissions	50	42	30	1	17	0	1	3	**144**
	REDD+	0	25	38	0	21	0	0	0	84
	Climate finance	0	0	10	0	4	0	0	0	14
	Renewable energy	5	14	66	0	16	8	0	0	**109**
Total		75	137	211	4	105	18	12	10	**572 (27%)**
	Human health	2	11	8	2	6	0	2	2	33

		Ghana's communications to UNFCC			Ghana's policies and strategies on climate change		Ghana's policies on areas related to climate change			Total
		Ghana's First Communication to the UNFCCC, 2000	Ghana's Second Communication to the UNFCCC, 2011	Ghana's Third Communication to the UNFCCC, 2015	National Climate Change Adaptation Strategy (NCAS), 2012	National Climate Change Policy (NCCP), 2013	Energy	Sanitation	Disaster Risk Reduction	
Social concern										
	Access to natural resources	0	2	0	0	0	0	0	0	2
	Gender	0	17	19	1	59	4	9	1	**110**
	Social protection	0	1	3	0	12	0	0	0	16
	Education	46	68	57	4	33	3	131	4	**346**
	Sanitation	3	6	32	8	48	3	418	2	**520**
	Migration	2	4	9	3	30	0	0	1	49
	Women	4	48	12	1	49	10	16	0	**140**
	Youth	1	3	4	0	5	0	10	0	23
	Children	0	8	3	0	16	0	19	0	46
	Climate smart agriculture	0	0	4	0	3	0	0	0	7
	Early warning system	0	6	7	1	5	0	0	3	22
	Disaster risk reduction	0	14	11	1	6	0	0	24	56
Total		58	188	169	21	272	20	605	37	**1370** (64%)

		Ghana's communications to UNFCC			Ghana's policies and strategies on climate change		Ghana's policies on areas related to climate change			Total
		Ghana's First Communication to the UNFCCC, 2000	Ghana's Second Communication to the UNFCCC, 2011	Ghana's Third Communication to the UNFCCC, 2015	National Climate Change Adaptation Strategy (NCAS), 2012	National Climate Change Policy (NCCP), 2013	Energy	Sanitation	Disaster Risk Reduction	
Environmental concern	Sustainable management	1	3	2	1	3	0	1	0	11
	Reforestation /Afforestation	26	17	30	0	10	2	0	2	**87**
	Natural resources	6	15	23	4	31	0	4	3	**86**
	Ecosystem-based Adaptation	0	0	0	0	3	0	0	0	3
	Community-based Adaptation	0	0	0	0	3	0	0	0	3
Total		33	35	55	5	50	2	5	5	**190 (9%)**

Source: Field work, 2015

4.1.3.1 Policy Coalitions

Based on the above content analysis, two coalitions can be distinguished in the policy subsystem: the economic-environmental coalition and the social coalition (figure 13). The economic-environmental coalition is made up of public and private institutions, particularly from:

- Ministries, Departments and Agencies;
- Members of the parliament;
- Academia and Research institutions; and
- Development Partners/Industry.

Private institutions are associated with public institutions in order to enhance the efforts of the public sector to promote a climate compatible economy or an environmental friendly economy. Academia and Research institutions involved in the process have the duty to support the government in these actions. In this coalition, the focus is put mainly on mitigation, then on adaptation strategies to climate change.

The social coalition is mainly made up of social institutions and public institutions at local level:

- Civil Society and NGOs;
- Chiefs and queen mothers; and
- Metropolitan, Municipal and District Chief Executives.

This coalition focuses on human well-being, particularly, the well-being of vulnerable communities. While stress is put on mitigation and adaptation in the first coalition, the second coalition stretches respectively on adaptation and social development. Finally, there was a consensus in the policy subsystem that led to the overall orientation which is adaptation- social development-mitigation.

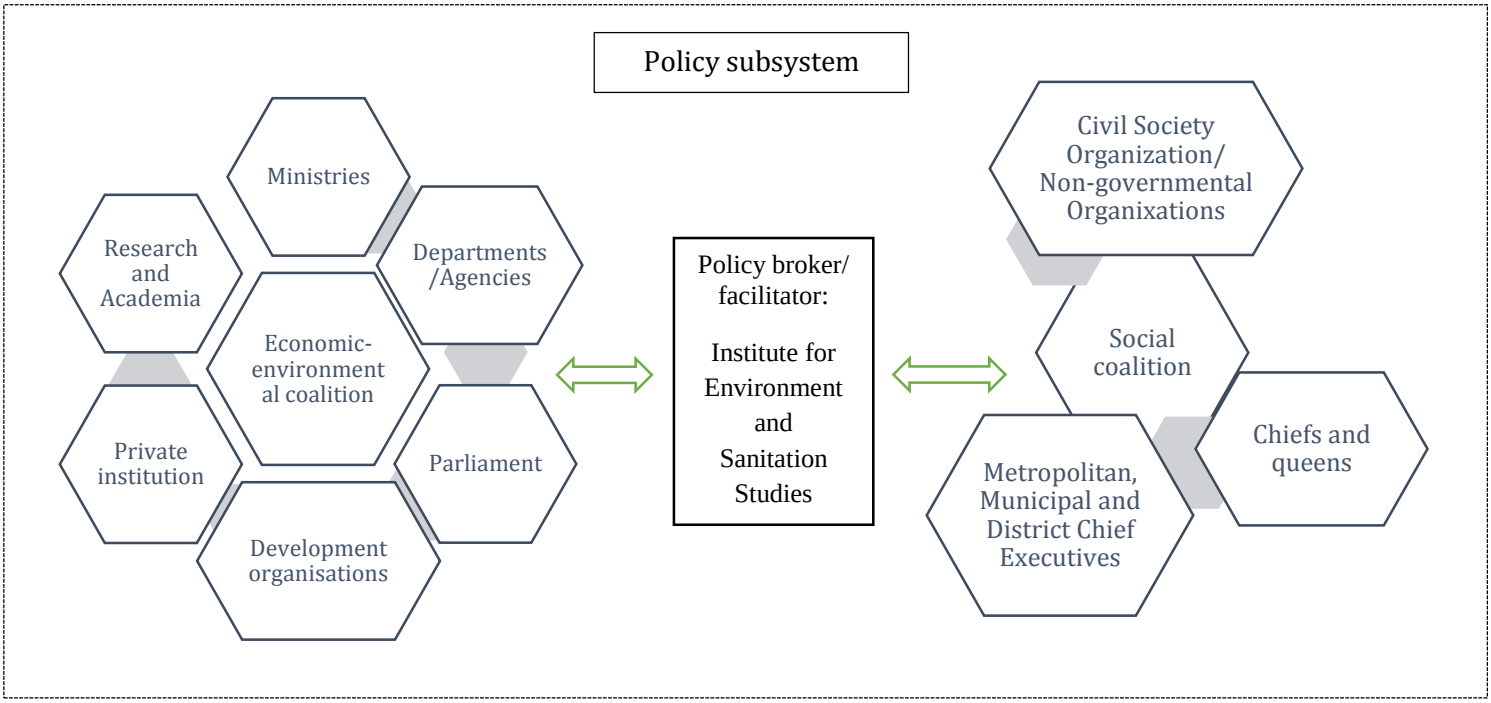

Figure 13: Composition of the policy subsystem (Field work, 2015)

Besides these coalitions, the policy arena can also be described in terms of influential actors, supporters and opponents:

- Influential are Public Sector Institutions and Parliamentary Select Committee. They constitute the lead of the economic-environmental coalition.
- Opponents are Civil Society and NGOs.
- Supporters are Research and academia institutions, Development Partners/Industry Chiefs and queen mothers, Metropolitan, Municipal and District Chief Executives. The two first institutions constitute a support for influential institutions, while the two last institutions constitute a support for the opponents.

4.1.3.2 Policy Beliefs

Still based on the conceptual analysis, three major beliefs can be determined:

- The green economy concern is how to reduce greenhouse gas emissions using renewable energy and REDD+ in order to ensure energy security and sustainable development;
- The social concern is how to enhance communities' access to sanitation and improve their education on climate change in order to reduce impacts on the most vulnerable particular women; and

- ❖ The environmental concern is how to preserve or regenerate our natural resources, particularly forests in order to reduce the overall impacts of climate change.

These three beliefs were clearly translated in the policy document:

Green economy concern:

"Section 1.2.2 The vision of the National Climate Change Policy is to: Ensure a climate-resilient and climate-compatible economy while achieving sustainable development through equitable low-carbon economic growth for Ghana (MESTI, 2013, page 1-8);

Section 1.2.2 The NCCP projects the delivery of Ghana's vision of a climate resilient and climate compatible economy — a green economy that would take advantage of the opportunities presented in addressing climate change while, simultaneously, reducing the impact of climate change on the people of Ghana; (MESTI, 2013, page 1-9);

Social concern:

"Section 2.1.1 It is therefore important that policy responses to climate change look beyond the environment to the broader social issues faced by specific social groups (MESTI, 2013, page 2-4)."

"Section 4.2 Vulnerable groups, such as the disabled, the aged, children, youth and women, are particularly affected as they have poorer coping mechanisms. Disaster risk strategies increase the resilience of social systems by minimizing the risk of exposure to future hazards, and reducing the vulnerability of communities and their property (MESTI, 2013, page 4-6)."

Environmental concern:

"Section 1.2.2 Specifically, the NCCP fosters the development of processes, plans, strategies and approaches that avoid, minimise or adapt to the negative impacts of climate change on the natural environment including ecosystems, species, genetic resources, ecological processes, lands and water (MESTI, 2013, page 1-9)."

"Section 4.3 Improved ecosystems and environmental management practices not only provide economic gains and improved ecological services, but also result in greater agro-biodiversity and increased carbon sequestration (MESTI, 2013, page 4-8)".

4.1.4 Involvement and Role of Scientists/Researchers into the Policy Process

Two research institutions and eight academic institutes were involved in the policy. They were mainly involved in the validation process, while few are represented at the policy formulation stage. Table 8 shows the involvement of various stakeholders particularly scientists/researchers in the process of policymaking.

Table 8: Proportion of institutions involved in the policy process

	Step 1		**Step 2**		**Step 3**
	Formulation of the policy framework	Validation of the policy framework	Formulation of the policy draft	Validation of the policy draft	Approval of the final Policy document
Research institutions					
Centre for Scientific and Industrial Research	X	X	X	X	-
Forestry Research Institute of Ghana	X	X	X	X	-
Total	2 (100%)	2 (100%)	2 (100%)	2 (100%)	0
Academic institutions					
Institute for Environmental and Sanitation Studies (UL)	-	X	X	X	-
Department of Geography (UL)	-	X	-	X	-
Department of Economics (UL)	-	X	-	X	-
Regional Institute for Population (UL)	-	X	-	X	-
Kwame Nkrumah University of Science and Technology	-	X	-	X	-
University of Cape Coast	-	X	-	X	-
University of Development Studies	-	X	-	X	-
Ashesi University					
Total	0	8 (100%)	1 (12%)	8 (100%)	0
6 Civil society and non-governmental organizations	0	6 (100%)	X 6 (100%)	X 6 (100%)	0
12 Public sector ministries	X 12 (100%)	X 12 (100%)	X 12 (100%)	X 12 (100%)	X 12 (100%)
10 Public agencies	X 10 (100%)	X 10 (100%)	X 10 (100%)	X 10 (100%)	0
Local governance	-	X	-	X	-
2 committees of the Parliament of Ghana	0	X 2 (100%)	X 2 (100%)	X 2 (100%)	X 2 (100%)
1 Private sector and industry	0	0	0	X 1 (100%)	0
3 International Organizations	0	0	0	X 3 (100%)	0

X: involvement; -: no involvement; N (%)
Source: Field work, 2015

It appeared that research institutions were involved at both formulation and validation stages except the approval stage of the document. In fact, these research institutions are part of the national climate change committee; this may explain their full participation in the process. Universities were mostly at validation stages of the process except the leading institution (Institute for Environmental and Sanitation Studies) which was at the formulation level. This table shows us that research/academic institutions were mostly represented at validation stage than at formulation stage. Therefore, their point of view is more consultative than influential in the process. Throughout the process, they brought their expertise and advice to policy makers.

4.2 Use of Scientific Evidence in Policy Documents

Apart from assessing the involvement of scientists in the policy process, the use of scientific evidence in the climate change policy document and in other policy documents was also assessed (annex 2).

4.2.1 Types of Evidence Used in Policy Documents

The summary of the content analysis of the policy documents is shown in table 9. When we consider all the policy documents, it appears that concepts from scientific input/evidence are the most frequent (48%), followed respectively by input from ministries and input from NGO/CSO. However, a comparison of the occurrence of these inputs in the National Climate Change Policy and in other policies, shows that scientific input comes at the second place preceded by advocacy input. In fact, the national climate change policy is formulated respectively based on input from advocacy groups (39%) and science (35%). Moreover, the input of scientific evidence in national climate change policy is lower than in other policies while the input from ministerial papers is higher than in other policies.

