Empowering Community Resilience to climate Change in Cameroon using Technology-enhanced Learning

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By

Sandrine MEGUIENG SIDZE

M. A.

Main supervisor: Prof. Dr. Thomas Koehler – TU Dresden
Second supervisors: Prof. Dr. Ulf-Daniel Ehlers – DHBW
Dr. Joerg Szarzynski – UNU-EHS

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Abstract

Located in Central Africa, Cameroon is considered the driving force of the sub-region due to its strategic location in the center of the African continent. During the last five years, the country has been under the constant threat of a large range of disasters like floods, droughts, landslides, epidemics, etc. In such a context, the government is implementing several strategies for Disaster Risk Reduction in the country. Under the lead of the Ministry of Territorial Administration and Decentralization, the Directorate of Civil Protection, coordinates Disaster Risk Reduction activities through a network of over 379 decentralized institutions and international partners (Ayanji, 2004). Despite a high level of deployment, these activities still prove to have a low level of efficiency on the field. Results from the literature review suggest that this may be due to strategies for public education and public awareness that do not mirror stakeholders' needs, capacities, and background. There is a need to: (1) identify the failures of the pre-existing public education and public awareness strategy, (2) assess the educational needs and capacities of each category of actors, (3) select adequate instructional methods and tools and (4) ensure the effectiveness and sustainability of the newly proposed strategy.

The aim of this work, which is a three-year PhD project funded by the AXA Research Fund, is therefore to propose a public education and public awareness model adapted to the Cameroonian context, using Technology Enhanced Learning to strengthen capacities and competencies of stakeholders involved in the problem of climate change.

The study makes use of a mixed method approach. From the literature review, four categories of actors involved into the climate change education process in the country have first been identified namely (1) government, (2) educational institutions, (3) Non-Governmental Organizations and (4) communities. A sample population has been driven from each category using the Respondent Driven Sampling method. Then data were collected during a six-month field trip in Cameroon, using semi-structured interviews (McNamara, 1999), qualitative survey (Fowler, 2009), direct observation (Bernard, 2006) and focus group discussion (Krueger & Casey, 2009).

Findings from data analyses, performed using Epi info software for quantitative data and MAXQDA software for qualitative data show that: the educational strategy is not clearly defined; there is a lack of adequate infrastructures; technologies available are not properly

used: either they are not evenly accessible, or when accessible they do not match learners' capacities and competencies. Finally, quality criteria for the evaluation of the existing educational strategy are not met, thus failing to ensure it sustainability.

The conceptual solution proposed in this work makes use of the concept of learning communities, especially Community of Practice as proposed by Lave and Wenger (1991) to develop an information and knowledge sharing community system to establish best practices for improving community resilience to climate change impact. This Community of Practice will operate essentially offline with a selected domain, a well-defined and structured community, and a practice that makes use of identified technologies already available among communities and, most importantly, that mirrors the Cameroonian socio-cultural context.

One unexpected factor that had to be taken into consideration while determining adequate technology tools, is the actors' perception, or rather say actors' (un)acceptance of "new technologies", which render the design of the instructional model quite challenging.

Keywords: Learning community, Community of Practice, public education, education technologies, climate change, capacity development, sustainability.

Zusammenfassung

Kamerun ist ein Land in Zentralafrika. Aufgrund seiner strategischen Lage in der Mitte des afrikanischen Kontinents, gilt das Land als die treibende Kraft der Sub-Region. Während der letzten fünf Jahre wurde Kamerun Opfer von ständigen Bedrohungen einer Vielzahl von Katastrophen wie Überschwemmungen, Dürren, Erdrutsche, Epidemien, usw. In diesem Kontext hat die Regierung eine Reihe von Strategien zur Verringerung der Katastrophenrisiken imstande gebracht. Dies wurde unter der Leitung vom Ministerium der territorialen Verwaltung und Dezentralisierung und vom Amt für Katastrophenschutz durchgeführt. Weiterhin nahmen mehr als 379 dezentrale Institutionen und internationale Partner an diese bedeutende Aktion teil (Ayanji, 2004). Die bei diesem Großeinsatz getroffenen Maßnahmen haben aber bisher eine sehr geringe Effizienz auf dem Feld gebracht.

Eine nähere Betrachtung im Zusammenspiel mit entsprechender Literatur lassen folgendes vermuten: die Strategien zur Sensibilisierung sind auf die Bedürfnisse, Kapazitäten und Hintergründe der Akteure nicht angepasst. Demnach sind folgende Tatsachen in Betracht zu ziehen: (1) Identifikation der Ausfälle der bevorstehenden Awareness-Strategie; (2) Bewertung den pädagogischen Bedürfnissen und Kapazitäten der einzelnen Kategorien von Akteuren; (3) Auswahl geeigneter Unterrichtsmethoden und Tools; (4) Gewährleisten der Wirksamkeit und Nachhaltigkeit der neu vorgeschlagenen Strategie.

Diese Arbeit stammt aus einem dreijährigen Promotionsprojekt finanziert von der AXA Research Fund. Das Ziel der Arbeit ist der Vorschlag eines Awareness-Modells, das an dem kamerunischen Kontext angepasst ist, und das die Bildungstechnologie zur Stärkung der Kapazitäten und Kompetenzen der beteiligten Akteure des Klimawandels nutzt. Aus der Literatur sind vier Kategorien von Akteuren identifiziert worden: Die Regierung, Bildungseinrichtungen, nationale und internationale Organisationen, Gemeinschaften.

Die Studie folgt einer Mixed-Method Forschung. Eine Stichprobe wurde aus jeder Kategorie von Akteuren mit Schneeballauswahl-Methode gezogen. Dann wurden Daten während einer 6-monatigen Studienreise in Kamerun gesammelt. Diese wurde in Begleitung mit semi-strukturierten Interview (McNamara, 1999), qualitativen Erhebung (Fowler, 2009), direkter Beobachtung (Bernard, 2006) und Gruppendiskussion (Krueger

& Casey, 2009). Die Daten wurden analysiert mit Epi-info Software für quantitative Daten und MAXQDA Software für qualitative Daten. Die Ergebnisse zeigen Folgendes:

- Die pädagogische Strategie ist nicht klar definiert
- Mangel an angemessenen Infrastrukturen
- Die verfügbaren Technologien sind nicht vorhanden und teilweisefalsch eingesetzt. Sie sind entweder nicht gleichmäßig verwendet oder sie stimmen mit den Fähigkeiten der Lernenden nicht überein.
- Qualitätskriterien für die Bewertung der bestehenden Ausbildungsstrategie sind nicht erfüllt

Die vorgeschlagene konzeptionelle Lösung, die in dieser Arbeit verwendet wird, benutzt das Konzept der Learning Communities, insbesondere "Community of Practice" wie von Lave und Wenger (1991) beschrieben. Ziel ist es, ein Informations- und Wissensaustausch Community-System zur Förderung bewährter Verfahren im Sinne der Verbesserung der Gemeinschaft gegenüber Auswirkungen des Klimawandels zu schaffen. Diese Community of Practice wird offline mit einer ausgewählten Domäne, eine gut definierte und strukturierte Gemeinschaft, und eine gut gestaltete Praxis funktionieren.

Ein unerwarteter Faktor, der bei der Bestimmung der angemessenen Technologie-Tools berücksichtigt werden müsste, ist die Wahrnehmung der Akteure oder besser gesagt die (Un-)Akzeptanz der "Neuen Technologien" durch die Akteure. Dies macht das Design des Instruktionsmodells zu einer richtigen Herausforderung.

Stichwörter: Lernen Gemeinschaft, Community of Practice, Awareness, Bildungstechnologie, Klimawandel, Kapazitätsentwicklung, Nachhaltigkeit.

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List of Abbreviations

AFPAT	:	Association des Femmes Peules Autochtones du Tchad
APF	:	African Partnership Forum
ARF	:	AXA Research Fund
BMBF	:	Bundesministeriums für Bildung und Forschung (German Federal Ministry of Education and Research)
BUCREP	:	Bureau Central des Recensements et des Études de Population (Central Bureau of the Census and Population Studies)
CCEE	:	Climate Change and Environmental Education
CIFOR	:	Center for International Forestry Research
COBAM	:	Climate Change and Forests in the Congo Basin
COP	:	Conference Of Parties
CoP	:	Community of Practice
CORDIS	:	Community Research and Development Information Service
CRTV		Cameroon Radio Tele Vision
CSO	:	Civil Society Organization
DHBW	:	Duale Hochschule Baden Wurttemberg
DHS	:	Demographic Health Survey
DPC	:	Direction de la Protection Civile (Cameroon Civil Protection)
DRM	:	Disaster Risk Management
DRR	:	Disaster Risk Reduction
EDS-MICS	:	Enquête Démographique et de Santé - Enquête à Indicateurs Multiples (MICS)
EI	:	Educational Institution
EPSON	:	European Spatial Planning Observer Network
ESD	:	Education for Sustainable Development
Est.		Estimates
ETIns	:	Educational Technology Insight
FAO	:	Food and Agriculture Organization
FGD	:	Focus Group Discussion
GFRAS	:	Global Forum for Rural Advisory Services
GIZ	:	Deutsche Gesellschaft für Internationale Zusammenarbeit
GPDRR	:	Global Platform for Disaster Risk Reduction
HH	:	Household Survey
ICDO	:	International Civil Defense Organization

ICT	:	Information and Communication Technology
IFRC	:	International Federation of Red Cross and Red Crescent Society
IICBA	:	International Institute for Capacity Building in Africa
INT	:	Interview
IO	:	International Organization
IPCC	:	Intergovernmental Panel on Climate Change
JICA	:	Japan International Cooperation Agency
Km	:	Kilometer
MINEDUB	:	Ministère de l'Education de Base
MINESEC	:	Ministère de l'Enseignement Secondaire
MINESUP	:	Ministère de l'Enseignement Supérieur
MINPOSTEL	:	Ministère des Postes et Télécommunications
MINTAD	:	Ministry of Territorial Administration and Decentralization
Mt	:	Mount
NGO	:	Non-Governmental Organization
NIS	:	National Institute of Statistics (Cameroon)
NRO	:	National Risk Observatory
NYP	:	Not yet published
ORSEC	:	ORganisation des SECours Plan
RDS	:	Respondent Driven Sample
RQ	:	Research Question
SAI	:	Sustainable Agriculture Initiative
SDC	:	Swiss Agency for Development and Cooperation
Sq.	:	Square meters
SRQ	:	Solution to Research Question
TEL	:	Technology-Enhanced Learning
TUD	:	Technische Universität Dresden (Dresden University of Technology)
UCAC	:	Université Catholique d'Afrique Centrale (the Catholic University of Central Africa)
UN	:	United Nations
UN SG CCST	:	United Nations Secretary General Climate Change Support Team
UNDP	:	United Nations Development Programme
UNEP	:	United Nations Environment Programme
UNESCO	:	United Nations Educational, Scientific and Cultural Organization
UNFCCC	:	United Nations Framework Convention on Climate Change
UNICEF	:	United Nations Children Fund

UNISDR	:	United Nations Office for Disaster Risk Reduction
UNITAR	:	United Nations Institute for Training And Research
UNSTATS	:	United Nations Statistics Division
UNU	:	United Nations University
UNU-EHS	:	United Nations University - Institute of Environment and Hunan Security
UNU-IAS	:	United Nations University – Institute for Advanced Studies
WASCAL	:	West African Science Service Center on Climate Change and Adapted Land Use
WCED	:	World Commission on Environment and Development
WHO	:	World Health Organization
WMO	:	World Meteorological Organization
ZEF	:	Zentrum für EntwicklungsForschung (Center for Development Research)

1   Introduction

The present work is entitled *Empowering Community Resilience to Climate Change Impact in Cameroon using Technology Enhanced Learning*. It consists in the design, implementation, and evaluation of an innovative strategy for public education and public awareness that aims to develop capacities of various stakeholders involved in the fight against climate change impacts in Cameroon.

The work stems from the evaluation of the failures of previous strategies for public education and public awareness implemented by the Cameroonian government, with the aim to help communities fight against impacts of climate change and environmental related problems. It explores various aspects to be taken into consideration in the design of a strategy for public awareness on climate change that aims to encourage population to be proactive in ensuring their own safety, especially, when the said strategy relies on the use of new technologies in a developing country with an environment as multicultural as it is in Cameroon.

Seven chapters wrap up the core points of this study. This first chapter is a general introduction that provides ground setting information necessary to the understanding of the research work as a whole. The chapter is divided into four sections. The first section (1.1.) is a description of the context that gave root to the study. The second section (1.2.) presents the overall goal the study aims to achieve, as well as specific objectives that will be guiding the research process. The third section (1.3.) explains the importance of the research for the topic of capacity building for climate change resilience in Cameroon. The fourth and last section (1.4.) provides definition for each of the key concepts developed in the work, to ensure a common understanding of the meaning they take within the scope of this study.

1.1   Background and Problem Statement

Climate change poses a major threat to the growth and sustainable development in Africa and hampers the ability to achieve the Millennium Development Goals (MDGs). Africa is particularly vulnerable to the effects of climate change, because of its dependence on yield of rain fed agriculture and poverty, but mostly because of a lack of capacity. Evidences and case studies from the literature (APF, 2007) raise the attention on the fact that some of the most adverse effects of climate change will be in developing

countries. The argument is that populations in developing countries are most vulnerable and least likely to easily adapt to climate change. Located in the heart of the African continent, and often regarded as the driving force of the Central Africa sub-region, Cameroon has not escape this situation.

During the past five years, the country has been under the constant threat of a large range of hazards resulting from natural and anthropogenic causes. These last three years these catastrophes became more and more frequent, and the country fails to easily overcome the situation. According to their common report on vulnerability analysis of the Far-North region in Cameroon, Eco consult and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) raise the fact that Cameron has low adaptive capacity, which is further constrained by weak linkages among government institutions nationally and between different levels of government and with communities (Berger, 2013). In such a context, the government is implementing a number of strategies for Disaster Risk Reduction that focus on education for capacity development. But still, results from the literature review suggest that these activities undertaken with the aim to achieve public awareness and public education have proved to be inefficient.

Assuming that the solution to overcome climate change impacts in Cameroon is to promote climate change education for capacity development, and regarding the fact that the government in Cameroon has implemented such a strategy without much success, this research hypothesis the following: indeed, education could be the key to enhance community resilience to climate change impacts in Cameroon, but this has to be done in a carefully systematic way. In other words, for climate change education to be effective and efficient in improving capacities of stakeholders involved in the fight against climate change in Cameroon, it should take into consideration the following aspects: stakeholders' category, needs, experience and background; appropriate methods and tools; and last but not the least, and the climate change education strategy should promote collaboration between actors in other to create a proactive community.

1.2   Aim of the study

This research work aims at proposing an innovative strategy for capacity development based on Technology Enhanced Learning to support Disaster Risk Reduction (DRR) activities in Cameroon. More specifically, the work focuses on the

design, implementation and evaluation of a knowledge sharing system supported by technology, that will initiate and facilitate collaboration between stakeholders involved in climate change and environmental related risks in Cameroon. The strategy is intended to help strengthening capacities and competences of the said stakeholders through information sharing and knowledge exchange. To reach this goal, five specific objectives have been set up:

- Evaluate pre-existing strategies for climate change education implemented by the government in Cameroon in order to understand reasons behind their failure;
- Identify the various actors involved in the Disasters Risk Reduction in Cameroon and assess their roles, their experience, their capacities and their needs;
- State objectives to be achieved by the newly proposed strategy;
- Determine appropriate instructional method, appropriate delivery technology tools and investigate on the availability and accessibility of the tools for the stakeholders;
- Determine quality criteria that will form the canvas for evaluation to the new strategy, in order to ensure its sustainability.

1.3   Significance of the study

The solution developed in this work addresses the current issue of the role of education in the fight against climate change impacts. Furthermore, it uses the potential of Information and Communication Technologies as a tool for capacity development. Considering that the strategy for information sharing and knowledge exchange proposed in this work takes into account the specificities of teach category of actors involved in disaster risk reduction in Cameroon, the expected impact is to:

- Promote a well informed and more proactive community in the fight against climate change impacts;
- Lead to informed decision-making process that results in more adapted policies;
- Affect the work of experts from Non-Governmental Organizations (NGOs), and increase involvement of experts from educational institutions;

- Help build up a best practices scheme that will lead to changing habits and forge new sustainable patterns.

1.4 Definition of key concepts

The following is a definition of key terms used throughout the work. It is essential to clearly define key concepts as they are understood in this work, in order to avoid misunderstanding or misinterpretations. As the research work is a multidisciplinary approach, definition of key concepts referring to climate change related terminology, and education related concepts including Technology Enhanced Learning and capacity development, have been provided.

1.4.1 Climate change related terminology

Definitions provided in this subsection relates to the concept of climate change and associated terms that help to better capture its meaning namely: hazard, vulnerability, disaster and risk, disaster risk management, disaster risk reduction and resilience.

Climate change

According to the Intergovernmental Panel on Climate Change (IPCC),

> Climate change […] refers to a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity. (IPCC, 2007)

This definition is supported by facts presented in a report of Working Group I of the IPCC.

Hazard

The United Nations Office for Disaster Risk Reduction (UNSIDR) defines hazard as: "a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation." It also characterized hazard as:

"latent conditions that may represent future threats and can have different origins: natural (geological, hydro meteorological and biological) or induced by human processes (environmental degradation and technological hazards). Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterized by its location, intensity, frequency and probability". (UNISDR, Living with Risk: A global review of disaster reduction initiatives, 2004)

Close to the notion of hazard comes the notion of vulnerability.

Vulnerability

United Nations Development Programme defines vulnerability as: "A human condition or process resulting from physical, social, economic and environmental factors, which determine the likelihood and scale of damage from the impact of a given hazard". (UNDP, 2004:11 cited by (Birkmann, 2006))

This definition of vulnerability clearly describes factors that permit to build indicators to evaluate vulnerability, but it is still unclear about the level of vulnerability in terms of geographical scope. In other words, could vulnerability be defined at the individual level and still have the same impact on the understanding of disaster/risk?

A more complete definition that could therefore be adopted in this study is the definition from United Nations University – Institute for Environment and Human Security (UNU-EHS), which defines vulnerability as:

> the intrinsic and dynamic feature of an element at risk (community, region, state, infrastructure, environment etc.) that determines the expected damage/harm resulting from a given hazardous event and is often even affected by the harmful event itself. V. changes continuously over time and is driven by physical, social, economic and environmental factors. (Birkmann, 2006)

This later definition of vulnerability gives an idea on criteria considered in the analysis of stakeholders' needs carried out for our research work.

Disaster / Risk

Going through the literature, there were about eight definitions of the word *disaster.* Two definitions – from the European Spatial Planning Observer Network (ESPON) and the International Federation of Red Cross and Red Crescent Societies (IFRC) – have been retained for this work.

The European Spatial Planning Observer Network defines a disaster as follow: "A disaster by itself is an impact of a hazard on a community or area –usually defined as an event that overwhelms the capacity to cope with it". (ESPON, 2003 cited by (Birkmann, 2006)).

According to the International Federation of Red Cross and Red Crescent Societies,

> Disasters combine two elements: events and vulnerable people. A disaster occurs when a disaster agent (the event) exposes the vulnerability of individuals and communities in such a way that their lives are directly threatened or sufficient harm has been done to their community's economic and social structures to undermine their ability to survive. […]. (IFRC, 1993)

The term disaster is often associated to the concept of risk, which has been defined by the United Nations Development Programme as:

> The probability of harmful consequences, or expected loss of lives, people injured, property, livelihoods, economic activity disrupted (or environment damaged) resulting from interactions between natural or human induced hazards and vulnerable conditions. Risk is conventionally expressed by the equation: Risk = Hazard x Vulnerability. (UNDP, 2004 cited by (Birkmann, 2006))

Disaster Risk Management and Disaster Risk Reduction

UNISDR defines Disaster Risk Management as "The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster". (UNISDR, 2009)

Even if they seem similar, Disaster Risk Reduction and Disaster Risk Management (DRM) are somehow slightly different but complementary.