Table 9: Frequency of concepts from various types of input used in the policy documents

		Frequency of concepts in all the documents N (%)	Frequency of concepts in the National Climate Change Policy N (%)	Frequency of concepts in other policies N (%)	
				Average	Total
Concepts from scientific input	Scenario	348 (27)	6 (5)	49 (29)	342
	Model	210 (16)	4 (4)	29 (17)	206
	Projection	75 (6)	4 (4)	10 (6)	71
	Uncertainty	55 (4)	2 (2)	8 (5)	53
	Extreme	44 (3)	10 (9)	5 (3)	34
	Disease	118 (9)	33 (31)	12 (7)	85
	Land use	188 (15)	11 (10)	25 (15)	177
	Vulnerability and impact assessment	46 (4)	0	7 (4)	46
	Adaptation strategy/options	99 (8)	9 (8)	13 (8)	90
	Resilience/indigenous knowledge/ traditional knowledge	86 (7)	29 (27)	8 (5)	57
	Sub-total	1269 (48)	108 (35)	166 (44)	1161
Concepts from public ministries/agencies input	Forest management	29 (4)	1(1)	0	0
	Insurance	43 (6)	11 (14)	4 (10)	28
	Agro-ecological	27 (4)	2 (3)	5 (12)	32
	Governance	45 (6)	13 (16)	4 (10)	25
	Water management	22 (3)	1 (1)	5 (12)	32
	Land management	18 (3)	2 (3)	3 (7)	21
	Economic impact	8 (1)	0	2 (5)	16
	Mitigation option/strategy/capacity	22 (3)	1 (1)	1 (2)	8
	Carbon	169 (24)	14 (18)	3 (7)	21
	Fund	319 (45)	33 (42)	22 (54)	155
	Sub-total	702 (27)	78 (26)	41 (11)	286
Concepts from advocacy groups Input	Awareness	156 (23)	14(12)	89 (54)	624
	Communities	241 (36)	43 (36)	20 (12)	142
	Well-being	2 (0)	1 (0)	28 (17)	198
	Livelihoods	141 (21)	29 (25)	0	1
	Adaptive Capacity	23 (3)	0	16 (9)	112
	Security	77 (12)	28 (24)	3 (2)	23
	Social and financial support	23 (3)	3 (2)	7 (4)	49
	Sub-total	663 (25)	118 (39[t])	163 (45)	1100

Source: Field work, 2015

The scientific concepts appearing the most are: scenario, model, land use and land use change, disease, adaptation strategies and resilience. Therefore, scientific evidence used in the policy documents is related to the state of change in Ghana's climate (evolution of climatic parameters over time), causes of climate change, and impacts of climate change particularly on human health

and adaptation strategies to combat climate change. The importance of such evidence is stated in this following statement from the policy document:

> *"Section 1.1.2 Given the uncertainty around climate change, any policy must prepare for a range of possible futures. The National Climate Change Policy recognizes this and also the fact that the nation cannot afford to wait for certainty before taking action. Policy decisions, therefore, need to be robust enough to withstand many different climate change scenarios. These decisions must be backed by hard evidence that would lead to a comprehensive options assessment and effective implementation. All decisions need to be supported by robust monitoring and reporting systems (MESTI, 2013, page 1-6)."*
>
> *"Section 1.1.2 The concerns on the potential results of climate change include: the impact on agriculture…, severe impacts on land use…, deteriorating health…, water scarcity (MESTI, 2013, page 1-7)."*

Among concepts from ministries and related agencies, the most frequent are: fund, carbon, governance and insurance. Therefore, the input from ministries and related agencies is based on funding mechanisms of adaptation and mitigation projects, strategies of reduction of carbon emissions and of increase of carbon sink (low carbon development strategies), improved governance mechanisms of natural resources and farm financial strategies such as farm or agricultural insurance.

> *"Section 2.2.1 Governance and coordination lie at the heart of the NCCP, which aims to create a broad constituency that goes beyond government to include the private sector, non-governmental organisations, Parliamentarians, communities and other key stakeholders (MESTI, 2013, page 2-9)."*
>
> *"Section 2.2.5 There should be a climate change fund with commitment from government and matching contributions from financial services firms. The climate change fund can be a long-term investment vehicle that supports the Government's efforts in managing climate change. Insurance firms can be encouraged to help underwrite climate change risks. Such policies can be at the retail level to households and on a wholesale level to banks that underwrite facilities that support environmentally sustainable activities (MESTI, 2013, page 2- 14)."*

The concepts that appear most under advocacy groups' input are: communities, awareness, livelihoods and security. The uptake of policy makers from NGO and CSO is related to strategies to reduce climate change impacts on local vulnerable communities and increase their resilience, particularly through awareness and sensitization activities (knowledge management strategies at local level), diversification of livelihoods for local vulnerable communities in order to ensure their security, mainly food security.

> *"Section 2.2.6 Good communication, education and awareness-raising around climate change are all essential to deliver the objectives described earlier in this discussion document. They are crucial for the success of climate change adaptation and low carbon strategies and to ensure good governance and transparency in progress towards sustainable national development. (MESTI, 2013, page 2- 14)."*

> *"Section 4.4 Systems need to be put in place to minimize the direct as well as the indirect impacts of climate change on human health and livelihoods, as well as improve resilience in the face of unavoidable change (MESTI, 2013, page 4- 13)."*

Table 10 summarizes the type of information taken by policy makers from evidence generating institutions:

Table 10: Types of information gotten from policy documents

Types of input	**Types of information gotten from these documents**
Input from science/research	Climate modelling
	Causes of climate change
	Impacts
	Adaptation options (agriculture, fishery, health, water conservation)
Input from ministries and related agencies	Adaptation and mitigation funds
	Mitigation options
	Improved environmental governance mechanisms
	Farm financial strategies
Input from advocacy groups	Adaptation strategies at local level for vulnerable communities (knowledge management, financial management, farm management, diversification)

Source: Field work, 2015

4.2.2 Purpose of Using Scientific Evidence in Policy Documents

Scientific evidence in climate change policymaking process has been used mainly for two purposes (table 11). Firstly, it was used to prioritize actions or strategies to implement in order to address climate change in Ghana. Next, it was used to clarify climate change issues, policy context and various concepts. However, policy orientations (objectives, vision, missions) were not based on scientific evidence. The foundation of the policy process is not scientific evidence (what should be achieved is not based on the findings from research) but scientific evidence is used to identify and prioritize adaptation, mitigation actions/options/strategies.

Table 11: Occurrence of concepts in the different sections of climate change policy documents

Types of use **Concepts**	**Tactical use (vision, objectives, missions, policy orientations)**	**Conceptual use (new ideas, understanding, or concepts to clarify or to present the context)**	**Instrumental use (Focus areas/strategies)**
Scenario	5	4	0
Model	1	3	1
Projection	3	3	0
Uncertainty	2	0	0
Extreme	4	8	3
Disease	3	14	23
Land use	1	3	11
Vulnerability and impact assessment	0	0	0
Adaptation strategy/options	0	9	24
Resilience/indigenous knowledge/ traditional knowledge	5	21	23
Total	24	65	85

Source: Field work, 2015

4.2.3 Printed materials used in the policy document

An analysis of references' section in the policy document revealed a total of 30 documents cited with a majority of information coming from policy briefs, policy documents and reports from NGOs (table 12)

Table 12: Types of references used in the policy document

Documents		Proportion N (%)
Article		0
Paper from research or academia		0
Assessment report from ministries		1 (3)
Assessment report from agencies		2 (7)
Reports from NGOs papers (UNDP, DFID, IIED, World Bank)		4 (13)
Ghana Policy document		5 (17)
Policy brief from research or academia		0
Policy brief from implementation agencies		18 (60)
Themes of policy brief	Adaptation	5
	Finance or economy	3
	Mitigation	2
	Disaster risk reduction	3
	Gender	1
	Indigenous knowledge	1
	Impacts	3

Source: Field work, 2015

Out of a total of 30 documents, 18 were policy briefs from governmental implementation agencies, 5 were policy documents, 4 were reports from NGOs and 3 were assessment reports from agencies and ministries. No article, paper from research or academia or policy brief from research or academia appeared in the references section of the document. This showed that scientific concepts appearing in the policy document may have come not from scientific/research/academic papers but other types of materials.

4.3 Knowledge Transfer to Policy Makers

4.3.1 Push Efforts towards Policy Makers

4.3.1.1 Types of Pushed Efforts used by Evidence Generating Institutions to Reach Policy Makers

The evidence used in policy and decision-making process is transferred by evidence generating institutions to policy makers mainly through the use of printed materials and meetings (figure 14).

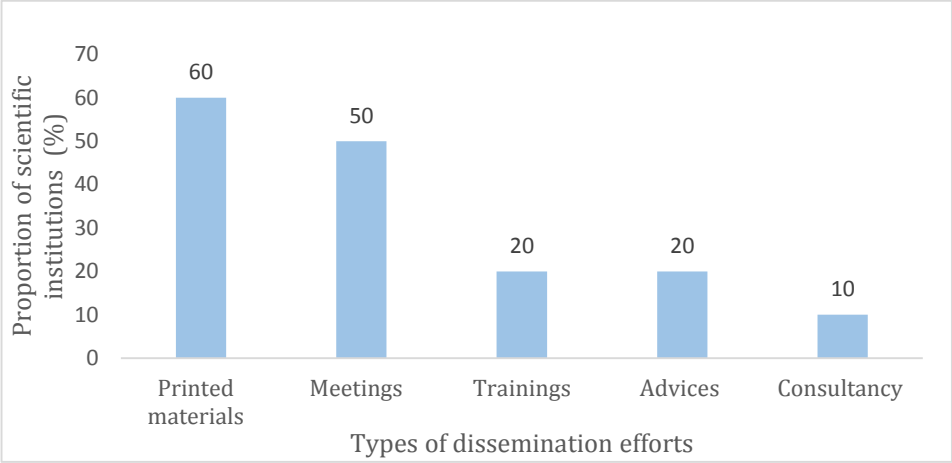

Figure 14: Types of pushed efforts used by evidence generating institutions to reach policy makers (Field work, 2015)

Trainings of policy makers, advice and consultancy are not so frequently used by evidence generating institutions to interact and transfer evidence to policy makers. According to an interview from the Environmental Protection Agency, trainings of policy makers are very costly because of perdiems and all the resources needed to organize such programs and to satisfy policy makers. Furthermore, about half of the evidence generating institutions believe that they transfer a lot of their evidence to policy makers (Figure 15).

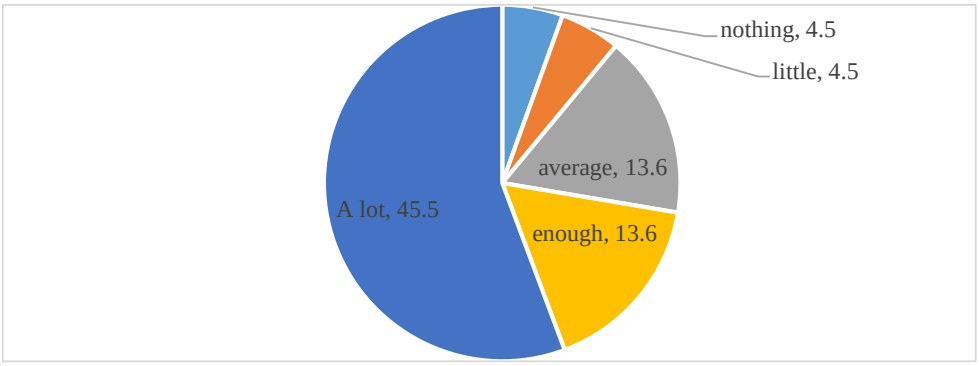

Figure 15: Perceived amount of evidence transferred by evidence generating institutions to policy makers (Field work, 2015)

4.3.1.2 Classification of Push Efforts by Institutions

The classification of push efforts used by evidence generating institutions to translate their evidence to policy makers has led to three translation groups or clusters. The figure 16 shows the proportion and types of institutions making every translation cluster. The first cluster is dominated by translation efforts of research institutions while the second is dominated by translation efforts of implementation agencies and the third one is dominated by translation efforts of academic institutions.

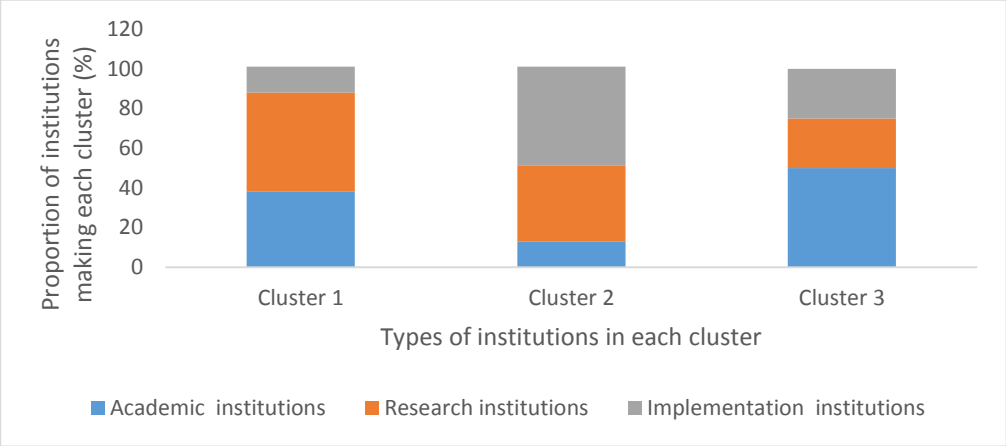

Figure 16: Types of institutions making dissemination clusters (Field work, 2015)

Some of the institutions making each cluster are presented in figure 17.

Cluster 1	Cluster 2	Cluster 3
•Council for Scientific and Industrial Research (CSIR) •Food and Agriculture Organization (FAO) •United Nations University (UNU)	• Ghana Statistical Service (GSS) • Forestry Commision Climate Change Unit (FCCU) • Environmental Protection Agency (EPA) • Town and Country Planning (TCP)	•Regional Institute for Population Studies (*RIPS*) •West Africa Centre for Crop Institute (WACCI) •Livestock and Pooltry Research Centre (LPRC) •Institute for Applied Science and Technology (IAST)

Figure 17: Names of some institutions making dissemination clusters (Field work, 2015)

Each cluster is characterized by a frame or model of knowledge translation efforts which are shown in the figure 18. Research institutions (cluster 1) make mostly use of meetings and printed materials to translate their evidence to policy makers, while implementation agencies (cluster 2) use printed materials. Academic institutions have various push efforts: meetings, advice, printed materials, trainings and consultancy.

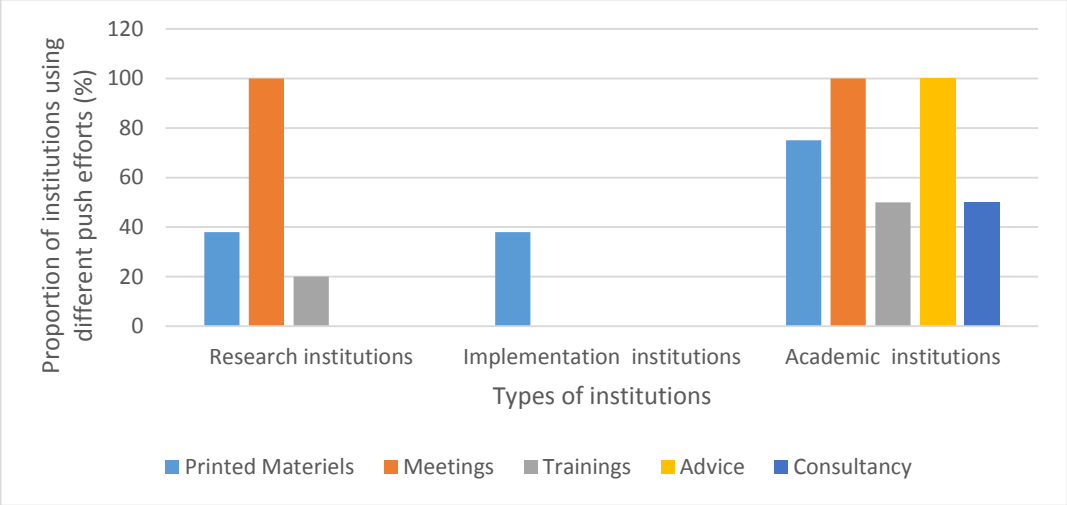

Figure 18: Push efforts undertaken by every type of institutions (Field work, 2015)

To reach out policy makers, the evidence generating institutions do not use the same methods. Implementation agencies prioritize printed materials (mainly reports of projects/programs) which help them to inform about what they have done. These materials also serve as justification of the funds received to carry out their activities. However, they produce also policy briefs but they target the general public. Research institutions focus on the use of printed materials and meetings to relate with policy makers. Because they are more concerned about the uptake of their evidence by policy makers, they try, through meetings, to inform them directly. Finally, academic institutions use various methods. Beyond classic ways of using printed materials and meetings, these institutions give advice to policy makers, they are involved in consultations to formulate policies and they organize trainings for policy makers. The figure 19 summarizes the various push efforts used by evidence generating institutions to transfer knowledge to policy makers.

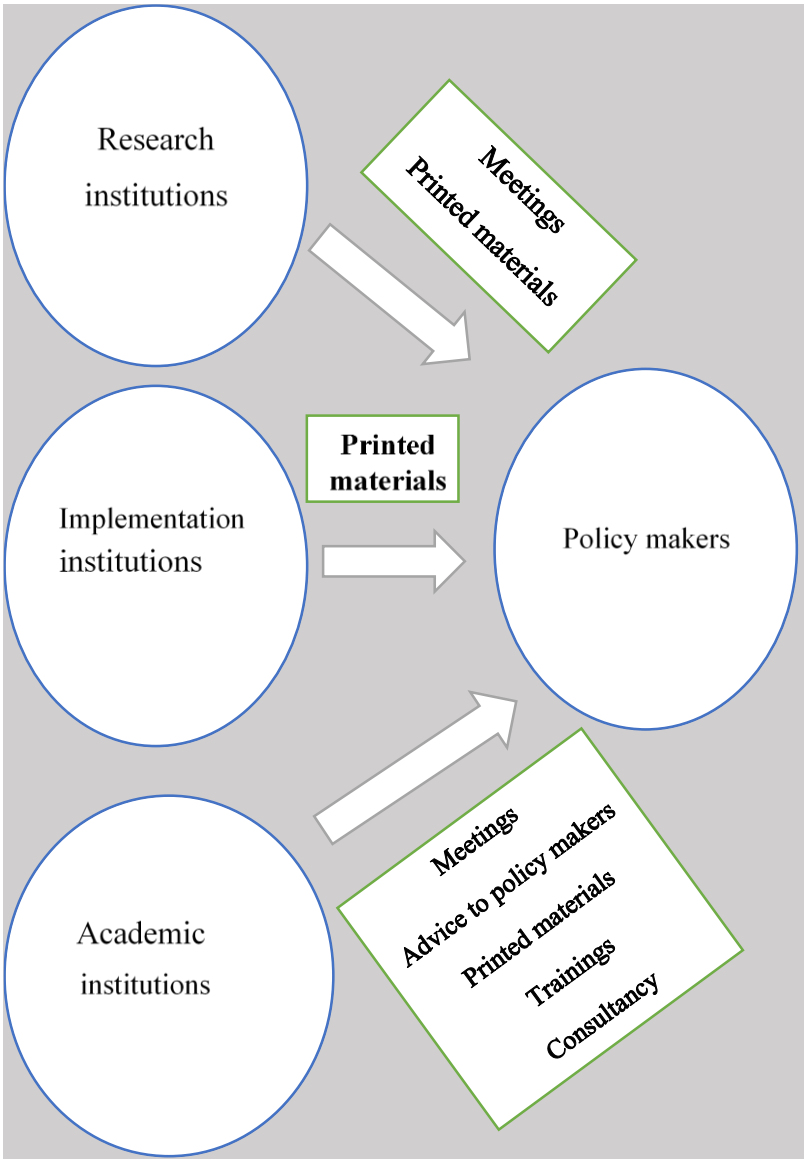

Figure 19: Push efforts model used by evidence generating institutions to transfer knowledge to policy makers (Field work, 2015)

4.3.1.3 Effective Push Efforts

Evidence generating institutions were asked to rank push efforts according to the importance they give to these efforts in reaching policy makers (figure 20). The most important push activities or efforts or communication channels that draws the attention of policy makers can be categorized into three:

- ❖ Joint projects, contract research and consultancy;
- ❖ Contacts with policy makers through conferences/workshops and face to face meetings; and
- ❖ Scientific publications in (refereed) journals or books and systematic reviews of scientific findings

Though printed materials and meetings are the efforts undertaken by evidence generating institutions to reach policy makers, they are not the most important channel that can enable a good transfer of evidence to policy makers. Most of these institutions believe that joint projects, contract research and consultancy are the most important in terms of knowledge transfer.

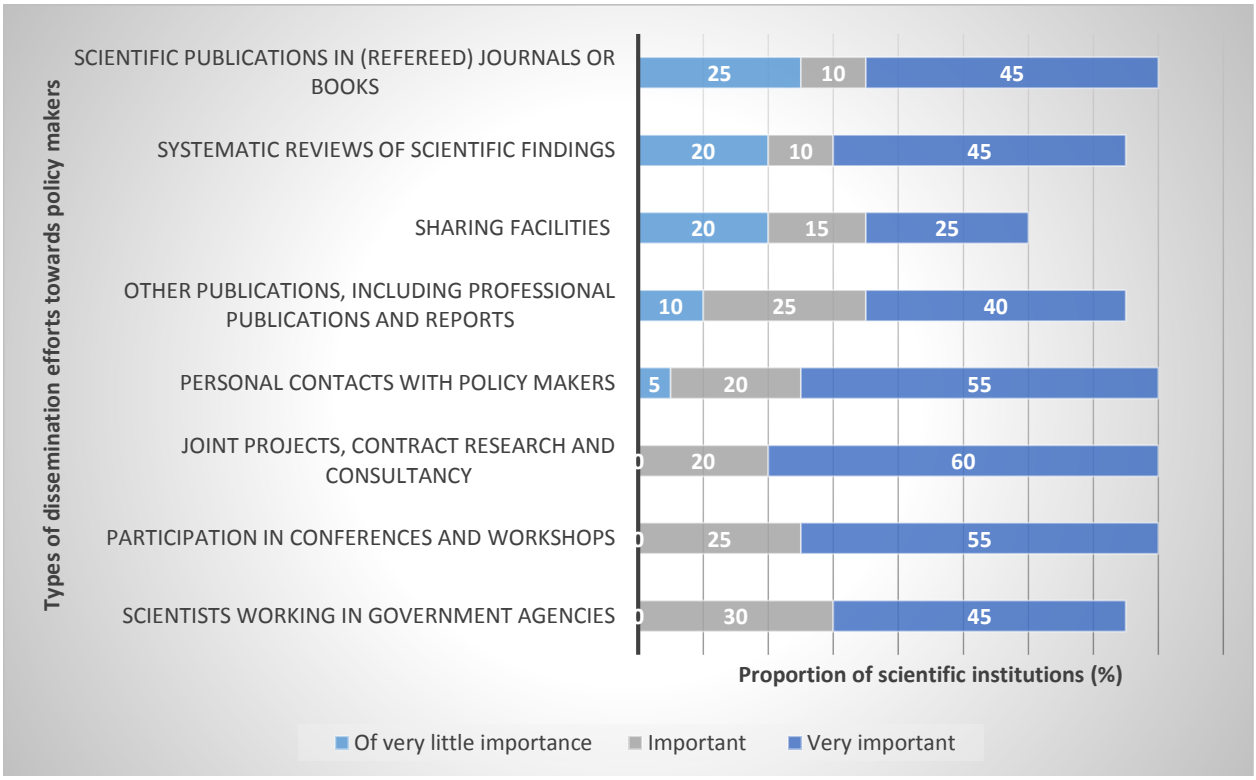

Figure 20: Level of importance of pushed efforts or dissemination activities (Field work, 2015)

4.3.2 Efforts of Evidence Generating Institutions to Support Use of Evidence by Policy Makers

Apart from transferring evidence to policy makers, some evidence generating institutions undertake efforts to support research use, to reach policy makers, and to make sure that they get the information (table 13).

About 30% of these institutions dispose of a network of experts on climate change mainly experts in climate change impacts and adaptation. In addition to climate change experts, some of these institutions (20%) limit restrictions to online resources and journals that may contain relevant research evidence on climate change, while others (65%) organize programs and trainings to enhance decision makers' capacity and skills to acquire and factor research into decision-making process.

Table 13: Facilitating pull efforts to support use of evidence by policy makers

	Proportion of evidence generating institutions (N (%))
Experts in	
Governance	1 (5)
Communication	2 (10)
Policy analysis	2 (10)
Economists	3 (15)
Social issues	3 (15)
Climate modelling	4 (20)
Climate change impacts	7 (35)
Climate change adaptation	9 (45)
Types of programs and trainings to support research use	
Online discussion forums	0
Webinars	0
Workshops	12 (60)
Personalized briefings	5 (25)
Easy access to online resources	4 (20)
Documentation and reporting tools	5 (25)

Source: Field work, 2015

4.3.3 Efforts Focused on Building and Maintaining Relationships between Evidence Generating Institutions and Policy Makers

An assessment of the appreciation of evidence generating institutions' collaboration with policy makers was done (figure 21). Most of evidence generating institutions found that their collaboration is very strong.

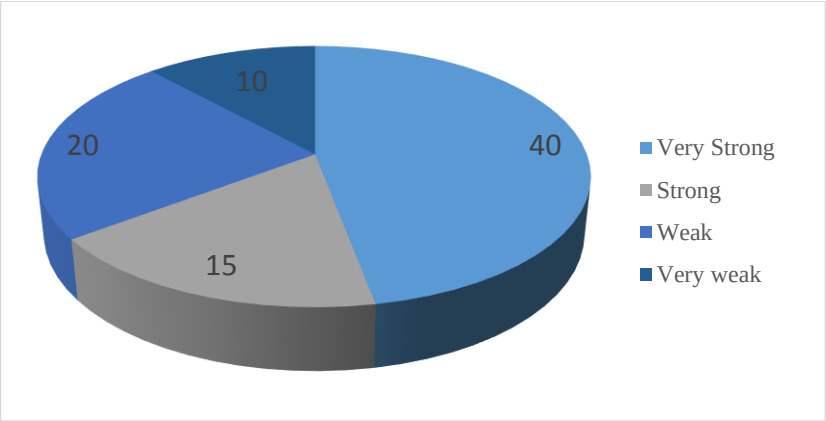

Figure 21: Evaluation of the collaboration between evidence generating institutions and policy makers (Field work, 2015)

The factors that make their collaboration successful are, among others:

- Good communication between policy makers and evidence generating institutions;
- Trust of policy makers in evidence generating institutions;
- Common interest between policy makers and evidence generating institutions;
- Occasional interactions for shared understanding of problems and awareness creation;
- Engagement of evidence generating institutions towards policy makers; and
- Media as a channel which facilitates the communication between policy makers and evidence generating institutions

Equally evidence generating institutions relate to policy makers in order to get funding and to share expertise and experience. The perceived financial contribution of policy makers to knowledge production and dissemination activities is less than 25% of the total research budget.

In their efforts to disseminate evidence to policy makers, evidence generating institutions do not act always alone. Most of them (75%) attested that they collaborate with other institutions, either at local or international level for research and dissemination activities, project implementation, capacity building, coordinating production of statistics, sharing resources. According to 60% of them, this collaboration helped evidence generating institutions to be more successful in their activities of dissemination.

4.3.4 Efforts to Evaluate Dissemination Activities towards Policy Makers

Most of evidence generating institutions (65%) used to evaluate their dissemination activities towards policy makers through different methods. Among them, 60% stated that funders stress the need to evaluate dissemination activities in research projects/programs. The most used of these methods is the quick written assessment after workshops (figure 22).