Disaster Risk Reduction on its part is a systematic approach to identifying, assessing and reducing the risks of disaster. UNISDR defines DRR in terms of choices, and actions. It states that:

> Disaster Risk Reduction is the concept and practice of reducing disaster risks through systematic efforts to analyze and reduce the causal factors of disasters. Reducing exposure to hazards, lessening vulnerability of people and property, wise management of land and the environment, and improving preparedness for adverse events are all examples of Disaster Risk Reduction.

In other words, DRM focus on strategies, measures and planning whereas DRR focus on effective actions. To better understand DRR and DRM, there is a need to understand concepts like disaster/risk, vulnerability, and resilience.

Resilience

There is no clear and easy definition of the term *resilience*. Most of the given definitions rather explain how resilience can be - or not - assimilates to coping. UNISDR defines resilience as:

> The capacity of a system, community or society potentially exposed to hazards to adapt by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures. (UNISDR, 2004 cited by (Birkmann, 2006))

In other words, resilience refers to the capacity to anticipate response and survive or continuing functioning after a disaster.

1.4.2 Education related terminology

As one of the central concepts in this work is Technology Enhanced Learning, it seems logical to start with a definition of learning.

Learning

Learning could be defined as the act of acquiring skills by instruction or study, or the modification of a behavioral tendency by experience.

The concept of learning is discussed in this work (2.1.) as a collective construction of knowledge within social interactions (Gasper, 1999). Considering that learners discussed in this work range from young to adult learners, that they belong to diversified social-economic class, and that they present various level of education, we deemed it important to combine formal learning and an informal learning in the solution proposed in this work.

Formal / Informal learning

Formal learning is learning that takes place within a teacher-student relationship, such as in a school system. The term formal learning has nothing to do with the formality of the learning, but rather the way it is directed and organized. In formal learning, the learning or training departments set out the goals and objectives of the learning. In a nutshell, formal learning relates to the academic milieu with well-structured institutions. It takes place in education and training institutions, leading to recognized diplomas and qualifications. (Merriam & Caffarella, 1999)

Whereas, informal learning, as Livingstone (1999, p. 51) points out, can be defined as "any activity involving the pursuit of understanding, knowledge or skill which occurs outside the curricula of educational institutions, or the courses or workshops offered by educational or social agencies." In other words, informal learning occurs through the experience of day-to-day situations. It occurs in communities through observation and participation to social activities (Paradise & Rogoff, 2009). It is learning from life, during a meal at table with parents, play, exploring, etc. unlike formal and non-formal learning, the way it is directed and organized is different.

Community

A community can be described as a group of people who share the same values and identify themselves as members of a larger entity, based on their interactions with other members of the group and participation to activities of the group. Unlike society which is a group of people sharing the same geographical or social territory, typically subject to

the same political authority and dominant cultural expectations, a community calls upon a certain cohesion between members that is reinforced by a sense of community. The sense of community here refers to "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together." (McMillan & Chavis, 1986). According to Gusfield (1975), there are two main dimensions necessary to the definition of a community: the territorial dimension and the relational dimension. The territorial dimension refers to the fact that community's members share the same geographic location, whereas the relational dimension refers to interpersonal relationship between members.

Learning communities

The concept refers to a community whose purpose is to engage and promote activities and interactions that allow for individual socially-constructed learning. There are various types of learning communities including Communities of Practice.

Community of Practice

The term *Community of Practice* has been first proposed by Etienne Wenger and Jean Lave in their book *Situated Learning: Legitimate Peripheral Participation* (Lave & Wenger, 1991).

Community of Practice is defined as follow:

> Communities of practice are formed by people who engage in a process of collective learning in a shared domain of human endeavor: a tribe learning to survive, a band of artists seeking new forms of expression, a group of engineers working on similar problems, a clique of pupils defining their identity in the school, a network of surgeons exploring novel techniques, a gathering of first-time managers helping each other cope.

In a nutshell, Communities of Practice refers to It refers to a group of people that share information about a common concern and define themselves in relation to it.

Technology Enhanced Learning (TEL)

There is no commonly accepted and precise definition of the term *Technology Enhanced Learning*. The term is generally used to describe the application of information and communication technologies to teaching and learning. The definition used in this work to encapsulate the word is from the European Commission – Community Research and Development Information Service (CORDIS)[1]. They define *Technology Enhanced Learning* as "the use of information and communication technologies can be used to support learning and teaching, and competence development throughout life".

1.5   Structure of the thesis

The present work is divided into six chapters. The first chapter presents reasons behind the choice of the research topic are explained. It also gives a description of the aim of the study and questions and objectives to be achieved, as well as the significance of the study and the definition of key terms. Chapter two presents the theoretical frameworks that underline the whole research analysis and shape the conceptual solution proposed to the research problem. The analysis of the state of the art with regards to Disaster Risk Management in Cameroon follows in chapter three, together with some insight on the place of education in the climate change debate. The chapter closes with an appraisal of the use of Information and Communication Technologies in education in general, and in developing countries like Cameroon in particular. Chapter four is about the research question and research methodology. It gives a detailed account for the research questions that guide the whole research process. Here are explained, the procedure used to select the sample population, data collection methods and tools, data management and data analysis procedures used to extract results, as well as some ethical issues raised by the data collection phase. Chapter five is about the presentation of results and discussion. The chapter is divided into three main parts: the first part gives a description of primary data used for this research; the second part is an attempt to answer the four research sub-questions developed in the previous chapter, and the third part briefly synthesizes these findings through the design of the Community of Practice that represents the solution to the research question posed in the work. The last chapter, (chapter six), highlights key findings of this work. It also critically reflects on the use of

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[1]CORDIS is the European Commission's primary public repository and portal to disseminate information on all EU-funded research projects and their results in the broadest sense.

learning communities as a multi-stakeholder' approach to solving climate change and environmental related issues. Finally, it describes the limitations of the study as well as some opportunities for further research.

2　Theoretical assumptions

This chapter describes theoretical frameworks that underline the design of a solution to the research question. The study is interdisciplinary and combines theoretical concepts from various topics including climate change, capacity building, education technologies and learning. It seeks to analyze how the four above mention concepts combines to influence Disaster Risk Management in Cameroon. The chapter therefore develops the concept of Community of Practice (2.1.), the ASSURE model for instructional design (2.2.), the MOVE framework for vulnerability assessment, and the UNESCO-IICBA framework for capacity development.

2.1　Community of Practice (CoP)

The social learning paradigm developed by Albert Bandura defines learning as an interaction between an individual and its environment. Learning in this sense is perceived as a cognitive process that takes place in a social context and that can be achieved by observing a behavior and its consequences. The learner here is not a passive recipient of information. He rather makes new knowledge out of the information collected from his environment (Bandura & Walters, 1963; Bandura, 1977). This thinking about learning and its social dimensions was later on expanded into the concept of Communities of Practice. The concept of Community of Practice was first proposed by Jean Lave and Etienne Wenger (Lave & Wenger, 1991). It stems from ideas and theories developed to account for the social component of human learning (Bourdieu, 1977; Vygotsky, 1978; Foucault, 1980; Giddens, 1984; Lave, 1988). It referred to a situation where an individual who is a "new comer" within an established community inserts himself inside the community by observing other members and performing basic tasks, before taking commitments. This is what Lave and Wenger called legitimate peripheral participation. The concept has since evolved.

Communities of practice is defined as "groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (Wenger, McDermott, & Snyder, 2002).It is used in this research to shape the process of acquiring, integrating, transforming and constructing new knowledge and best practices on the fight against climate change impacts among various stakeholders involed in Disaster Risk Reduction in Cameroun.

As such, CoP can be applied in various domains, ranging from organizations, governments, associations, to education, etc. In fact, the Community of Practice developed in this research work covers all of these domains, due to the variety of actors involved.

2.1.1 Key components of a Community of Practice

Three elements are crucial to the identification of a community as a Community of Practice namely: the domain, the community and the practice (Wenger, 1998).

The domain is "whatever creates the common ground. It defines the identity of the community, its place in the world and the value of its achievements" (Wenger, McDermott, & Snyder, 2002, p. 31). The domain refers to the purpose of the existence of the Community of Practice. It is the platform that provides the framework to exchange ideas, share information, experience, and expertise. This requires a mutual commitment from all members of the community. The domain should be designed in such a way that every member of the community feels confident enough to trust other members and be willing to get and/or share knowledge from them. Moreover, in situations where the Community involves various categories of people with different background and experience, like it is the case with the subjects under study here, the domain has to be tailored in such a way that each category of actor feels concerned, like a group on *Climate Change Awareness in Cameroon.*

The community refers to the people that actually constitute the Community of Practice. It is regarded in terms of individuals as well as groups of people as they build inter-relationship among each other. The community is successful when members engage into shared activities, and when interactions are frequent enough so as to sustain the link between them and favor knowledge construction. A community can vary in size. It could be made up of a small group of people having similar backgrounds and interested in sharing about the same concern. But it could also consist of a network of small groups of people with different backgrounds but same concern, who congregate in order to find solutions to their concern, building on different perspectives. As true as it is that the size of a community has an impact on its functioning or even its efficiency, it still holds that whether of small-size or broader, a community is constituted with the aim to solve problems through knowledge sharing. The Community of Practice developed in this work

is based on a multi stakeholders' environment. It aims to bridge an exchange environment between four different groups of stakeholders already organized into communities.

The Practice is "a sort of mini-culture that binds the community together" (Wenger, McDermott, & Snyder, 2002, p. 39). It is about developing methods, repertoire of stories, resources, selecting adequate tools, which facilitate learning among members of the community. Learning in a social and cultural context results from the existence of socially shared concerns. It becomes a social practice, a collaborative way for seeking solution to a specific problem within a community. In this kind of collaborative learning, people rely on one another's resources and skills (Chiu, 2000). They interact and engage in a common task, whether face-to-face, online or through other means of communication to share experience, skills, knowledge, etc. thus, developing an identity as a member of a Community of Practice. In a CoP, these interactions between members can be performed in a physical setting like during face to face meetings or members can also communication in a virtual environment by building Virtual Communities of Practice (VCoPs) (Dubé, Bourhis, & Jacob, 2005; Murillo, 2006; Zarb, 2006; Hara & Hew, 2007; Murillo, 2008)

In the current context of globalization, the concept of Community of Practice seems to be mostly analyzed in terms of Online Communities of Practice (OCoP) or Virtual Communities of Practice (VCoP). This is made easier by the growth of the internet, mostly in industrialized countries, which facilitated the development of Virtual CoPs, to the detriment of CoPs that develops "offline". In fact, one key tool that fosters knowledge sharing in CoP is internet. However, considering that in most developing countries, especially in rural areas, access to internet is still an issue, implementing a CoP in the context of this study implies to take into consideration possible "Offline CoPs" and the socio-cultural context they evolved in.

Finally, depending on the size of the community, activities and tools used to support information and knowledge sharing may vary (Brault, 2010). Selection of adequate tools or technology depends also on how far from or how close members of the community are to each other. It is also about how capable they are to use these tools. Various authors in the literature investigated the use of technology in learning communities. These tools may range from face to face meetings, internet technologies, radio broadcasting, mobile phones, etc. (Barab, Kling, & Gray, 2004; Kietzmann, et al., 2013).

2.1.2 Design, evaluation and sustainability of a CoP

The literature makes a distinction between naturally evolved Communities of Practice and Communities intentionally created with a specific goal (Dixon, Allen, Burgess, Kilner, & Schweitzer, 2005; Kimble, Hildreth, & Bourdon, 2008; Olson, Zimmerman, & Bos, 2008; Saint-Onge & Wallace, 2003; Wenger, 1998; Wenger, McDermott, & Snyder, 2002). But, whether naturally evolved and spontaneously organized (Orr, 1990; Brown & Duguid, 1991; Lave & Wenger, 1991)or intentionally created and carefully managed (Lesser & Everest, 2001; Wenger, 2000; Wenger & Snyder, 2000), the success of a Community of Practice is not always guaranteed. Reasons why some efforts succeed while others fail may vary (Schlager, Fusco, & Schank, 2002).

The success of a CoP depends on how adequately designed the model is. Wenger (1998) proposes the CoP model to be constructed around the domain, the community and the practice. An adequate design for a Community of Practice will therefore investigate these three elements.

The table below summarizes guidelines for the design of the CoP discussed in this research work. The guidelines have been adapted from (Brault, 2010) and guidelines proposed by the Education Learning Initiative.

Table 1: Guidelines for the design of a CoP (adapted from Brault **(2010)** and EDUCAUSE[2])

Areas to be developed	Guiding Questions	Supporting activities
DOMAIN	- What is this community's primary purpose? - What are the benefits to the stakeholders? - Given the intended audience, what are the key issues and the nature of the learning, knowledge, and tasks that the community will steward? - What sphere of influence do we want to develop? - Who is this community for?	- Create a mission and vision statement for the community - Conduct a needs assessment through informal discussions, formal interviews, surveys, and/or focus groups - Define the benefits of the community for all stakeholders - Identify the major topic areas for community content and exploration.
COMMUNITY	- Who are the community's important stakeholders? - What specific needs will the community be organized to meet? - What could be their roles? - How often do the members meet? - How to deal with possible conflicts? - How to look for new members? - How to make the community visible?	- Identify the major stakeholders by interviewing experts, reading literature, etc. - Conduct a needs assessment through informal discussions, formal interviews, surveys, and/or focus groups

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[2] Education Learning Initiative (ELI) website: http://www.educause.edu/eli

PRACTICE	- What type of participation members are willing to propose? - What knowledge should be shared, developed and documented? - How to organize resources? - What learning activities can be prepared in such a way to include learners' background? - How to organize activities? - How to compare with practiced outside? - How to communicate within subgroups of the community - How to communicate with the outside?	- Identify those involved in developing a field they like, those for whom the community is a good opportunity to interact with peers, those who want to produce something for the general interest, etc. - Identify tasks that community members are likely to want to carry out in the community. - Develop a series of scenarios that describe various synchronous and asynchronous experiences of the different personas - Create a directory or folder structure for organizing discussions, documents, and resources - Identify any face-to-face meeting opportunities for community members - Determine facilitators' roles and recruit the first community facilitator(s).

To maintain the CoP and foster its evolution, one may refer to the seven principles proposed by Wenger, McDermott and Snyder (2002) for cultivating a Community of Practice. These principles are described as follow:

- **Design for evolution**

"Evolution is common to all communities, and the primary role of design is to catalyze that evolution" (Wenger, McDermott, & Snyder, 2002). Some communities build around already existing networks or groups and as new members join in, the focus of interest may be shifted moderately or drastically. For this reason, the community needs a core group of leaders who will play like goal keepers. However, just as important as it is to keep the vision of the community, it is as well important to design methods and activities that will trigger members' regular participation and attract new members so as to maintain a certain dynamic inside the community in order to keep it alive.

- **Open a dialogue between Inside and outside perspectives**

The development of the community relies on the acknowledgement of its member's potential and their capacity to share and/or create knowledge. When designing the structure of the community and determining the role of members, the core team needs to gather an external point of view on the structure of the community. This can be achieved by inviting peers from other learning communities or simply observing how other communities structure their development. "As a result of this dialogue, the people who understand the issues inside the community and have legitimacy within it are also able to see new possibilities and can effectively act as agents of change" (Wenger, McDermott, & Snyder, 2002).

- **Invite different levels of participation**

The background, experience, and expertise of members inside a community vary from one another. Even if the community is supposed to meet regularly, not all members participate at the same pace. There will be members who like to take the lead, those who will increase their level of participation depending on how interesting they find the topic under discussion for example; others will simply keep a peripheral role and attend a

meeting just to gather information, etc. Whatever the reasons behind members' motivation, involvement or participation to activities of the community (whether online of offline), all levels of participation must be encouraged (Bates, 2004).

-   Develop both public and private community spaces

Participation to the life of the community is based on free will. Members can join or leave the community as they wish. To foster their motivation, they should feel free to regroup in smaller units inside the community, with more specific agendas. For example: within a community involving four different types of actors (A, B, C and D) gathered around a common goal and who decide to meet online, one could identify four small groups constituted with members who belong to each category (group A, group B, group C and group D). In turn, within those small groups, some members could form even smaller units to share a concern specific to their geographic area and even decide to meet face-2-face on a regular base. A successful community design offers opportunities for public and private spaces, and builds around the contribution of these two components.

-   Focus on Value

Determine the value of a community right from its start is not an easy task. Sometimes this value develops with time, through discussions between individual members, feedbacks, group meetings, etc. the value of the community in this sense will reside in the fact that it provided a platform for knowledge sharing, and possibilities for members to build new networks.

-   Combine Familiarity and Excitement

"Successful communities offer the familiar comforts of a hometown, but they also have enough interesting and varied events to keep new ideas and new people cycling into the community" (Wenger, McDermott, & Snyder, 2002). During these activities, members feel free to propose ideas or give their opinions without being afraid of judgmental reactions. The community in this sense represents certain stability in the life of its members, and provides a place where one can engage into discussion with other members on a daily base without getting uncomfortably tangled in one another's lives (Oldenburg,

2001). Brault (2010) proposes for example to create some events, like sporting events, but adapted to the field, so as to challenger members of the community, but in a neutral universe, where the outcome is not really important, except for one's ego. "Routine activities provide the stability for relationship-building connections, whereas exciting events provide a sense of common adventure" (Wenger, McDermott, & Snyder, 2002).

-   Create a rhythm for the community

It is crucial for a community to operate following a rhythm, just like routine activities in individuals' lives. Activities should be planed and take place on carefully distributed manner. For instance, there should be a right number of face-2-face meetings, online meetings, private interactions, public interactions: discussion forums, training sessions, sporting events, gather together for drinks, etc. This is not an easy task especially in large communities, also considering the fact that every "active" member would like to propose his/her "beat", "but finding the right rhythm at each stage is key to a community's development" (Wenger, McDermott, & Snyder, 2002).

2.2   ASSURE model for instructional design

An instructional design model helps to propose a teaching and learning model that is developed depending on the characteristics of the learner. Among the existing instructional design models that where developed (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956; Branson, et al., 1975; Kemp, 1977; Dick & Carey, 1978; Gagné, Briggs, & Wager, 1992; Merrill, 1994; Kirkpatrick & Kirkpatrick, 1994), the one selected to serve as a base to this work is the ASSURE model for instructional design.

The ASSURE model is an instructional design model developed by Heinich, Molenda, Russell & Smaldino (1989). The acronym describes the six fundamental principles necessary to develop an effective approach to teaching: **A**nalyze learners, **S**tate objectives, **S**elect media and materials, **U**tilize technology, media & materials, **R**equire learner participation and **E**valuate & revise (Heinrich, Molenda, & Russell, 1989).

Figure 1: ASSURE model for instructional design

Some instructional designers consider the ASSURE model as an improved and more detailed version of the ADDIE model (Molenda, 2003). It emphasizes on the learning styles of learners as one of the key elements to be considered while designing the most effective learning environment adapted to the learners.

Despite the fact that it is the model par excellence of educators to implement the use of technologies in teaching in school environment, the ASSURE model is relevant in this work as it helps consider key factors that have to be developed in design of a public education and public awareness model for capacity development in the context of climate change education. These factors result from the following guiding questions:

- Who are the learners (e.g.: what are their characteristics, background, experience, etc.)?
- What is the learning context (e.g.: environmental education policies, educational system, etc.)?
- What are the learning constraints (e.g.: infrastructure, curriculum, staff, etc.)?
- What is the desired new behavior (e.g.: knowledge effectively acquired)?
- What are the delivery options (e.g.: technology tools, media, etc.)?