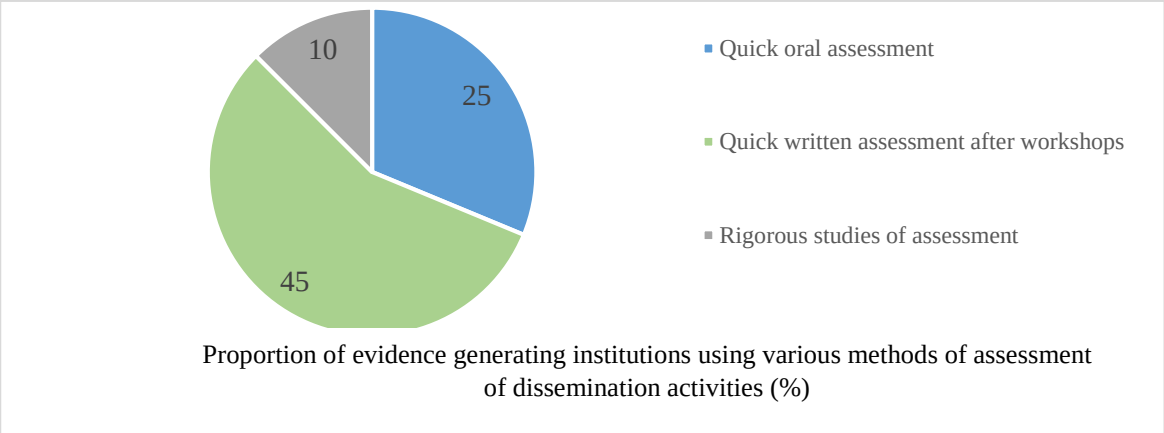

Figure 22: Methods of assessment of dissemination activities by evidence generating institutions (Field work, 2015)

Knowledge dissemination is an important part of research projects activities. Indeed, 70% of evidence generating institutions focused always on the importance to integrate dissemination activities in their work. Moreover, the presence of such activities is very important for donors/funders of research projects/programs. Forty percent of these institutions recognize that it is a criterion to get funds from donors. However, the perceived proportion of annual budget allocated to dissemination activities by most of these institutions is less than 25% (figure 23).

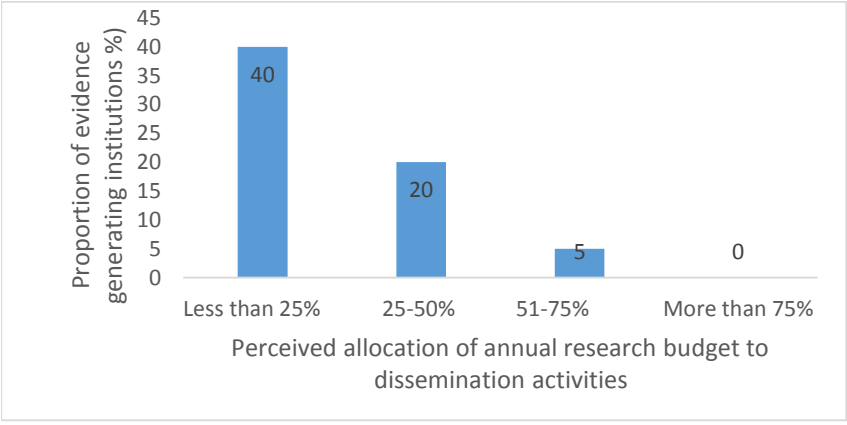

Figure 23: Perceived allocation of annual research budget to dissemination activities by evidence generating institutions (Field work, 2015)

During a research project, the perceived time devoted to dissemination activities varies from an institution to another. For some projects, it is a continuous process while others spend between 4 to 12 months drafting printed materials, organizing and holding meetings of all kinds to inform about their findings.

4.3.5 Effectiveness of evidence generating institutions in transferring knowledge to policy makers

Table 14 shows for each institution the various efforts undertaken to reach out policy makers.

Table 14: Assessment of institutions in transferring knowledge to policy makers

N	Name of the institution	Type of institution	Concordance between research agenda and national priority	Transfer of knowledge to policy makers	Amount of knowledge transferred	Types of ways to transfer knowledge	Effectiveness in transferring knowledge
1	Centre for Gender Studies and Advocacy (CEGENSA)	National	Yes	Yes	Enough	Push efforts Evaluation efforts	Very unlikely effective process
2	Centre for Agricultural Bioscience International, West Africa Center, Ghana	Regional	Yes	Yes	Average	Push efforts Facilitating pull efforts Interaction/relationship Evaluation efforts	Extremely likely effective process
3	Council for Scientific and Industrial Research (CSIR)	National	Yes	Yes	A lot	Push efforts Facilitating pull efforts Interaction/relationship Evaluation efforts	Extremely likely effective process
4	Environmental Protection Agency (EPA)	National	Yes	Yes	MD	Push efforts Interaction/relationship	Likely effective process
5	Fisheries Scientific Survey Division (FSSD)	National	No	Yes	A lot	Push efforts Interaction/relationship Evaluation efforts	Likely effective process
6	Food and Agriculture Organization	Inter national	Yes[	Yes	Enough	Push efforts Facilitating pull efforts	Extremely likely effective process

	(FAO), Ghana					Interaction/relationship Evaluation efforts	
7	Forestry Commission Climate Change Unit (FCCCU)	National	Yes	Yes	A lot	Push efforts Facilitating pull efforts Interaction/relationship Evaluation efforts	Extremely likely effective process
8	Friends of The Earth-Ghana (FEG)	Inter national	Yes	Yes	Average	Push efforts Facilitating pull efforts	Unlikely effective process
9	Ghana Meteorological Agency (GMA)	National	No	Yes	A lot	Push efforts	Very unlikely effective process
10	Ghana Statistical Service (GSS)	National	Yes	Yes	A lot	Push efforts Facilitating pull efforts Interaction/relationship Evaluation efforts	Extremely likely effective process
11	Global Water Partnership (GWP)	Inter national	Yes	Yes	A lot	Push efforts Facilitating pull efforts Interaction/relationship Evaluation efforts	Extremely likely effective process
12	Institute For Applied Science And Technology (IAST)	National	Yes	Yes	Enough	Push efforts Facilitating pull efforts	Unlikely effective process
13	Institute for Environmental and Sanitation Studies (IESS)	National	Yes	Yes	Average	Push efforts Facilitating pull efforts Interaction/relationship Evaluation efforts	Extremely likely effective process
14	International Water Management Institute (IMWI)	Inter national	Yes	Yes	A lot	Push efforts Facilitating pull efforts Interaction/relationship Evaluation efforts	Extremely likely effective process
15	Livestock and Poultry Research Centre (LPRC)	National	Yes	No	Nothing	-	-

16	Regional Institute for Population Studies (RIPS)	National	Yes	Yes	A lot	Push efforts Facilitating pull efforts Interaction/relationship Evaluation efforts	Extremely likely effective process
17	Science and Technology Policy Research Institute (STEPRI)	National	_	Yes	MD	MD	-
18	Town and Country Planning (TCP)	National	Yes	Yes	A lot	Push efforts Facilitating pull efforts Interaction/relationship Evaluation efforts	Extremely likely effective process
19	United Nations University (UNU)	Inter national	Yes	Yes	A lot	Push efforts Facilitating pull efforts Interaction/relationship Evaluation efforts	Extremely likely effective process
20	West Africa Centre for Crop Institute (WACCI)	Inter national	No	Yes	Little	Push efforts Facilitating pull efforts Evaluation efforts	Extremely likely effective process

Source: Field work, 2015

It reveals that over the 20 institutions, 12 combine the three types of methods to transfer knowledge to policy makers (push efforts, facilitating pull efforts, and exchange efforts). Higher the number of methods used by evidence generating institutions, higher the probability to reach effectively policy makers. Therefore, we can conclude that the process of knowledge transfer may likely be highly effective in these 12 institutions because it is dominated by a combination of the three methods. The remaining eight institutions undertake push and/or facilitating pull efforts but they lack interactions with policy makers; what makes their knowledge process transfer a little weaker and less effective.

4.4 Perceived Effectiveness and Barriers to Knowledge Exchange and Implementation of Science-based Policies

4.4.1 Perceptions on the effectiveness of knowledge exchange process

Table 15 presents the perceptions of evidence generating institutions on their role of knowledge disseminators and the use of scientific evidence by policy makers

Table 15: Perceptions on science-based policies and use of scientific evidence by policy makers (N=20)

Concepts	Items	Percent (N (%))
Production and dissemination of knowledge by evidence generating institutions	Research into use (RIU) is a priority for scientific institutions	18 (90)
	Scientific institutions organize programs to enhance the capability of developing and executing research-dissemination efforts	18 (90)
	Scientific research plays an important role in the policy making process	16 (80)
	During these 10 last years, efforts of researchers in translating their scientific evidence to policy makers have increased	12 (60)
	Scientists are the backbone in policy-making process	8 (40)
	Scientific findings are the base of policy documents	4 (20)
Use of scientific evidence by policy makers	There is an appetite or an interest for the use of scientific evidence in policymaking in Ghana	16 (80)
	There are policy dialogues in which scientists are involved	10 (50)
	Policy makers make use of scientific evidence in their decision-making process	9 (45)
	Policy makers always consult scientists for decision-making	5 (25)
Support from policy makers	There is a policy for the promotion of science/technology application in the society	8 (40)
	Funds/systems are in place to support "research into use" programmes	8 (40)

Concepts	Items	Percent (N (%))
	Policy makers establish institutions to support them in their decision-making	7 (35)
	Funds/systems are into place to support dissemination efforts	6 (30)
	Policy makers fund research to support their decision-making	4 (20)

Source: Field work, 2015

Most of evidence generating institutions perceived the role of research as very important, crucial for policy making. This role can be categorized into two:

- It informs policy/decision makers: scientific evidence serves as a link between issues on the ground and how policies are formulated. It facilitates forward-looking decision-making and improves an already existing knowledge. Scientific research provides the necessary knowledge for policy makers to make informed and strategic decision. Researchers provide policy makers with information and data that could affect every aspect of the economy.
- It shapes policy making: it guides policy design and used for policy monitoring and evaluation. For example, in the context of climate change policy, scientists/researchers provided scientific basis of impacts of climate change using various scenarios. These data were made available and submitted to policy makers to be discussed. Then, they start writing the policy and strategy. In return, policies also direct the types of research work that are undertaken by scientists.

More than half of the institutions interviewed agreed that over the 10 last years, efforts of scientists to translate their evidence to policy makers have increased. This is due to three major factors:

- The type of government: most of policy makers are educated, sometimes coming from science background. They are always seeking information and evidence to sustain their policies and decisions. In fact, about 75% of the evidence generating institutions interviewed recognized that there is an interest for the use of scientific evidence in policy-making in Ghana;
- The priority given by donors and international community on science-based policy: it has become a requirement of many international institutions for research and development projects grants; and

- ❖ Understanding of scientists of the necessity to make their users, particularly policy makers and communities on the ground, aware of their evidence. They believe that scientific findings will help in solving issues.

Despite the increase of dissemination efforts, most of evidence generating institutions believe that scientific evidence is not the base of policies in the country. Moreover, science-based policies are not always perceived as solution to improve policy-making and implementation because when they are technical, they are not understood by policy makers.

This may be the reason why research institutions think that their dissemination efforts are not yielding the fruit which should be the reduction of climate change impacts in the country.

4.4.2 Perceptions on the Formulation and Challenges Related to the Implementation of the National Climate Change Policy Document

Table 16 presents in a specific way the perceptions of evidence generating institutions on the national climate change policy document.

Table 16: Perceptions on the national climate change policy document

	Items	**Percent (N (%))**
Policy document	Scientific evidence contributes to the improvement of policies on climate change in Ghana	9 (45)
	Policies and directions in the document are relevant and can lead to climate change adaptation and mitigation	8 (40)
	The policy document is based on scientific evidence	7 (35)
	Science-based policies are a solution to improve policy making and implementation in Ghana	7 (35)
	Dissemination efforts towards policy makers are sufficient and can help to reduce climate change impacts in the country	6 (30)

Source: Field work, 2015

Regarding the national climate change policy document, all evidence generating institutions involved in the policy process and interviewed believe that the national climate change policy document is scientific evidence-based because:

- ❖ The process was facilitated by scientists from the University of Legon and supported by researchers;
- ❖ The process was consultative: all key stakeholders were involved in the process such as NGO/CSO, Private/Industries, Funders/Donors, and Representative of communities; and

This is in line with the results of the content analysis which showed that the policy document is based on scientific evidence. Moreover, all these institutions think that the policies and directions in the document are relevant and can lead to climate change adaptation and mitigation for the following reasons:

- ❖ The policy document focuses on adaptation;
- ❖ The policy document could influence decisions of policy makers;
- ❖ Policies and directions in the policy document will enhance education and create awareness;
- ❖ Policies and directions in the policy document touch on all the key sectors of Ghana's economy

An assessment of the contribution of each stakeholder in terms of input into the policy process showed that academia has mainly contributed to the debate followed by NGOs/CSO (figure 24). In fact, the University of Legon was the lead of the process and two over six consultations have been made with academia and high level experts.

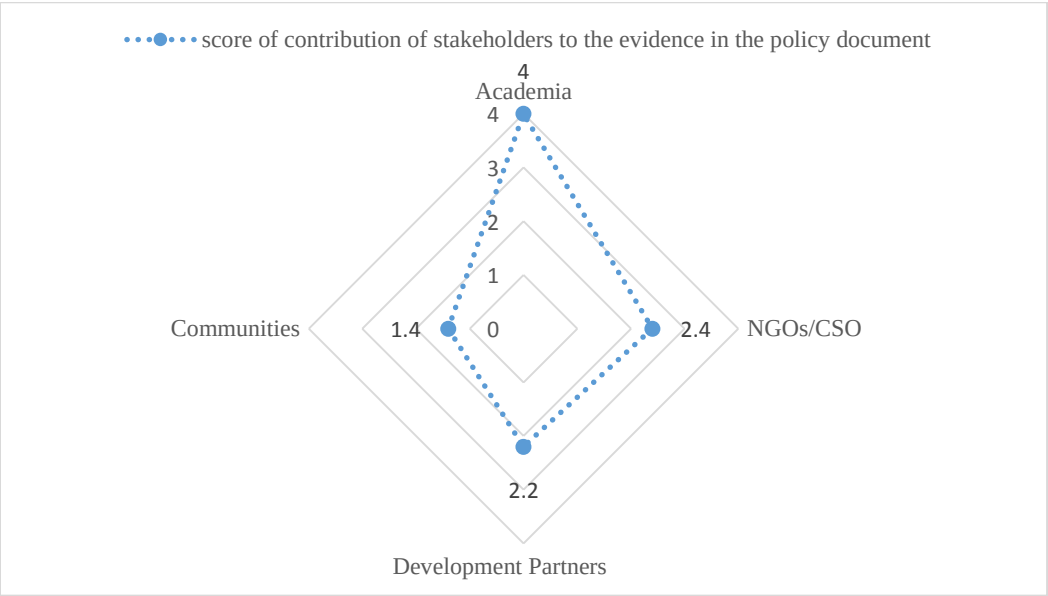

Figure 24: Contribution of various stakeholders into the policy document in terms of evidence (Field work, 2015)

Despite the important contribution of stakeholders in the policy process, some challenges can hinder the success and effectiveness of the policy document at the implementation stage. Table 17 indicates some of these challenges.

Table 17: Challenges and solutions suggested to succeed in the implementation of the Climate change policy document

Challenges	**Solutions**
Budget constraints	Allocate more funds to the implementation
	Strong legislation framework which will bind agencies to commit percentage of their budgets towards implementation of the policy
	Involve more stakeholders at the implementation stage
Political will	Need to integrate high level of decision makers
Culture and beliefs	Education
	Create more awareness about the issue
Access to adequate tools	Access to more funds
Understanding of research findings by policy makers	Collaborate and work on problems together (scientists and policy makers)

Source: Field work, 2015

The major challenge indicated is related to the budget constraints. The main factor that can hinder the implementation and fail the policy is the lack of funds due to difficulty in funds mobilization or failure to release funds on time. Apart from these challenges, others concern the political will and cultural context of communities (perceptions, beliefs).

To overcome these challenges, researchers are suggesting solutions in social, economic and political sectors. They include education, awareness, important mobilization of funds, high commitment of policy makers, and involvement of more stakeholders at implementation stage.

4.4.3 Perceptions on the Barriers to Knowledge Exchange between Evidence Generating Institutions and Policy Makers

4.4.3.1 Perceived Cultural Barriers

Table 18 shows the proportion of institutions that agreed on the cultural factors that could explain the difficulties in exchanging information with policy makers.

Table 18: Perceived barriers in terms of cultural differences between scientists and policy makers (N=20)

Items	**Percent (N (%))**
Scientists generate data for advanced knowledge	17 (85)
Decision-makers are driven by a range of political, economic and social drivers that reflect other societal issues and science is just one point of view, and frequently not the most influential	13 (65)
Scientists and decision-makers are different in terms of objectives and methodologies	12 (60)
Decision-makers may mobilize specific information to support a particular agenda without always giving consideration to the full range of available evidence or detailed public debate	11 (55)

Source: Field work, 2015

According to this table, the major cultural barrier to knowledge exchange is the type of knowledge produced by scientists. They are involved in theoretical and advanced knowledge while policy makers are more technical and pragmatic. On the side of decision makers, the major cultural factor is that they take political, economic and social concerns more into account than scientific concerns. Moreover, they don't give consideration to the full range of available evidence or detailed public debate.

It is important to notice that for effective decisions, policy makers need relevant and update data. Researchers underlined the need to conduct census in various areas to get data, the need to create centers where data are collected and made available to researchers to be used in order to advise policy makers. Therefore, scientists have to generate data for advanced knowledge but they have to work on the way they transfer it in order to make it meaningful for policy makers.

4.4.3.2 Perceived Institutional Barriers

Table 19 shows the perceived institutional barriers by research institutions. The major institutional barrier from decision makers' side is the lack of funding for climate change research and dissemination activities. According to scientists, this lack of funding explains the reason why they are not too much engaged in outreach activities. Moreover, research institutions believe that there are some limitations in dealing with policy makers' needs mainly because they are not too committed to support financially scientific research. From this table, it comes that neither negotiation/communication skills are lacking in research institutions nor integrative/participative methods to deal with issues.

Table 19: Institutional perceived barriers to knowledge exchange between scientists and policy makers (N=20)

Items	**Percent (N (%))**
Government itself constitutes a barrier because they do not sufficiently fund research dissemination activities	11 (55)
Scientists are not too engaged in outreach activities because of lack of funding	11 (55)
Government itself constitutes a barrier because they do not sufficiently fund research on climate change	10 (50)
Scientists has limitations in dealing with policy makers needs	7 (35)
Communication skills of scientists are unfit for knowledge dissemination activities	5 (25)
Integrative research methods lack in scientific/academic institutions	5 (25)
Scientists are not too engaged in outreach activities because they under-value such kind of activities	4 (20)
Negotiation skills of scientists are unfit for knowledge dissemination activities	3 (15)
Scientists are not too engaged in outreach activities because of insufficient time	2 (10)

Source: Field work, 2015

4.4.3.3 Perceived Barriers in terms of Accessibility of Policy Makers to Scientific Evidence

Most of research institutions believe that accessibility of policy makers to scientific evidence is not a challenge. According to them, the major barrier is that research projects/programs take long time, while policy makers have short time to show their results (table 20).

Table 20: Perceived barriers linked to the accessibility of policy makers to scientific evidence (N=20)

Items	Percent (N (%))
Policy makers do not have access to science because it takes more than three years for scientific articles to be published following data collection	4 (20)
Policy makers do not use evidence because they have short time to show results	4 (20)
Decision makers do not use evidence in the policy process because it is a long process	4 (20)

Source: Field work, 2015

4.4.3.4 Perceived Barriers Linked to the Personal Views of Scientists and Policy Makers

According to most of research institutions, scientists are seen as the producers of knowledge and are responsible for making this knowledge available to policy makers. This perception of scientists by policy makers makes difficult the knowledge exchange between scientists and policy makers. Also, more than half of research institutions agree that scientists do not have a clear understanding of politics. Moreover, their work is not perceived as able to impact policy process. The lack of enthusiasm to share knowledge and lack of support in terms of research findings are equally underlined as barriers.

Table 21: Personal views of scientists by policy makers (N=20)

Items	Percent (% (N))
Scientists are seen as the producers of knowledge and are responsible for making this knowledge available to policy makers	11 (55)
Scientists frequently have superficial understanding of politics	9 (45)
Work of scientists is perceived to end with the publication of their results, and does not extend to the potential consequences of the applications of their research in policy process	8 (40)
Lack of support in terms of research findings	8 (40)
Lack of enthusiasm to share knowledge	7 (35)

Source: Field work, 2015

4.4.3.5 Perceived Barriers in Relation to the Characteristics of the Research Output

Based on the proportion of research institutions that have disagreed with the statements in the table 22, we can conclude that the characteristics of scientific evidence are not a major barrier to its use by policy makers. In fact, for almost all research institutions, the volume of evidence produced, its relevance, validity, accuracy and quality do not constitute a challenge. However, the barriers are related to the time needed to read scientific papers and the skills to appraise and understand them.

Table 22: Perceived barriers related to characteristics of the research output (N=20)

Items	**Percent (N (%))**
Policy makers lack skills and knowledge to appraise and understand the scientific evidence	6 (30)
Policy makers need time to read evidence sources	6 (30)
The sheer volume of research evidence currently produced on climate change is low	2 (10)
Outcomes of scientific research are not relevant to policy makers because they do not take into account the specific contexts in which they operate and information needs that they require	1 (5)
Outcomes of scientific research are not accurate, valid and of high quality	1 (5)
Policy makers do not trust outcomes of scientific research because they may contain biases	1 (5)

Source: Field work, 2015

4.4.3.6 Perceived Barriers in Relation to the Communication with Policy Makers

The major perceived barrier related to the communication of scientific evidence to policy makers is the insufficiency of knowledge brokers or agents (table 23). Moreover, the contacts between policy makers and researchers seem not enough, policy makers are too busy to attend dissemination activities and the messages are too technical for them.

Table 23: Perceived barriers related to communication with policy makers (N=20)

Items	**Percent N (%)**
There are few knowledge brokers or agents	7 (35)
The way the messages are framed in the reports is too technical to be understood by policy makers	5 (25)
Policy makers are too busy and lack time to fully attend dissemination activities	5 (25)
Policy makers lack personal contact with researchers	5 (25)
There are few opportunities to transfer or inform policy makers on climate change issues	3 (15)

Source: Field work, 2015

In order to show the score of agreement about perceived barriers to knowledge exchange between scientists and policy makers, a pentagon has been drawn (figure 25). It shows the six types of barriers perceived by research institutions. The higher is the score, the higher is the agreement of research institutions about the barrier. Based on this pentagon, *cultural differences between policy makers and scientists* constitute the major barrier to knowledge exchange. In fact, policy makers and scientists are different in terms of goals, methodology and time frame, making difficult the collaboration between them. It is followed by *institutional barriers* which are mostly related to the lack of funding for research and dissemination activities. The third major barrier is the *perceptions of policy makers on scientists' work*. Most of time, scientific evidence is perceived useful just for publication but its potential consequences to resolve existing issues is neglected. Again, we can see that in Ghana, the barriers are not too much related to the accessibility of policy makers to scientific evidence, neither to the characteristics of the research output nor to the communication of scientific evidence to policy makers.

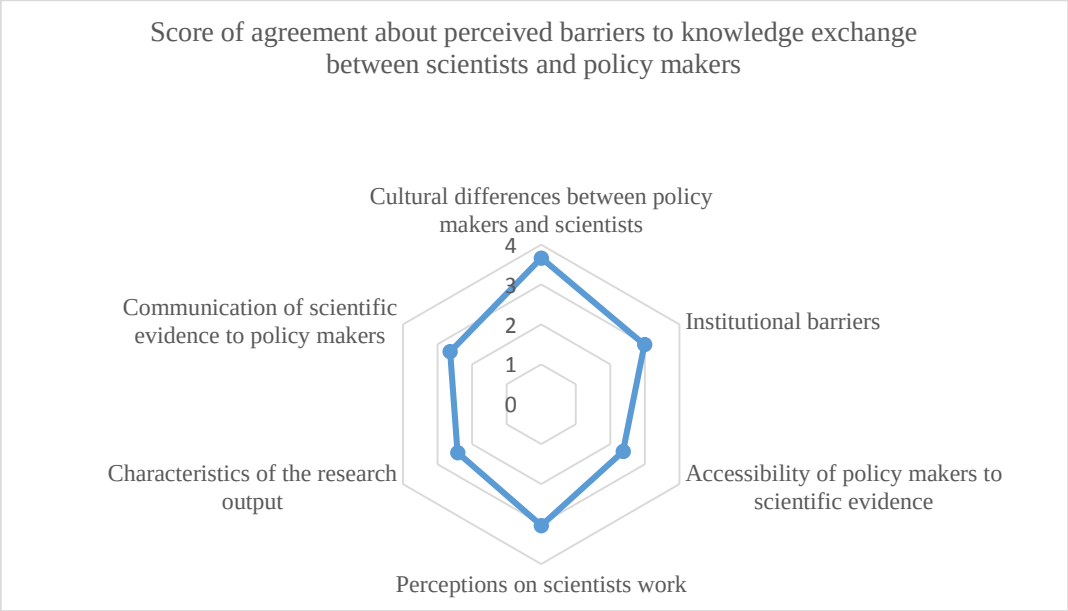

Figure 25: Agreement on perceived barriers to knowledge exchange between scientists and policy makers (Field work, 2015)

Chapter 5: Discussion

This section aims at explaining and interpreting results that were found in this study. It is framed around the objectives of this study. It starts with the discussion of results related to the climate change policy process followed by the discussion of the findings on knowledge dissemination/transfer as well as the uptake of scientific evidence by policy makers. Finally, the perceived barriers to knowledge exchange will also be discussed.

5.1 Climate Change Policy Process

The policy-making process has been studied in order to discover the types of actors involved, the beliefs of policy makers and the role of scientists in this process. In fact, many actors were involved such as public sector institutions (ministries, departments, and agencies), civil society and NGOs, development partners and industries, parliamentarians, metropolitans, municipal and district chief executives, traditional headships, research and academic Institutions. This diversity of actors is an advantage in this process because it is a way to guarantee that the interests of major stakeholders are included in the policy document. There were two coalitions in the process with different concerns but through consensus they were able to come to an agreement (see 4.1.3.2). Throughout the formulation and validation process, research institutions were represented. This differs from the viewpoint given by Sarpong and Anyidoho (2012) who studied the climate change and agricultural policy processes in Ghana. Accordingly, scientists are not invited to join the policy discussion. Their statement may be based on the proportion of existing climate change scientists compared to the number involved in the process. Indeed, in the course of policy formulation, three public research/academic institutions were involved and during the validation stage, seven and probably more were consulted (Table 9 in 4.1.4). However, only public research institutes were involved in the process, while international and regional research institutions were absent. This may be a weakness in this process because these international and regional scientific bodies are playing a great role in generating knowledge on climate change in the country (EPA, 2015). Furthermore, while for other policies, the consultant drafts the document and sends it to policy makers for approval, in the case of the climate change policy document, a consultant (Institute for Environment and Sanitation Studies) has worked closely with policy makers and two other research institutions to formulate the policy draft which was subject to some consultations before entering into the process of consultative validations (see 4.1.2.1). This may be a strength of this policy process which is recognized to be evidence-based.

Regarding the concerns in the policy document, it has been shown that the major concerns of policy makers are both economic, development and environmental. Through this study, we discover that the government aims at ensuring energy security and sustainable development through the reduction of greenhouse gas emissions either by using renewable energy or by afforestation or reforestation. This is line with the vision of the climate change policy document which is "to ensure a climate resilient and climate compatible economy while achieving sustainable development and equitable low carbon economic growth for Ghana (MESTI, 2013, page ix). This concern is further emphasized in the foreword by the president of Ghana in the policy document:

> *"Undoubtedly, the umbilical linkages between environment and socio-economic development are unequivocal. The critical role environment plays in supporting the resource base for economic growth and the implications thereof cannot be ignored. What has compounded the challenging relationship between the environment-development nexus is the growing threat of climate change globally, and Ghana is no exception (MESTI, 2013, page v)."*

An analysis of this concern reveals that the major interest of Ghana is climate change mitigation. This policy orientation influences climate change projects agenda which is mainly made up of research and development projects on mitigation (EPA, 2015). In fact, according to the third national communication of Ghana to UNFCCC, 65% of projects implemented from 2011 to 2014 are related to climate change mitigation, while 29% are in adaptation sector and the remaining projects stress development issues. In achieving their policy aim, the government has its research arm, the Forestry Research Institute of Ghana (FORIG) belonging to the council for Science and Industrial Research. This institute, represented in the advisory board of the policy process, is the main supporter of the environmental-economic-development concern of the country. On the opposite of this institution, other research institutions working in climate change area in Ghana devote their time and resources to climate change adaptation. A review of published papers and grey reports showed that few of them were related to mitigation, while the majority was about adaptation strategies but also on impact assessments and climate modeling (EPA, 2015). This double position of research and academic institutions may have contributed to shape the focus of the economic-environmental coalition which is not only based on mitigation but on both mitigation and adaptation.