As explained by Sharon Smaldino, one of the authors of the theory, to ASSURE good learning, the designer does not consider only one single thing but rather areas of emphasis. Each of the areas corresponding to the six steps of the interactive process covers specific activities.

A: Analyze Learners

The first element to consider in the design of a learning context is to understand who the learner is. It is important as it influences the statement of objectives, the type of tools and strategies useful to support and facilitate the learning. This knowledge includes age, gender, level of education, interest, academic background, learning styles, and when applicable ethnic group, religion, etc.

S – State Objectives

At this level the teacher states objectives for each learning module. This consists in a specification on the type of competence learners should have acquired by the end of the learning process. To be effective, these objectives have to be SMART: Specific, Measurable, Attainable, Realistic, and Timely. Stating clear and effective objectives is necessary for teachers to assess students' progress, but also to students themselves for self-evaluation.

S – Select methods, media, and materials

At this stage, instructional strategies are selected based on the learning objectives but also depending on the learners. Best practices tend to account for learner-centered instructional methods, as they trigger learners' active participation. In this kind of scenario, the teacher plays the role of a facilitator. Materials are also selected according to the instructional strategy selected as well as the content to be delivered. As for the choice of media, they represent the best and effective support when they are adapted both to the learners and the learning environment (e.g.: when the adequate infrastructure is available). It is worth mentioning here that the instructor also plays an essential role, considering that he should have a mastery of the media he plans to use.

U – Utilize media and materials

One of the strength of the ASSURE model for instructional design resides in the fact that it is not concerned only in selecting the appropriate methods and materials, but it is also concerned about how to utilize the media, materials and methods selected. The ultimate goal here is to make sure they effectively support the achievement of objectives stated for the learning process. This support is effective once one follow the "5 P's" process (Smaldino, Lowther, & Russell, 2008).

- *Preview technology, media and materials*: plan a thorough review of all technology, media and materials that are going to be used. This includes for instance to perform a reading of a support materials to be rendered available to student during the teaching/learning process, to avoid inappropriate content;

- *Prepare technology, media and materials*: gather together all materials, check they work properly, and organize them into sequences. For instance, determine what activity come first and select specific tools to support each activity in a systematic way.

- *Prepare the Environment*: prepare the learning environment. In case of a lecture for instance, this refers to preparing infrastructures (room, table rows, computers availability, light, sockets, etc.);

- *Prepare the Learners*: as stated in Smaldino et al. (2008, p. 102), "research on learning tells us very clearly that what is learned from an activity depends highly on how learners are prepared for the lesson". In this case, preparing the learners includes informing learners about learning requirements, learning objectives, assessment procedures if applicable, various tasks to be completed, etc.;

- *Provide the Learning Experience*: this step refers to effectively implementing the lesson.

R – Require Learner Participation

The fifth stage of the ASSURE model is about selecting various ways in which learners' participation to the learning process can be stimulated. Learners' here are considered both as a group and as individuals. Therefore, activities planned to require participation include team work, group presentation, individual reports, individual web searches, question/answer sessions, etc.

E – Evaluate and Revise

The final step in the ASSURE model process is about evaluation and improvements. In this step, selected teaching strategies, media, and materials are evaluated, as well as learners' achievements. The evaluation could be carried out by the teacher himself, with the help of indicators derived from questions like: did the lesson meet the learning objectives planned? Was the choice of media and materials appropriate? Did the delivery process go smoothly? Etc. The last step in evaluation is receiving learner's feedback. Is it positive or negative? Are the learners satisfied by the lesson? Did they feel like they actually acquire what they were supposed to, as stated in the objectives, etc.?

A summary of activities implemented at every stage of the model are presented in the figure below:

A	• Analyze learners	Age, gender, level of education, interest, academic background, learning styles, ethnic group, religion?
S	• State standards and objectives	State SMART objectives to be achieved by the learning process
S	• Select strategies, technologies, media and materials	Learners-centered strategies, teacher as facilitator, media selected according to learners, etc.
U	• Utilize technologies, media and materials	Preview materials, prepare materials, learners, environment, provide learning experience.
R	• Require learners' participation	Learners as a group: team work, group reports, etc. Learners as individuals: individual assignments, etc.
E	• Evaluate and revise	Summative evaluation and/or formative evaluation: Students' feedback, teacher's self-evaluation

Figure 2: Detailed description of the six stages of the ASSURE instructional model

Far from being a linear process, the ASSURE instructional design model, is a set of areas to be considered while designing a learning process and stages are interdependent from one another. This specific instructional design model has been selected in the present work to serve as a canvas to develop and operationalized the dynamic of knowledge building and knowledge exchange between members of the research population. Step 1 of the model provides criteria to analyze the population under study, thus helping to categorize them into groups that will be used to build up the learning community; step 2 helps stating SMART objectives that will be useful to scope areas of interest for the community's common concern, whereas steps 3, 4 and 5 provides elements necessary to understand, shape and monitor interactions between members of the groups among themselves and with the rest of the community.

2.3   MOVE framework for vulnerability assessment

Methods for the improvement of Vulnerability Assessment in Europe (MOVE), is a project created by the European Commission with the aim to create knowledge, frameworks and methods for the assessment of vulnerability to natural hazards and climate change in Europe. Its aim is to improve resilience at international, national, sub-national and local scales by developing indicators to identify, interpret and explain

vulnerability to natural hazards. This framework has proved to be useful in the current research as it gives a deep insight into the various levels of vulnerability and adaptation.

As explained in chapter 1, understanding vulnerability is necessary to identify criteria to be taken into consideration in the analysis of stakeholders' needs. In fact, to inform and train stakeholders so as to empower their resilience to the effects of climate change, it makes sense to understand how their vulnerability is expressed first. The vulnerability component of the MOVE framework for vulnerability assessment describes vulnerability as a multi-faceted concept, accounting for key causal factors such as exposure, susceptibility, lack of resilience, each of which could be described as follow (Birkmann, et al., 2013):

Exposure is qualified in terms of spatial and temporal patterns. Its describes the extent to which a unit of assessment falls within the geographical range of a hazard event, and covers attributes like infrastructures, livelihoods, economies, cultures, etc.

Susceptibility (or fragility) describes the predisposition of elements at risk to suffer harm. The focus in the current work has been put on this particular component of vulnerability. As much as all other components of vulnerability are important as a whole, the focus on ecological, physical, social, economic, cultural as well as institutional aspects of susceptibility are the main elements used to build up thematic questionnaire used in interviews and surveys to evaluate respondents' perception of risks and needs' assessment.

 Lack of resilience or societal response capacity is described in terms of capacity to anticipate, capacity to cope and capacity to recover. These three elements: anticipate, cope and recover represents the areas in which capacity needs to be developed in the model proposed for public awareness in this work. In other words, this shows that various actors involved into climate change and environmental related issues need to be well informed and properly trained on how to prevent, react to, and recover from disasters.

The *adaptation* component describes actions to be taken in relation to the management of risks and specific activities undertaken for disasters risks reduction. It encompasses all activities aiming at reducing exposure, reducing susceptibility and improving resilience.

The figure below represents the vulnerability component, as extracted from the MOVE framework for vulnerability assessment.
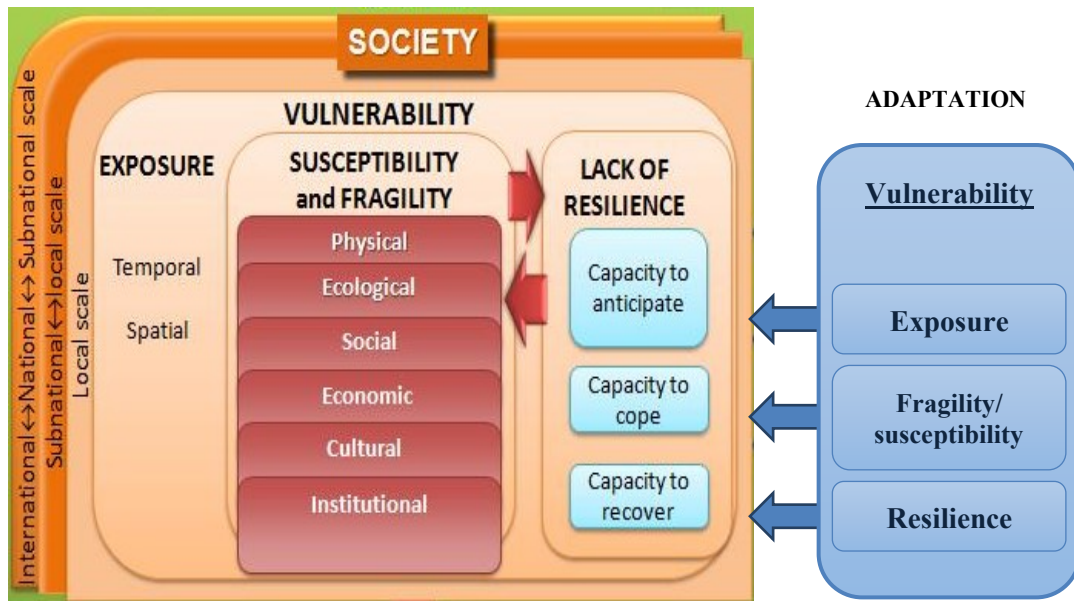
Figure 3: Vulnerability and adaptation components of the MOVE framework for vulnerability assessment (adapted from Birkmann et al. 2013)

It is worth mentioning here that a standard vulnerability assessment in Cameroon has not been performed in this work. Members that are referred to in this research are from various backgrounds, but they share a common interest, which is to look for strategies to empower the community's resilience to climate change impact. A deep understanding of: who they are, what their experiences are, what they need in terms of knowledge or resources, in order to design an effective learning community, also relies on a good assessment of their vulnerabilities and their capacities. The MOVE framework for vulnerability assessment has been chosen here to provide a clear description of vulnerable areas to be dealt with.