5.2 Knowledge Dissemination/Transfer from Generating Institutions to Policy Makers

The results suggest that evidence generating institutions use mainly printed materials and meetings to transfer evidence to policy makers. This is in line with Marfo and Nutakor (2009) who found that scientific publications and formal meetings are the dominant channels for communicating information needs of both scientists and policy actors in forestry sector in Ghana. Beyond publications in peer reviews, printed materials are mainly policy briefs (EPA, 2015) such as CSIR *Newsletter*, CSIR Policy brief, climate policy brief of RIPs, etc. According to Grimshaw et al. (2012), printed materials are of common use. They contain specific information, such as key facts and figures that capture the attention of target audience. However, according to the United Nations Entity for Gender Equality and the Empowerment of women, types of reading materials needed depend on communication strategy and target audiences. For policy makers, the use of research report and concrete proposal for action (in the shape of policy recommendations) as effective tools to present pertinent evidence[3] was suggested. Our informal interviews revealed that most of the research projects carried by research and academic institutions are funded by international or regional institutions. Due to this situation, research reports are not designed for national policy makers but for the funding institutions. Therefore, there may be researches going on in the country but because of accountability and confidentiality issues, few of them can reach national policy makers.

In terms of effectiveness of push efforts, this study has revealed that scientists do not consider printed materials and meetings as the most effective methods to transfer evidence to policy makers. Joint projects, contract research and consultancy, contacts with policy makers through conferences/workshops and face to face meetings would be effective in reaching out policy makers because they allow interaction between policy makers and scientists. The literature has also highlighted the importance of such methods (Huberman; Walter, Davies and Nutley in Ginsburg et al., 2007). This study has found that evidence generating institutions do not generate and make use of systematic reviews on climate change while this push effort has been proved efficient in policymaking process, particularly in health policies and programs (Perrier et al., in Grimshaw et al., 2012). In fact, the main science policy research institution, which is the Science and Technology Policy Research Institute (STEPRI), has no department or specific program on

[3] http://www.endvawnow.org/en/articles/1258-print-materials-for-reading.html; 27/1/2016 at 03:30 pm

climate change. There is no scientific body in charge to compile findings of climate research in Ghana, what will be of great help to policy makers. It is the Environmental Protection Agency (EPA) through their national UNFCCC focal point which produces a review of the national situation on climate change. However, this review does not include policy recommendations for national policy makers.

This study has equally revealed that there was an important use of scientific evidence in the policies. According to Lavis and colleagues (2006), two key factors are important in the use of research evidence: interactions between researchers and policy makers in the context of policy networks such as formal advisory committees and in the context of informal relationships; and research that matched the beliefs, values, interests, or political goals and strategies of elected officials, social interest groups, and others. The study of the policy process has shown that the leading institution of the process, Institute for Environment and Sanitation Studies (IESS), was involved in the national climate change committee and collaborated with the policy makers in the policy formulation. There were also some consultations with research/academic institutions and experts in the field (Table 9 in 4.1.4). Moreover, the institutions interviewed during the field work have either formal or informal relationships with policy makers and most of them believe that their relationship is strong (figure 17 in 4.3.3). Concerning the second criterion of "research matching the interests of policy makers", this is not totally met because the agenda research is mostly framed by donors who give their own direction to studies. Nevertheless, most of research projects in the country are related to mitigation of climate change (65%) (EPA, 2015). This matches with the major interest, belief of government which is to look for strategies to reduce greenhouse gases emissions to ensure economic growth of the country.

Furthermore, the institutions have been classified according to their dissemination efforts. Research institutions use meetings as their main dissemination method while implementation institutions use printed materials, while academic institutions deploy a variety of methods including meetings, advice to policy makers and printed materials. The third communication of Ghana to UNFCCC locates universities as the major institution mandated of climate change research and they receive the largest percentage of funds (78%) to carry out research (EPA, 2015). This may explain the broad range of methods they use to reach out policy makers.

An analysis of the knowledge transfer process reveals some successes and weaknesses that need addressing to better the process. Some successes include:

- Existence of formal and informal interactions with policy makers;
- High interest of policy makers for science-based policies;
- External influence/pressure of donors who require public policies that are based on solid evidence and research projects that include policy makers;
- Existence of policy document for science and technology;
- Use of printed materials (executive summaries, research reports, publications, policy briefs, newsletters) and meetings (conferences, workshops);
- Pledge of the government to raise public investment in research projects; and
- Initiative put into place for the creation of a national research fund;

Some weaknesses are:

- Lack of channels or strategies to distribute printed materials such as policy briefs to policy makers;
- No generation of systematic reviews of research on climate change;
- Language too technical (lack of simplicity of the message delivered); and
- Low contribution of the government to the national research budget on climate change.

5.3 Uptake of Scientific Evidence in Policymaking Process

The study of the contribution of scientific outputs in the policy documents has shown that this contribution was high, compared to output from NGOs/CSO activities and from ministries and implementation agencies. In fact, the policy document draft was formulated by an academic institution (Institute for Environment and Sanitation Studies) in collaboration with other research institutions. This same fact has been reported in the case of Tanzania policy process (ESRF, 2011), where policies and strategies have been informed by research reports reviewed by research institutions mandated to work on the problem identified by Ministries.

However, many studies have revealed the low use of scientific knowledge in decision-making process. For example, Marfo and Nutakor (2009), in their study, revealed a low use of scientific evidence in forestry decision-making process in Ghana (1-10% of the scientific evidence is used by 44% of policy makers). This study could not deeply examine the use of climate change knowledge in decision-making by policy makers. Nevertheless, there is a high probability for the

same trend in climate change decision-making. Indeed, a quick review of the types of references included in the references section of the climate change policy document showed that no paper from research or academia appeared in the references section of the document (Table 12 in 4.2.3). This figure reveals that information from scientific/research institutions has not been used while interviews and content analysis of the policy documents reveal proofs of use of scientific evidence in the process. In fact, this can be explained by following assumptions:

- The references are not complete or are not well cited;
- The papers mentioned in the references are themselves based on scientific evidence;
- Scientists involved in the process do not reference their source of information, meanwhile they would have made use of evidence coming from their research activities; and
- The policy document is not a scientific paper where all consulted documents should be mentioned.

Beyond these attempts of explanation, this controversial fact helps us to presume that there is an indirect use of scientific evidence by policy makers in decision-making process. Articles or scientific papers may not be directly used by policy makers. They are maybe taken by their agencies to produce policy briefs that become the printed materials they use. Therefore, we can assume that printed materials from research and academia are indirectly used, while advice, expertise from research academia through direct contacts either from meetings or join projects are the most used.

5.4 Perceptions on Barriers to Knowledge Exchange Process

The identification of perceived barriers to knowledge transfer and use in policymaking process has revealed that scientists agreed that the major perceived barriers to knowledge exchange in Ghana is cultural differences between policy makers and scientists, institutional barriers and the perceptions of policy makers on scientists' work (tables 17-22 in 4.4.3). Differences between science and policy cultures are barriers that have been also found by Marfo and Nutakor (2009). Cultural differences are expressed in terms of type of knowledge produced (too advanced knowledge), research methods and approaches (too technical and scientific), medium priority given to scientific point view. Generation of evidence on climate and weather requires use of scenarios, models and other techniques that are not always easy to be understood by people who are not from the field. However, these methods and approaches of climate scientists are necessary

to understand climate change causes and impacts in the country. This requirement is clearly stated in the climate change policy document:

> *"Section 2.2.3 Another challenge is how best to establish meaningful dialogues between climate scientists and the users of knowledge and offer accessible and relevant resources to stakeholders concerned with sustainable development. This requires high-level and well- structured science to map the interactions and feedbacks between its complex climate systems in order to provide policymakers with the evidence they need to formulate valid policies and to guide implementation (MESTI, 2013, page 2-11)."*

Nevertheless, it is necessary for evidence generating institutions to use an easy and accessible language to translate their findings to policy makers. Furthermore, the research findings should be subject to policy analysis in order to show the successes and drawbacks when they will be implemented by policy makers. This further step could increase the uptake and use of research findings by policy makers.

Institutional factors such as the lack of funding for research and dissemination activities by government are some other barriers to climate change knowledge exchange. Though climate change is of high priority in the country, there is an inadequate financial allocation in national budget (EPA, 2015). From our interviews, this is due to the low interest given by the government to research findings. They know the importance of research but they rely on regional and international institutions to fund research in the country. More and more, research institutions are asked to sell their services and products to private institutions and industries to get funds. The Tanzanian Economic and Social Research Foundation has also reported a similar situation where research institutions try to rely on collaboration with private sectors/industries to get research funding (ESRF, 2011).

> *"Section 3.1.1 Current capacity for climate change research remains low, especially in universities and their research institutes. This could be attributed to limited incentives and resources available for climate change research. For example, many if not all, the universities lack adequate technologies and equipment necessary for research into climate change science. (MESTI, 2013, page 3-9)."*

Another barrier to knowledge exchange is related to the perceptions of policy makers on scientists' work (scientists are responsible for making research evidence to policy makers and more interested in publishing than translating evidence into policy actions). According to evidence generating institutions, policy makers perceive the knowledge exchange in one way, and this can really jeopardize their efforts to relate with them. From this study, the exchange is mainly around "getting funds" but there is also sharing of expertise and experiences. For example, there is an ongoing project in the Science and Technology Policy Research Institute (STEPRI) called DRUSSA (*Development Research Uptake in Sub-Saharan Africa*) where policy makers and scientists interact to be informed by one another. However, there is a need to improve the two-way exchange of information in climate change policy sector.

The accessibility of policy makers to scientific evidence, the characteristics of the research output and the communication of scientific evidence to policy makers do not constitute challenges to knowledge exchange in the country. This is different from the results found by Armstrong et al. (2011) who identified the absence of personal contact between researchers and policy makers and practitioners in health sector and Marfo and Nutakor (2009) who identified communication between scientists and policy-makers as a barrier to science policy interface in Ghanaian forestry sector. In fact, they showed that there is weak inter-sectoral coordination and lack of communication and exchange between relevant institutions (Marfo and Nutakor, 2009). For instance, the research institution, the FORIG (Forestry Research Institute of Ghana) under the Ministry of Environment, Science, Technology and Innovation (MESTI), is separated from Forestry Commission and Ministry of Lands and Natural Resources who are their major clients. This undermines the communication in this sector. For issues related to climate change, there is an administrative mechanism in place led by the Ministry of Environment, Science, Technology and Innovation (MESTI) and all the institutes under the Council of Science and Industrial Research are recognized to be the research arm of the MESTI.

Conclusion and Recommendations

Climate change is both a political and scientific issue. To address it efficiently, there is need for exchange of knowledge between evidence generating institutions and policy makers in order to formulate evidence-based policies, particularly science-based policies able to reduce vulnerability and impacts. This study entitled "Knowledge Exchange between Evidence Generating Institutions and Policy Makers in Policymaking Process to Address Climate Change in Ghana" is an attempt to analyse the transfer and use of science into climate change policies in Ghana. Specifically, it aims at describing the National Climate Change policy formulation process, the translation and use of scientific knowledge in policy making as well as perceptions on the barriers to knowledge exchange between the two communities. This study has revealed based on a content analysis of existing policy documents on climate change that among evidences from science, NGOS/CSO and ministries, the scientific input is the most important evidence. Generated by many research/academic institutions, implementation and observatory agencies, this input is transferred mainly to policy makers through printed materials and meetings. However, some challenges are identified. They include among others: lack of funding for research and dissemination activities, perception of policy makers on knowledge exchange process and scientists' work, cultural differences between policy makers and scientists expressed in terms of generation of too advanced knowledge not always easy to be understood have been pointed out. To overcome these barriers and strengthen existing relationship/partnership between policy makers and evidence generating institutions, the following recommendations are made (table 24).

Table 24: Recommendations to improve climate change knowledge exchange process

Axes of intervention	**Suggestions of actions**	**Institutions to involve**	**Resources**
To strengthen the exchange process from policy makers to evidence generating knowledge	To create common platforms for information sharing; To invite policy makers to seminars to engage them on regular basis; Increase the pulling and exchanging efforts (trainings, consulting services) in order to help policy makers to search and use scientific evidence.	Ministries, agencies, departments research/academia	Willingness Funding
To break down cultural differences	To appoint scientists to serve as knowledge brokers in ministries, agencies and departments and key people in the agencies	Ministries, agencies, departments	Willingness Commitment

Axes of intervention	Suggestions of actions	Institutions to involve	Resources
	who can sustain findings after projects end; To involve more scientists from national and regional/international research institutions in the bowels that take or make policies.	research/academia	
To increase the production and translation of relevant information for policy makers	To acquire skills for engaged and co-produced research, communication and policy-oriented research and analysis; Production of policy briefs in an accessible language to policy makers; Co-production and distribution of printed materials by both research/academia and agencies; To focus on the formulation and implementation of co-projects where policy makers will be deeply involved; To integrate social media into communication.	Research, academia, Agencies, EPA, STEPRI	Funding
To increase the access of policy makers to science	To strengthen capacities of RIPS, CSIR and EPA to act as incubation centers where policy makers consult researchers there; To create a department in the Ghanaian policy institution (STEPRI) where policy research on climate change issues will be undertaken.	Research, academia, agencies	Funding Infrastructures
Lack of funding	Political willingness and commitment To put into place a prayer committee in order to quicken the creation of Ghana research fund, good management and distribution; To have technical committees from ministries to support research institutions and academia; To look for donors (international, private) whose research agendas are common with national research needs.	Ministries, Research, academia	-

Source: Field work, 2015

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Annex1: List of stakeholders involved in the policy process

Public sector ministries

- Ministry of Environment, Science, Technology and Innovation
- Ministry of Finance and Economic Planning
- National Development Planning Commission
- Ministry of Communications
- Ministry of Foreign Affairs
- Ministry of Lands and Natural Resources
- Ministry of Local Government and Rural Development
- Ministry of Health
- Ministry of Water Resources, Works and Housing
- Ministry of Food and Agriculture
- Ministry of Energy
- Ministry of Educaton

Agencies

- Environmental Protection Agency
- Council for Scientific & Industrial Research
- Forestry Research Institute of Ghana
- National Disaster Management Organization
- Ghana Irrigation Development Authority
- Energy Commission
- Forestry Commission
- Ghana Statistics Services
- Ghana Health Services
- Ghana Meteorological Agency

Parliament of Ghana

- Parliamentary Select Committees on Environment, Science and Technology
- Parliamentary Select Committees on Lands and Forestry

National Houses of chiefs

Academic institutions

- University of Legon
- Kwame Nkrumah University of Science and Technology
- University of Cape Coast
- University of Development Studies
- Ashesi University

Civil society and non-governmental organizations

- Abantu for Development
- Abibiman Fundation
- Friends of the Earth- Ghana
- Rebonet
- Development Institute
- Ghana Climate Change Adaptation Network

International Organisations in Ghana

- UK Department for International Development
- Embassy of the Netherlands
- Conservation International

Private sector and industry

- Environmental Applications and Technology Centre

Source: Field work, 2015

Annex 2: Frequency of concepts used to determine the uptake of scientific evidence in policy documents

		Ghana's communications to UNFCC			Ghana's policies and strategies on climate change		Ghana's policies on areas related to climate change			Total
		Ghana's First Communication to the UNFCCC, 2000	Ghana's Second Communication to the UNFCCC, 2011	Ghana's Third Communication to the UNFCCC, 2015	National Climate Change Adaptation Strategy (NCAS), 2012	National Climate Change Policy (NCCP), 2013	Energy	Sanitation	Disaster risk reduction	
Academic/Research Evidence	Scenario	122	89	128	3	6	0	0	0	**348**
	Model	94	46	64	1	4	1	0	0	**210**
	Projection	23	10	35	2	4	1	0	0	75
	Uncertainty	10	12	29	0	2	2	0	0	55
	Extreme	4	9	7	5	10	0	2	7	44
	Disease	2	41	11	7	33	0	21	3	**118**
	Land use	56	51	54	4	11	0	5	7	**188**
	Vulnerability and impact assessment	16	8	15	0	0	0	6	1	46
	Adaptation strategy/options	30	23	8	24	9	0	0	5	**99**
	Resilience/indigenous knowledge/ traditional knowledge	0	10	16	20	29	0	0	11	**86**
Sub-total		357	299	367	66	108	4	34	34	1269

		Ghana's communications to UNFCC			Ghana's policies and strategies on climate change		Ghana's policies on areas related to climate change			Total
		Ghana's First Communication to the UNFCCC, 2000	Ghana's Second Communication to the UNFCCC, 2011	Ghana's Third Communication to the UNFCCC, 2015	National Climate Change Adaptation Strategy (NCAS), 2012	National Climate Change Policy (NCCP), 2013	Energy	Sanitation	Disaster risk reduction	
Evidence from ministries, departments and agencies	Forest management	5	6	17	0	1	0	0	0	29
	Insurance	1	13	13	1	11	0	1	3	43
	Agro-ecological	1	3	17	4	2	0	0	0	27
	Governance	0	12	9	2	13	0	7	2	45
	Water management	8	0	9	0	1	0	3	1	22
	Land management	1	6	6	1	2	0	0	2	18
	Economic impact	3	2	3	0	0	0	0	0	8
	Mitigation option/strategy/capacity	0	3	18	0	1	0	0	0	22
	Carbon	47	40	56	0	14	1	9	2	169
	Fund	10	51	128	2	33	3	86	6	319
Sub-total		76	136	276	10	78	4	106	16	702
Evidence from NGOs, CSO,	Awareness	21	40	33	9	14	5	22	12	156
	Communities	33	25	64	11	43	6	48	11	241
	Well-being	0	0	0	0	1	0	1	0	2

		Ghana's communications to UNFCC			Ghana's policies and strategies on climate change		Ghana's policies on areas related to climate change			Total
		Ghana's First Communication to the UNFCCC, 2000	Ghana's Second Communication to the UNFCCC, 2011	Ghana's Third Communication to the UNFCCC, 2015	National Climate Change Adaptation Strategy (NCAS), 2012	National Climate Change Policy (NCCP), 2013	Energy	Sanitation	Disaster risk reduction	
	Livelihoods	6	39	37	17	29	0	3	10	141
	Adaptive Capacity	7	3	1	5	0	0	0	7	23
	Security	6	10	23	1	28	4	1	4	77
	Social and financial support	1	6	8	1	3	0	0	4	23
Sub-total		74	123	166	44	118	15	75	48	663

ANNEX3: QUESTIONNAIRE

CLIMATE CHANGE KNOWLEDGE PRODUCTION AND TRANSLATION QUESTIONNAIRE (FOR SCIENTISTS)

INTERVIEWER INSTRUCTIONS: This questionnaire should be filled out for the selected respondent as directed. Follow all instructions as directed. Texts in bold and italicized print are instructions to the Surveyor and should not necessarily be read out.

1. INTERVIEWER INFORMATION

1.1	Interviewer Name	
1.2	Interviewer Code	_____
1.3	Survey ID	_____
1.4	Date	_____

I am…….....; a student working as surveyor in the field work of Miss Mahouli Goubalan. She is a Masters' student in the West African Science Service Center on Climate Change and Adapted Land Use (WASCAL) Program. WASCAL is a large-scale research-focused Climate Service Center mandated to help tackle the challenges of climate change in West Africa by strengthening human capacity through Masters' and Doctorate Programs. She is carrying out a study as part of WASCAL's program in Climate Change and Human Security located in Togo, Lomé aimed at looking at the translation into and the use of science policies to address climate change in Ghana.

The information obtained through this study is not meant for any political nor governmental purposes. We ask your consent in order to record this interview for research purposes only. You are assured of the confidential treatment of the valuable information you supply to me. Should you have any queries, please do not hesitate to contact any of the following persons:

1. Dr Grace Villamor (gracev@uni-bonn.de)

2. Mahouli Goubalan (Student) (+233549746854; s.goubalan@hotmail.fr)

2. IDENTIFICATION OF THE RESPONDENT

Name of the respondent: ……..……

Name of the institution: …….

Type of institution: Public ☐ Private ☐ Local NGO ☐ International NGO ☐ Other (specify)☐

Type of stakeholder: Lecturer ☐ Researcher ☐ Policy maker ☐ Administrator ☐ Other (specify)☐

Position in the institution: Full professor ☐ Associate professor ☐ Postdoc ☐ Director/Head/Coordinator☐ Other ☐ (specify)

Years spent in present unit/job: ☐☐

Level of education **(*Highest Degree obtained*):** Certificate ☐ BSc ☐ MSc☐ PhD☐ Other (specify)☐

Age: ☐☐☐ Sex: Male ☐ Female ☐

Tel: ☐☐☐☐☐☐☐☐☐☐ Email:

3. DESCRIPTION OF THE INSTITUTION

3.1	When was your institution established?	
3.2	What are the mandates/ mission/roles of your institution? ***Check all that apply***	1. ☐ Research only 2. ☐ Teaching, Learning and Research 3. ☐ Teaching, Learning and Policy Oriented Research 4. ☐ Policy oriented Research 5. ☐ Science Advisory 6. ☐ Coordination between stakeholders 7. ☐ Implementation 8. ☐ Other (specify)
3.3	Who are the main users of knowledge that is generated by your institution? ***Check all that apply***	1. ☐ Scientific community 2. ☐ Communities/ consumers 3. ☐ Professionals 4. ☐ Policy makers 5. ☐ Others (specify)
3.3a	Please, rate the importance of these users for your institution?	Of very little importance | Important | Very important | The most important ☐ | ☐ | ☐ | ☐
3.4	Who are the funders of your activities?	1. ☐ Income from your own activities 2. ☐ Government departments 3. ☐ Business 4. ☐ Regional and International Agencies 5 ☐ Others (specify)
3.5	Is climate change issue a priority for your institution?	1. ☐ Yes 2. ☐ No
3.5a	If yes, when have you started dealing with this issue?	
3.5b	If No, why?	

4. CONTEXT AND CLIMATE FOR KNOWLEDGE TRANSLATION

4.1	According to you, what is the role of scientific research in policy making process?	
4.2	Is research into use (RIU) a priority for your institution?	1. ☐ Yes 2. ☐ No
4.2 a	State and explain reasons	

4.2	Is there an appetite or an interest for the use of scientific evidence in policymaking in Ghana?	1. ☐ Yes 2. ☐ No
4.2a	If Yes, How? ***Check all that apply***	1. ☐ Policy makers always consult scientists for decision making 2. ☐ There are policy dialogues in which scientists are involved 3. ☐ Policy makers fund research to support their decision making 4. ☐ Policy makers establish institutions to support them in their decision making 5. ☐ Scientific findings are the base of policy documents 6. ☐ Scientists are the backbone in policy making process 7. ☐ There is a policy for the promotion of science/technology application in the society 8. ☐ Other (specify)
4.2b	If no, why?	
4.3	In Ghana, during these 10 last years, how was the evolution of the efforts of researchers in translating their scientific evidence to policy makers?	1 ☐ Increase 2 ☐ Decrease 3 ☐ Same 4 ☐ Up and Down 5 ☐ Other (specify)
4.4	Are there funds/systems in place to support these efforts? ***If No, skip 4.5a***	1. ☐ Yes 2. ☐ No
4.4a	If yes, how do they support these efforts?	1. ☐ Funding dissemination activities 2. ☐ Funding research into use programmes 3. ☐ Other
4.5	Which one of this type of structures do you have in your institution?	1 ☐ Unit or department in charge to transfer scientific evidence to policy makers 2 ☐ Library or a documentation center that provides access to research evidence 3 ☐ No formal unit but existence of people whose role is primarily to keep policy/decision makers informed about the latest research evidence that might be of strategic value 4 ☐ People attending political meetings and closely working with the politicians? (different from the previous category) 5 ☐ Other
4.5a	If options 3 and 4 chosen, ask the number of people?	
4.5b	What is their area of specialization (competences)?	

4.5c	Why was this profile chosen?	
4.6	Do you organize programs to enhance the capability of developing and executing research-dissemination efforts in your institution?	1. ☐ Yes 2. ☐ No
4.6 a	How often do you organize these programs in a year?	
4.6 b	If No, why?	

5. **KNOWLEDGE EVIDENCE AND PRODUCTION**

5.1	Which category of research do you carry out?	1☐ Basic research (research that is not motivated by an immediate application) 2☐ Applied research (research geared towards a specific application) 3☐ Experimental development (prototyping and other systematic work using practical experience)
5.1a	Which category is the most important in your institution?	
5.2	Do you carry out research related to climate change/ produce evidence/data on climate change?	1. ☐ Yes 2. ☐ No
5.2a	If yes, in which area are you operating? ***Check all that apply***	1. ☐ Agriculture and food systems 2. ☐ Water and Sanitation 3. ☐ Natural Resources Management 4. ☐ Human Health 5. ☐ Gender 6. ☐ Migration 7. ☐ Energy 8. ☐ Disasters 9. ☐ Atmosphere and Climate 10. ☐ Development 11. ☐ Others

5.3	Do you research on issues relevant to policy makers? (Do you take into account their needs in terms of information?)	1. ☐ Yes 2. ☐ No
5.3 a	If yes, which ones?	
5.3 b	If yes, how do you know that these issues are relevant to them?	1. ☐ We were informed by them 2. ☐ We found that it would have been of interest to them 3. ☐ We are following a policy document 4. ☐ We hold regular meetings for the exchange and identification of research priorities 5 ☐ Others (specify)

5.3 c	If no, why?	
5.4	At which stage do you mostly involve policy makers?	1. ☐ Framing of research proposal 2. ☐ Implementation of the research 3. ☐ At the end of the project 4. ☐ Other (specify)
5.5	During these 10 last years, how many projects/programs/activities related to climate change did you carry out?	☐☐☐
5.6	Do you think that the results of your researches are relevant for policy/decision makers in the field of climate change?	1. ☐ Yes 2. ☐ No
5.6 a	Please, state the reasons	
5.7	What is the percentage of current projects funded by policy makers?	
5.8	What is the percentage of current projects supported by policy makers?	
5.9	What is the percentage of current projects involving both scientists and policy makers?	
5.10	What is the percentage of current projects aiming at addressing issues raised by policy makers themselves?	