2.4 UNESCO-IIACB Capacity Building framework

"Capacity development is a central strategy for reducing disaster risk" (UNISDR, 2007). As such, numbers of UN agencies, and Non-Governmental Organizations proposed frameworks to assess, develop, implement and evaluate strengths, attributes and resources available within community, society or organization that can be used to achieve agreed goals (cf. UNISDR's definition of capacity). In the context of this research, capacity to be developed targets resilience to disasters and risks. And as the research focuses on educational capacities, the framework selected for capacity development is the IICBA framework for capacity building.

The UNESCO International Institute for Capacity Building in Africa (UNESCO-IICBA) established in 1999, is mandated to strengthen the capacities of teacher education institutions of its 53 member States. This is carried out through a range of initiatives, including introducing Information and Communication Technology for education. They came out with a capacity building framework that takes into consideration various levels of capacity development (2.4.1.) including environmental, institutional and individual capacity (UNESCO-IICBA, 2006). Indicators developed to implement, measure, and evaluate capacity development activities in the current work derived from the capacity building matrix (2.4.2.) proposed in the IICBA[3] framework.

2.4.1 Levels of capacity

There is a common consensus on levels to be covered by capacity development. As described by UNDP, there are three different levels of capacity: individual, institutional and inter/national (UNDP, 2008, pp. 5-6).

Capacity at the individual level

This includes individuals, communities, groups, or teams. It refers to knowledge, skills, experience, value, attitude, awareness, etc. Capacity at the individual level is the most fundamental element of capacity. It refers to the ability of individuals to set objectives and use one's own knowledge, experience and abilities to reach these goals. Individual

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[3] UNESCO-IICBA

capacities can be achieved by the means of informal, non-formal, as well as formal education, including training.

Capacity at the organization level

This includes human, physical and intellectual resources, as well as inter-institutional linkage (network, partnership, etc.). It refers to the way individual capacities are utilized, combined and strengthened to help achieve the organization's goals. It encompasses internal policies, management systems and strategies that will influence the organization's performance (JICA, 2004) and allow the organization to operate and deliver on its mandate.

Capacity at the environment level

Environment here refers to the context in which individual and organizational capacities are expressed. The environment level here covers various dimensions: formal institutions like policies, informal institutions like traditional as well as cultural norms, etc. that have an impact on the way individual and organizational capacities interact in an effective and sustainable manner. Simply put, capacity at the environment level refers to the environment and conditions necessary for demonstrating capacity at the individual and organizational levels (JICA, 2004).

2.4.2 The capacity building matrix

The starting point of capacity development activities or analysis is the assessment of already existing capacities and identification of needs. In that regard, the UNESCO-IICBA proposes a capacity building matrix that could be used as a template to identify who needs capacity enforcement, the object of capacity to be developed, the implementation of a strategy for capacity building, the manner the strategy will be developed and criteria to ensure its sustainability. The table below represents a summary of the capacity building matrix as proposed by UNESCO-IICBA.

Table 2: IICBA Capacity building matrix

Overall Goal						
Project Goal						
Areas		Whose capacity?	Capacity to do what?	Breakdown (elements) of the capacity	How to develop the capacity?	How to sustain the capacity?
	Environment (Policy framework, legal system, etc.)					
Target Organization	**Organization** (Infrastructure, budget, decision-making process, leadership, administrative structure, organization culture, etc.)					
	Individual (Skill, knowledge, attitude, value, experience, etc. of staff)					

The UNESCO-IIACB framework for capacity building presented above serves as a base to develop the components of capacities of DRM actors to be developed. A combination of these two frameworks (MOVE framework and IICBA framework) leads to settle the research context and validate the research problem.

Identification and analysis of level of capacities and types of capacities of stakeholders under discussion in this research work will be presented alongside with results of the analysis in chapter five.

3   State of the art

A review of the state of the art in this research consists in discussing previous research works, reports, policies, as well as best practices that explore the use of education and awareness as a weapon to fight against dramatic impacts of climate change and environmental related issues in general, and in Africa in particular. Here is provided some insights on the role of education in fighting climate change impacts and its importance for capacity development.

In this chapter, a description of strategies implemented by the government and Non-Governmental Organizations, among others, for the management of climate-related disasters and risks in the targeted country (Cameroon) is provided as well as an internal and an external evaluation of the said strategies (3.1.). This chapter also explains the role of education and awareness in fostering communities' adaptive strategies and communities' resilience to climate change impacts, especially in most at risk areas (3.2.).

In the nowadays context, where everything is computerized, digitalized, education is no longer an exception. Education implies knowledge exchange: between people in the same area as well as across the globe. Knowledge sharing, in the aim to solve issues of global concern like climate change requires to bring together wider groups of people, and communities to exchange ideas, evidence, expertise, and best practices. This requests the use of a means for wider communication like internet or broadcasting, as well as adequate media and tools (technologies), even to simply gain access to information. In this regard, new development in Information and Communication Technologies made it possible to shift from "traditional" education to technology enhanced education. Part (3.3.) which closes this chapter, gives an insight on the role of technology enhanced learning in the fight against climate change impacts in general and its implementation in the specific context of a developing country.

3.1 Disaster Risk Management in Cameroon

Responsibilities for the management of disasters and risks in Cameroon is shared in between various actors from the governments (ministries, decentralized organs) under the lead of the Directorate of Civil Protection (DCP) which ensures the implementation of general organization of civil protection for the whole country (Bang, 2013). Activities undertaken by DCP range from disaster preparedness, vulnerability assessment, coordination of rescue operations, to capacity development of all personnel involved in civil protection, and information publication through the release of annual reports (DPC, 2003; 2004; 2005; 2006) (2008; 2009; 2010) (2012). These activities prove to be of outmost importance in a country prone to natural hazards, where a combination of socio-economic and environmental factors makes the population highly vulnerable to disaster risks (Bang, 2013).

3.1.1 Some facts on the country

Located in the heart of Central Africa, with a surface area of 475 442 sq km (land: 472,710 sq km and water: 2,730 sq km)[4]. Cameroon share boundaries to the North with Chad, to the North-West with Nigeria, to the East with Central African Republic and to the South with Congo, Gabon and Equatorial Guinea. The country experiences three types of climate: equatorial climate in the South, tropical climate in the Centre and Sahelian climate in the North, with extremely diverse ecosystems (African Development Bank, 2010). The vegetation is made up of steppes, mountain forests and prairies in the North, dense rain forests in the South, and savannah in the Centre. The country experiences environment - current issues like water borne diseases (highly prevalent), deforestation, overgrazing, desertification, poaching, overfishing.

The country is divided into 10 regions: eight French-speaking regions and two English-speaking regions. Official languages are English and French, and in addition to these languages, the country hosts about 279 national languages from various ethnic groups (SIL, 2015). Practicing religion is part of the habits of the population. The constitution of

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[4] Information from the World Fact Book. https://www.cia.gov/library/publications/the-world-factbook/geos/cm.html

the country allows free practice of religion, but main religious groups are Christian 40%, and Muslim 20%. The remaining 40% of the population practice indigenous beliefs.

Cameroon's population is estimated to 23,739,218 inhabitants (2015 est.) with 54.4% of total population living in urban areas. The age structure is distributed as follow:

- 0-14 years: 42.78% (male 5,115,958/female 5,039,122)
- 15-24 years: 19.58% (male 2,337,061/female 2,310,178)
- 25-54 years: 30.53% (male 3,644,779/female 3,603,610)
- 55-64 years: 3.96% (male 458,001/female 481,717)
- 65 years and over: 3.15% (male 348,754/female 400,038)

With regards to the literacy rate, the population aged from 15 years old and over, that can read and write represents 75% of the total population, with literacy rate distributed between male and female respectively as 81.2% and 68.9% (2015 est.).

As concerned the country profile on Information and Communication Technologies, the number of fixed lines subscriptions is of 1.05 million with a rate of 5 subscribers per 100 inhabitants (2014 est.). About 17.3 million of the country population possesses a subscription to mobile lines with a rate of 75 subscribers per 100 inhabitants. As for access to internet, only 11% of the total population is internet users (2014 est.).

With regards to the climate change situation, Cameroon is prone to natural disasters as well as epidemics: according to UNICEF Cameroon situation report from November 2012, "with the arrival of the rainy season there have been significant floods and population displacements in localized areas, an increased risk of a cholera epidemic". For instance, between 2004 and 2013, 46.172 cases were reported, with 1.817 fatalities (UNICEF, 2013).

Flooding is also an issue in the country. In fact, emergency situation was declared in the North and Far North regions in 2012 and 2014 (UNICEF, 2012; IFRC, 2013). The estimated number of flood displaced persons as per recent updates have reached 88,640 people, hence the need to act.

3.1.2 Disaster Risks Reduction in Cameroon

There is a legal basis underlying the management of disasters in Cameroon. The disaster risk management system in Cameroon is governed by a number of laws and decrees among which, the most important is Law No. 86/016 of 06 December 1986 organizing civil protection department. Under the lead of the Ministry of Territorial Administration and Decentralization, the Department of Civil Protection, coordinates Disaster Risk Reduction actions through a network of over 379 decentralized institutions (Ayanji, 2004). The government exhibited a strategy for Disaster Risk Reduction organized around 3 main phases: the period before the disaster, the period during the disaster and the period after the disaster. These activities follow the *Disaster Management Cycle* framework (fig. 4) which is divided into 4 specific phases namely mitigation, preparation, response and recovery. This framework was designed to illustrate the process government, civil society and other partners should follow to prevent and reduce the impact of disasters, react in emergencies situations and plan for further steps to recover after the disaster (Coetzee, 2009).