6. PUSH EFFORTS (Efforts to disseminate scientific evidence)

6.1	Do you always disseminate your scientific evidence to users (research findings, data, and experiential evidence)?	1. ☐ Yes 2. ☐ No
6.1 a	If no, why?	
6.2	What are the infrastructures used to disseminate this scientific evidence?	1. ☐ Printed Materials 2. ☐ Meetings 3. ☐ Outreach (trained personnel meeting with users to give them information) 4. ☐ Opinion Leaders (use of influential people in the institution to target knowledge, attitude of the audience) 5. ☐ Other (specify)

6.3	What are the printed materials you produce? What is the average number of these materials per year?	Materials Number 1. ☐ Reports 2. ☐ Actionable messages (Guidelines) 3. ☐ Policy briefs 4. ☐ Systematic reviews of research 5. ☐ Traditional literature review or rapid review 6. ☐ Summaries or abstracts of primary studies 7. ☐ Summaries or abstracts of systematic reviews 8. ☐ Published papers 9. ☐ Research briefs 10. ☐ Other (specify)
6.3 a	Which ones are the most spread or consulted by users?	
6.4	What are the meetings you organize? What is the average number of these meetings per year?	Meetings Number 1. ☐ Conferences 2. ☐ Seminars 3. ☐ Workshops 4. ☐ Exhibitions 5. ☐ Symposiums 6. ☐ Trainings 7. ☐ Other (specify)
6.5	Do you have a functional electronic databases or search engines to consult?	1. ☐ Yes 2. ☐ No
6.5a	Which ones?	
6.5b	How many do you have?	
6.5c	Which one is the most consulted?	
6.5d	Please, state the reasons	
6.6	What are the channels used to disseminate scientific evidence (communication channels)?	1. ☐ Sending via persons 2. ☐ Newspapers 3 ☐ TV 4. ☐ Radio 5. ☐ Websites 6. ☐ Social media (Facebook, Twitter….etc.) 7. ☐ Physical contact through workshops 8. ☐ Release and free access in libraries, institutions and house publications 9. ☐ Other (specify)

6.7	How much knowledge do you transfer to policy makers?	1 -- nothing 2 – little 3 – average 4 – enough 5 – A lot

6.8	What were your efforts towards policy makers during these five last years? How often in a year (for each type of effort)?	Efforts Frequency 1. ☐ Printed or Electronic Publications 2. ☐ Workshops/Conference 3. ☐ Trainings 4. ☐ Advices to policy makers 5. ☐ Consultancy 6. ☐ Others
6.9	Do you compile journals, letters, and bulletins on climate change and disseminate them to the policy makers?	1. ☐ Yes 2. ☐ No
6.10	Please, indicate how important you consider the following channels for policy makers in terms of knowledge transfer	

	Of very little importance	Important	Very important
Scientific publications in (refereed) journals or books			
Systematic reviews of scientific findings			
Other publications, including professional publications and reports			
Participation in conferences and workshops			
Personal contacts with policy makers			
Joint projects, contract research and consultancy			
Scientists working in Government Agencies			
Sharing facilities			
Others (specify)			

7. FACILITATING PULL EFFORTS (EFFORTS to support research use, to reach policy makers, to make sure that they get the information)

7.1	Do you dispose of a network of experts on climate change issue?	1. ☐ Yes 2. ☐ No
7.1a	If yes, what are the competences of these experts?	1. ☐ Policy analysts 2. ☐ Economists 3. ☐ Social expert 4. ☐ Governance Expert 5. ☐ Communication Expert 6. ☐ Expert in Climate Modelling

		7. ☐ Expert in Climate Change Impacts 8. ☐ Expert in climate change adaptation 9. ☐ Other (specify)
7.2	Do you limit restrictions to online resources and journals that may contain relevant research evidence on climate change?	1. ☐ Yes 2. ☐ No
7.3	Do you organize programs and training to enhance decision makers' capacity and skills to acquire and apply research into decision making process?	1. ☐ Yes 2. ☐ No
7.3a	If yes, which ones	1. ☐ Online discussion forums 2. ☐ Webinars 3. ☐ Workshops 4. ☐ Personalized briefings 5. ☐ Easy access to online resources 6. ☐ Documentation and reporting tools (Take-home messages, pages summary, reports) 7. ☐ Other
7.3b	What is their frequency in a year?	

8. EXCHANGE/LINKAGE ACTIVITIES (Efforts focused on building and maintaining relationships between researchers and policy makers)

8.1	How often do you organize deliberative dialogues or policy dialogues?	
8.2a	What is the contribution of policy makers in knowledge production and dissemination related to climate change issues?	1. ☐ Financial 2. ☐ Technical 3. ☐ Other
8.2b	If it is financial, how much in average of your budget for these studies is coming from policy makers?	1. ☐ Less than 25% 2. ☐ 25-50% 3 ☐ 51-75% 4. ☐ More than 75%
8.2c	If it is technical, explain further	
8.2d	If other contribution, explain	
8.3	Do you develop partnerships outside the context of co-production of research?	1. ☐ Yes 2. ☐ No
8.3a	If yes, explain the purpose of these partnerships?	
8.3b	If no, why?	
8.4	How do you appreciate your collaboration with policy makers?	1. ☐ Very Strong 2. ☐ Strong 3 ☐ weak 4 ☐ Very weak
8.4a	What are the factors that make your collaboration successful?	

8.5	Do you collaborate with other scientific/academic institutions for knowledge dissemination?	1. ☐ Yes 2. ☐ No
8.5 a	Which institutions:	
8.5b	Can you explain further this collaboration? (which activities do you undertake together?)	
8.5c	What is the effect of this collaboration on knowledge dissemination? Explain	1 ☐ More successful 2 ☐ Less successful 3 ☐ No added value 4 ☐ Other (Specify)

9. EVALUATION OF EFFORTS TO LINK RESEARCH TO ACTION

9.1	Do you evaluate your dissemination activities towards policy makers?	1. ☐ Yes 2. ☐ No
9.2	If yes, how do you evaluate your dissemination activities?	1 ☐ Quick Oral assessment (appreciation of participants) 2 ☐ Quick written assessment after workshops 3 ☐ Rigorous studies of assessment 4 ☐ Other (specify and explain)
9.2a	If no, why?	1 ☐ Think it is not important 2 ☐ Think it is important but don't include it in their programs/projects 3 ☐ Lack of financial resources 4 ☐ Lack of competences 5 ☐ Other (specify and explain)
9.3	Do Funders stretch on the need to evaluate dissemination activities?	1. ☐ Yes 2. ☐ No
9.3a	Is it a criterion to get funds from donors?	1. ☐ Yes 2. ☐ No
9.4	According to you, do policy makers make use of scientific evidence in their decision making process?	
9.4a	If yes, give some practical examples	
9.4b	If No, what are the challenges of using science in policy process? (explain further)	1 ☐ Lack of interest 2 ☐ Lack of Political will 3 ☐ Lack of resources 4 ☐ Other (specify)
9.5	For any project, how many months do you attribute to dissemination activities?	

9.6	What is the proportion of your annual budget allocated to dissemination activities?	1. ☐ Less than 25% 2. ☐ 25-50% 3. ☐ 51-75% 4. ☐ More than 75%
9.7	Do you always focus on the importance to integrate dissemination activities in your work?	1. ☐ Yes 2. ☐ No
9.8	If No, why?	
9.9	How does scientific evidence contribute to the improvement of policies on climate change in Ghana (give examples)?	

11. ROLE IN THE NATIONAL CLIMATE CHANGE POLICY PROCESS

10.1	Are you aware of the existence of a National Climate Change Policy document? If No, skip this section	1. ☐ Yes 2. ☐ No
10.1a	If yes, were you involved in this process If No, skip this section	1. ☐ Yes 2. ☐ No
10.1b	What is the process used to write this document?	1 ☐ Wide Stakeholders consultations for policy formulation 2 ☐ Stakeholders engagement for policy validation 3 ☐ Others (specify)
10.1c	If yes, at which stage were you involved?	1 ☐ Facilitation of the policy dialogue 2 ☐ Stakeholder engagement (academia workshops) 3 ☐ Policy drafting 4 ☐ Policy validation 5 ☐ Other (specify)
10.d	In which extend were you involved in the process?	1 ☐ At all the stages 2 ☐ Only stakeholder engagement 3 ☐ Stakeholder Engagement and
10.e	What were your theme of reference and tasks?	
10.2	Did you make use of scientific evidence to complete your task?	1. ☐ Yes 2. ☐ No
		Evidence Proportion (%)
10.3	Which type of evidence did you use? Can you estimate the percentage of each type of documents you (as an individual) consulted to fulfil your task during the process?	1. ☐ Data 2. ☐ Reports of National programs and projects and other existing policy or strategic documents 3. ☐ Articles from academia 4. ☐ Reports from research programs/projects 5. ☐ Systematic reviews of research 6. ☐ Others (specify)
10.4	Did you make available the findings of the institution or put any expertise to the use of policy facilitators during the process?	1. ☐ Yes 2. ☐ No

10.5	If you contributed in another way during the process, can you explain further?	
10.6	Is there any network or alliance/association of scientists represented during the process?	1. ☐ Yes 2. ☐ No
10.6a	Which ones?	
10.6b	What was the role of this association during the process?	
10.7	Did your input appear in the policy document?	1. ☐ Yes 2. ☐ No
10.7a	If No, what might be the reasons?	
10.8	Did scientists have a voice during the policy validation? Explain	
10.9	What should be the contribution of scientist during the Climate Change Policy document implementation?	
10.10	What were the opportunities in mobilizing and using scientific evidence during stakeholder consultations and drafting of the policy?	
10.11	What were the challenges?	

11. PERCEPTIONS ON THE POLICY DOCUMENT, POLICY PROCESS

11.1	Can you say that the policy document is scientific evidence based? If no idea, go to question 11.5	1. ☐ Yes 2. ☐ No
11.1a	Please, state the reasons	
11.2	Rank per importance the stakeholders which have mostly contributed in terms of knowledge to the policy document? (attribute figures)	Academia NGOs/CSO Funders Communities Others (specify)
11.3	Do you think that the policies and directions in the document are relevant and can lead to climate change adaptation and mitigation?	
11.4	Please, state the reasons	
11.5	Do you perceive science based policies as a solution to improve policy making and implementation?	
11.6	Do you think that dissemination efforts towards policy makers are sufficient	

	and can help to reduce climate change impacts in the country?	
11.7	According to you, what may be the challenges in implementing this policy?	
11.8	How can we address these challenges?	

12. CHALLENGES related to knowledge production and dissemination activities

		I strongly disagree	I disagree	Neutral	I agree	I strongly agree
	Cultural differences					
12.1	Scientists and decision makers are different in terms of objectives and methodologies					
12.2	Decision makers are driven by a range of political, economic and social drivers that reflect other societal issues and science is just one point of view, and frequently not the most influential					
12.3	Scientists generate data to advance knowledge					
	Decision-makers may mobilize specific information to support a particular agenda without always giving consideration to the full range of available evidence or detailed public debate					
	Institutional barriers	**I strongly disagree**	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
12.4	Government itself constitutes a barrier because they do not sufficiently fund research on climate change					
12.5	Government itself constitutes a barrier because they do not sufficiently fund research dissemination activities					
12.5	Scientists are not too engaged in outreach activities because they under-value such kind of activities					
12.6	Scientists are not too engaged in outreach activities because of lack of funding					
12.7	Scientists are not too engaged in outreach activities because of insufficient time,					
12.9	Scientists has limitations in dealing with policy makers needs					

12.10	Negotiation skills of scientists are unfit for knowledge dissemination activities					
12.11	Communication skills of scientists are unfit for knowledge dissemination activities					
12.12	Integrative research methods lack in scientific/academic institutions					
	Science in-accessibility	**I strongly disagree**	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
12.13	Policy makers do not have access to science because it takes more than three years for scientific articles to be published following data collection					
12.14	Policy makers do not use evidence because they have short time to show results					
12.15	Decision makers do not use evidence in the policy process because it is a long process					
12.16	Decision makers do not use evidence in the policy process because it requires a lot of funds					
12.17	Policy makers do not use evidence because it is useless by the time it is made available					
	Conventional approaches to knowledge exchange	**I strongly disagree**	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
12.1	Scientists are seen as the producers of knowledge and are responsible of making this knowledge available to policy makers					
	Personal perceptions and worldviews					
12.19	Scientists frequently have superficial understanding of politics					
12.20	Information being presented by scientists to decision makers is interpreted based on their own personal knowledge and past experiences					
12.21	Work of scientists is perceived to end with the publication of their results, and does not extend to the potential consequences of the applications of their research in policy process					
12.22	Lack of enthusiasm to share knowledge					
12.23	Lack of support in terms of research findings					
	Characteristics of the research output	**I strongly disagree**	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
12.24	The sheer volume of research evidence currently produced on climate change is low					
12.25	Policy makers lack skills and knowledge appraise and understand the scientific evidence					

12.26	Outcomes of scientific research are not relevant to policy makers because they do not take into account the specific contexts in which they operate and information needs that they require					
12.27	Outcomes of scientific research are not accurate, valid and of high quality					
12.28	Policy makers do not trust outcomes of scientific research because they may contain biases					
12.29	Policy makers need time to read evidence sources					
	Communication to policy makers	**I strongly disagree**	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
12.30	The way the messages included in the reports are framed is too technical to be understood by policy makers					
12.31	Policy makers are too busy hence lack time to fully attend dissemination activities					
12.32	Policy makers lack personal contact with researchers					
12.33	There are few knowledge brokers or agents					
12.34	There are few opportunities to transfer or inform policy makers on climate change issue					

Comments on constraints you face in translating scientific evidence into policy making

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13. SOLUTIONS

13.1	According to you, what are the strategies to put into place to improve the integration of policy makers in science?	1 ☐ Public communication for wider support 2 ☐ Collective problem framing 3 ☐ Participatory funding decisions 4 ☐ New research evaluation criteria 5 ☐ Long-term funding for sustainability science 6 ☐ Other (specify)

13.2	What are the strategies to encourage scientific institutions which transfer their evidence?	1 ☐ Reward of academic faculty and corporate researchers for engaging substantively well with policy-makers 2 ☐ Other (specify)
13.3	What are the strategies to help scientists produce and translate relevant information for policy makers?	1 ☐ Acquiring skills for engaged and co-produced research 2 ☐ Acquiring skills for communication 3 ☐ Focusing on knowledge integration and synthesis 4 ☐ Exchange of experience and expertise between scientists to learn more from others 5 ☐ Other (specify)
13.4	What are the solutions to improve the access of policy makers to science?	1 ☐ Establishment of literature databases which will provide access to up-to-date research and 2 ☐ Information that will be centrally managed and include only reliable, high quality scientific research 3 ☐ Establishment of a center which will collect and translate scientific findings into language accessible to policy makers 4 ☐ Other
13.5	How can we establish such centre (strategies)?	
13.6	How can scientists be more actively integrated into the decision making process?	
13.7	What are the solutions to enhance partnerships between policy makers and scientists?	
13.8	How do social media, websites and other media contribute to knowledge exchange?	
13.9	what are the strategies to strengthen the influence of scientists in the policy making	
13.10	What can we do to increase the number of projects on research into use?	

CONCLUDING COMMENTS

We are about to conclude the interview, are there any comments or contributions that you may want me to know about?	1. ☐ Yes 2. ☐ No
Comments: **Thank you for your time**	