Figure 4: ADMIRE[5] Disaster Management cycle

According to Cameroon statement at the Global Platform for Disaster Risk Reduction in Geneva in Switzerland in 2009, the country decided for a DRR strategy centered around five main axes. One of these five axes is to "use knowledge, innovation and education to

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[5]http://enziq.com/cgi-sys/suspendedpage.cgi

build a culture of safety and resilience at all levels" (GPDRR, 2009).This strategy based on knowledge, innovation and education is implemented as follow:

   i. A system of information on disasters and risks is implemented on national level;

   ii. Disaster Risk Reduction is included in the curriculum of national education in primary education, secondary education, higher education, a vocational education;

Courses on environmental education are introduced in school curriculum in primary and secondary education, and courses on civil protection are already introduced in higher education programs. For instance, a Master in Strategy, Defense, Security, Conflict Management and Disasters Management is implemented at the University of Yaoundé II-SOA. Another Master in Human Rights and Humanitarian Action is implemented at the Catholic University of Central Africa (UCAC), among others.

   iii. Vulnerable communities and local authorities are informed on Disaster Risk Reduction through public education and awareness campaigns.

Public awareness and public education is one of the core activities on disaster risks prevention as implemented by the Department of Civil Protection. For instance, two awareness campaigns for mass communication are organized every year, following the methodological indications of the International Civil Defense Organization (ICDO) and UNISDR. Regional focal points of the National Risk Observatory (NRO) are also involved in the organization of the ceremony at the local level. Finally, specific training is regularly provided to members of crises committees at regional and divisional levels, in order to familiarize them with the implementation of ORSEC plans.

Despite such a high level of deployment, a self-evaluation of the strategy from the National Risk Observatory shows that significant achievements have been made, but with limitations in some fundamental aspects such as financial resources and operational capabilities.

3.2 Climate Change and Education

As a method of solving development-related problems, a number of United Nations agencies incorporated sustainable development as an overarching goal of economic and social development (WCED, 1987, p. 43). One of their key strategies to achieving a more sustainable society is to focus on education (3.2.1.) identified under the Agenda 21[6], which was established to try and encourage the behavioral change necessary for a more sustainable future through the integration of the principles, values and practices of sustainable development throughout all aspects of education and learning. Most African countries followed up by selecting education as the main strategy for capacity building (3.2.2.).

3.2.1 Education in the Climate Change debate

During COP 21 in Paris on 4th December 2015, a whole day had been dedicated to climate change education. The idea developed is that Education became the ideal solution to help lessen the impacts of climate change and environmental related problems.

In the last two decades, Climate Change and Environmental Education (CCEE) and Education for Sustainable Development (ESD) have become major tools for protecting the environment and ensuring sustainable development. The issue at stake here is to develop strategies to better address climate change, or simply put, find ways to get the message across the people.

Climate change is a multifaceted issue whose consequences can be identified in various aspects of life. In this regard, research from a various range of disciplines share the same concern: lessen the impacts of climate change at a global level, at a national level, but also at an individual level. As the United Nations Educational, Scientific and Cultural Organization (UNESCO) puts it, the big challenge with climate change nowadays is on "changing minds, not the climate"[7]. Therefore, education and awareness-raising play an

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[6]Agenda 21 is a 300-page document divided into 40 chapters that have been grouped into 4 sections. It is a non-binding, voluntarily implemented action plan of the United Nations with regard to sustainable development. It is a product of the Earth Summit held in Rio (Brazil) in 1992. The final text was the result of drafting, consultation, and negotiation, beginning in 1989 and culminating at the two-week conference where 178 governments voted to adopt the program.

[7]UNESCO's actions on climate change mitigation and adaptation, in the context of the Paris Climate Conference 2015 (COP21): http://en.unesco.org/themes/changing-minds-not-climate

essential role in increasing the climate change adaptation capacities by enabling individuals to make informed decisions.

The present work is rooted in the current debate on the fight against climate change through education as advocated by the international community. In fact, in a need to promote effective international cooperation on climate change education, public awareness, public participation, public access to information, a number of UN agencies decided to work together to lay the ground for building climate-resilient societies. In this regard, the 3rd December 2012 in Doha in Qatar, seven UN organizations gather together to launch the United Nations Alliance on Climate Change Education, Training and Public Awareness. Founding members of the Alliance include: the Food and Agriculture Organization of the United Nations (FAO), the United Nations Environment Programme (UNEP), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat, the United Nations Children's Fund (UNICEF), the United Nations Institute for Training and Research (UNITAR) and the World Meteorological Organization (WMO). One of their goals is to support Parties to the UNFCCC in their efforts to design, initiate and undertake activities related to climate change education, training and public awareness. With the aim to support the implementation of Article 6 of the UNFCCC (UNFCCC, 1992), more members joined the UN Alliance: the United Nations Development Programme (UNDP), the United Nations Secretary-General's Climate Change Support Team (UN SG CCST), the United Nations University – Institute for Advanced Studies (UNU-IAS) and the World Health Organization (WHO). Activities planned cover:

- Providing and disseminating information and resource materials;
- Strengthening cooperation and mobilizing partnerships among Parties, IGOs, NGOs, academia, the private sector, local governments and community-based organizations;
- Supporting countries in developing a long-term, strategic and country-driven approach to climate change education and training;
- Designing and implementing training programmes, developing guidelines and providing other direct support to national focal points for Article 6 of the Convention;
- Providing financial and technical support.

With regards to Non-Governmental Organizations, the International Federation of Red Cross and Red Crescent societies (IFRC), plays a noticeable role too. IFRC has a long tradition of educating communities on disaster risks, increasing safety and resilience through campaigns, informal education, participatory learning and formal school-based interventions. Their focus on public education and community awareness to develop capacities stems from the fact that there is currently a strong emphasis on public awareness and public education for Disaster Risk Reduction (IFRC, 2011). Based on years of experience in public education, they came out with a guide on public awareness and public education for Disaster Risk Reduction. This guide has been designed to help national Societies to plan and develop public awareness and public education efforts for Disaster Risk Reduction. This has been of valuable help in the current study by providing specific operational guidance and activities as well as tools for promoting capacity development for Disaster Risk Reduction.

3.2.2 Education for capacity development in Africa

Climate change education has been included in governmental strategies for disaster risks reduction in most African countries. Education for capacity development has been implemented through research-based suggestions, formal school-based trainings, and informal education approach.

Research based suggestions

Existing resources and expertise of UNU-EHS in capturing and analyzing the vulnerabilities of communities or systems exposed to environmental threats and to offer scientifically-based suggestions for adaptation provided one of the backgrounds for this work. For instance, UNU-EHS is involved in projects with a similar scientific research agenda: The WASCAL project (West African Science Service Center on Climate Change and Adapted Land use). It is a large-scale research-focused program funded by the German Federal Ministry of Education and Research (BMBF) and coordinated by the Center for Development Research (ZEF), University of Bonn. The program is designed to help tackle the challenge of developing effective adaptation and mitigation measures against climate change and thereby enhance the resilience of human and environmental systems to climate change and increased variability in ten African countries: Benin, Ivory Coast, Gambia, Ghana, Senegal, Togo, Nigeria, Niger, Mali, and Burkina Faso. Through its Competence Center, a newly established institute in West Africa, the West African

Science Service Center on Climate Change and Adapted Land use provides science-based advice to policymakers and stakeholders on climate change impacts, mitigation, and adaptation measures. The Core Research Program complements the scientific activities of the Competence Center, whereas the Graduate Studies Program contributes to the education of the next generation of African scientists and policy makers in the field of climate change and land management.

Formal school-based trainings

In most African countries, climate change awareness is gradually included in school curriculum at primary, secondary and higher education level. In Cameroon for instance, at the level of primary and secondary education, topics on environmental studies have been inserted into geography lessons. At the level of higher education, Geography departments in public and private institutions as well, included environmental studies in their curriculum, some with a focus on climate change studies.

In other countries like the Democratic Republic of Congo, capacity development in higher education has been tackled through the launching in October 2014, of a Master program named *Master ECoM-ALGER*[8] at the Faculty of Medecin of the University of Kinshasa. The program is supported by the Ministry of Public Health, and both Université de Franche-Comté and Université Paul Valéry, Montpellier 3 in France. The objective of this master study is to understand the épidémiogène functioning of ecosystems in order to adjust strategies by acting on the environmental determinants of disease emergence and natural disasters, and to train experts on ecological approaches to diseases, natural hazard assessment, analysis of hazards and vulnerabilities. The overall goal is to contribute to building resilience of management systems and population towards climate change impact.

Learning communities as an informal education approach

There are examples of learning communities as a tool for capacity building on climate risk management in Africa. One case study is a Community of Practice named *Building climate risk management capacity in West Africa*[9]. It is a multi-stakeholders Community of Practice initiated by the Capacitating African Smallholders with Climate Advisories

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[8] http://www.preventionweb.net/academic/view/39771
[9] https://ccafs.cgiar.org/fr/building-climate-risk-management-capacity-west-africa#.Vwe1j_mLRMw

and Insurance Development (CASCAID) program which aims to extend the use of climate information for seasonal agricultural decision-making to more than 2 million farmers in five countries in West Africa (Burkina Faso, Ghana, Mali, Nigeria, and Senegal). The project aims to provide index-based insurance services to farmers in selected countries through public-private partnerships. The goals of that project are: to bring more than 2 million farmers to use climate information in support of seasonal agricultural decision making by 2019, to implement equitable climate advisory services that reach at least 200,000 farmers and improved crop monitoring and food security early warning systems for about 100,000 more smallholder farmers.

The CoP gathers members from various professional categories including smallholder farmers, governmental agencies like Senegal's National Civil Aviation and Meteorological Agency (ANACIM), educational institutes like the University of Reading, Washington State University, University of Ghana, the AGRHYMET center, Jet-Propulsion Laboratory (JPL) of the California institute of Technology, and international partners like the International Research Institute for Climate and Society (IRI), the World Agroforestry Centre (ICRAF), and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). Each and every member has a well-defined role inside the life of the community.

Activities implemented by the community build on existing climate services initiatives in the region so as to match supply with real demand. Information and Communication Technologies like rural radio broadcasting, as well as crowd sourcing are used to achieve a deeper impact. Moreover, openness to other projects' initiatives helps support knowledge exchange and building of best practices.

The community also takes into consideration members individualities: all actors are expected to co-design, test, and validate the climate services products proposed as outcomes, and gender issues are also addressed.

Outputs from this CoP are made available under the form of reports that can be accessed on the project web page[10].

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[10]https://ccafs.cgiar.org/building-climate-risk-management-capacity-west-africa#h3_1

3.3 Teaching and learning with technology

Technology is the collection of techniques, skills, methods, processes and tools used in the production of services or in the accomplishment of objectives. It is a two-face concept that can be assimilated to "knowledge" and/or to a "tool". According to Wheelwright, these two aspects cannot be separated as technology in its etymology "combines the meanings of an art and a technique, involving both knowledge of the relevant principles and an ability to achieve the appropriate results" (Wheelwright, 1966, p. 328). Teaching with technology here therefore refers to knowing how to effectively select and incorporate adequately tools into teaching process in order to achieve the best learning outcomes. This part gives a brief history on the evolution of the concept of technology enhanced learning (3.3.1.), its role in environmental education (3.3.2.) and recalls on the understanding of technology enhanced learning in the context of developing countries (3.3.3.).

3.3.1 Technology Enhanced Learning

Technology-enhanced learning is not a new concept. As stated in the preliminary chapter of this work, there is no common understanding on the definition of the term. The definition adopted for this research is the one provided by the European Commission – Community Research and Development Information Service. They define *Technology Enhanced Learning* as "the use of information and communication technologies (…) to support learning and teaching, and competence development throughout life". As explained in Osman (2014) quoting Stienen et al. (2007) and Selwyn (2002), ICT is "an umbrella term includes the use of Computers, Internet, and other technologies". These technologies (understand here media) range from TV, radio, computers, tablets and mobile devices, webcams, blackboards, whiteboards, virtual classroom, etc. Educators have always integrated technology, whatever types and forms of technologies like text books, chalk, etc. into their instruction strategy in order to provide learners with higher quality learning experiences.

However, with the constant evolution of the world, innovations in access to information, content delivery, is developing quickly, together with the need to share knowledge across distant communities, which request remote access to one another using internet. Traditional communications media have been redefined and reshaped to fit to the new context: telephony and television are being redefined into new services such as Internet

telephony and Internet television, print publishing like newspapers are reshaped into blogging and web pages, whereas letters/mails are being reshaped into e-mails, e-fax, etc. Even "advanced" SMS systems are redefined into instant messengers, etc. Everything is moving towards achieving an information exchange as fast and synchronous as possible.

Emerging learning management systems and e-learning authoring tools have facilitated the creation of, access to and sharing of knowledge at all level of education, from nursery school to higher education with virtual classrooms, virtual universities. New online learning models encourage learners to be more active participants in their own learning. With the use of ICT in education, new forms of learning come along, that cover all domains and all aspects of life. The learning process here is self-directed, flexible and aimed at problem solving (Ehlers, 2009).

3.3.2   The use of technology enhanced learning in environmental education

The use of technology tools in creating a learning environment to tackle environment related issues has already been explored by a certain number of institutions. This is the case with the project *Video-mediated farmer-to-farmer learning for sustainable agriculture* (Van Mele, 2011). It is an initiative from the Global Forum for Rural Advisory Services (GFRAS), the Sustainable Agriculture Initiative (SAI) and the Swiss Agency for Development and Cooperation (SDC) who have asked Agro-Insight to implement a study on how video and a web-based platform for video exchange can contribute to farmer-to-farmer learning among the rural poor across the globe, with a focus on sustainable agriculture. The purpose of this study was to provide evidence-based information and a framework of analysis for development partners to make decisions regarding the launching of a common project of an open and global internet-based exchange platform for farmers using short video clips. All these highlight the importance of the use of new technologies in environmental related education.

Another example on the use of video materials is the project "Knowledge sharing film on experiences of adapting to climate change" which is an initiative of the Association des Femmes Peules Autochtones du Tchad (AFPAT). It aims to disseminate information on climate change with the Mbororo community, and promote the sharing of local knowledge on climate change adaptation. The project has been funded by Africa Adapt which is an independent bilingual network (French/English) focused exclusively on Africa. The Network's aim is to facilitate the flow of climate change adaptation

knowledge for sustainable livelihoods between researchers, policy makers, civil society organizations and communities who are vulnerable to climate variability and change across the continent[11]. The project consisted in videotaping testimonies on adaptation from the Mbororo Peuhl tribe, as well as the villagers' lively debates. The video is to serve as best practice experience to other communities.

Finally, learning could also be improved with the help of radio broadcasting. This is the case with the Climate Change and Forests in the Congo Basin (COBAM)[12] Project. COBAM aims to provide policymakers as well as local communities with the information, analysis and tools they need to implement policies and projects for adaptation to climate change and reduction of carbon emissions in the forests of the Congo Basin. The project is implemented by Center for International Forestry Research (CIFOR) under the African Development Bank grant to the Economic Community of Central African States. The project covers six countries of the Central Africa sub region: Cameroon, Central African Republic, Equatorial Guinea, Gabon, Democratic Republic of Congo and Republic of Congo. It consists of producing a series of radio programs to be broadcasted on national radio channels in selected countries. For instance, the program "Au rythme des saisons" (Following Changing Seasons), broadcasts monthly on Cameroon national radio channel, Cameroon Radio TeleVision (CRTV). The radio program aims to educate listeners by providing information about climate change, communities' vulnerabilities, livelihood activities, deforestation, local institutions, etc. COBAM project is still going on, and organizers are looking for an eventual extension of the project to other countries of the Congo Basin region.

3.3.3 Some impediments to the effectiveness of technology enhanced learning in Africa

It is true that Information and Communication Technologies are the major driving forces of globalized and knowledge-based societies of a new world era (Potgier & Herselman, 2003 cited by (Osman, 2014)), but as Mrs. Aicha Bah Diallo[13], Head of the Basic Education Division at UNESCO Headquarters in Paris put it, "It is somewhat of a

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[11] http://www.africa-adapt.net/en-us/about/

[12] http://www.cifor.org/cobam/

[13] Mrs. Aicha Bah Diallo, Head of the Basic Education Division at UNESCO Headquarters in Paris Former Minister of Education in Guinea.

paradox to talk about information and communication technologies in Africa when many people, particularly in rural areas, don't even have access to electricity".

According to results from the *Cameroon Demographic Survey 2011* (EDS-MICS, 2012), only 54% of households have access to electricity in the country. Furthermore, there is a disparity between rural areas and urban areas. Indeed, in rural areas only19% of households have electricity, compare to 88% in urban areas (EDS-MICS, 2012).

Moreover, in regions like sub-Saharan Africa, "most technologies, electronic networks, computers, etc. are far beyond the reach of the majority"[14]. With a poverty rate estimated to 42.7% of the population living with less than 2 USD a day (World Bank est. 2012), the "priority is food, meeting basic needs, struggling to survive and not the latest technologies".

However, the use of technology is an essential ingredient to development. In developing countries like African countries, and mostly in rural areas, technologies will refer to tools such as radio and TV, and sometimes mobile phones. According to the World Bank statistics on Cameroon, the country under study in this work, there are 2,611,314 Internet users as of December 2014, that is 11.0% of the total population. There are 1,400,000 Facebook subscribers as of November 2015, which represents a 5.9% penetration rate in the country. Couple to these facts, about 17.3 million of the country population possesses a subscription to mobile lines, which represents about 73% of the total population; one is tempted to believe that it is certainly on these types of technologies that should build the technological base for developing countries.

Other factors that may hamper the implementation of technology based strategies for capacity development in most African countries. They will be discussed in chapter five of this work.

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[14]Op.cit.

4 Methodology

The current chapter presents the research question to be solved in this work (4.1.). It also describes the research procedure implemented to achieve the study. Here are presented three elements: the research design (4.2.), data collection procedures (4.3.), data management and analysis (4.4.).

4.1 Research question

Based on the results from a preliminary analysis of the literature, the research question of in this work is addressed as follow: How to design, implement and evaluate an innovative technology based strategy for information and knowledge sharing to foster capacity development of various stakeholders involved in the fight against climate change impacts in Cameroon?

This research question has been operationalized into four sub questions in order to achieve a more comprehensive working canvas. The questions are as follow:

- RQ1: What are the reasons behind the failure of the pre-existing strategy of public education and public awareness implemented in Cameroon?
- RQ2: How to assess educational needs and capacities of each category of actors involved in the fight against climate change impact in Cameroon?
- RQ3: What are the most appropriate instructional methods and tools to support learning activities?
- RQ4: How to ensure the effectiveness and sustainability of the newly proposed strategy?

For each sub question, a guideline has been proposed and corresponding indicators have been derived.

- SRQ1: Evaluate the pre-existing public awareness strategy for disaster risk reduction in order to capture weak points;
- SRQ2: Identify and analyze actors in play to determine their roles in the broad picture of disaster risk management;
- SRQ3: Identify and assess methods and tools used to deliver activities planned under the previous strategy for public awareness on disaster risk reduction;

- SRQ4: Determine availability and access to technologies and build on actors' relation to the technologies.

The following table summarizes the operationalization of the research question:

Table 3: Summary table of the scientific problem

Research question	Operationalized questions	Solutions' guidelines
How to design, implement and evaluate an innovative technology based strategy for information and knowledge sharing to foster capacity development of various stakeholders involved in the fight against climate change impacts in Cameroon?	**RQ1**: What are the reasons behind the failure of the pre-existing strategy of public education and public awareness implemented in Cameroon?	**SRQ1**: Evaluate the pre-existing public awareness strategy for disaster risk reduction in order to capture weak points
	RQ2: How to assess educational needs and capacities of each category of actors involved in the fight against climate change impact in Cameroon?	**SRQ2**: Identify and analyze actors in play to determine their roles in the broad picture of disaster risk management
	RQ3: What are the most appropriate instructional methods and tools to support learning activities?	**SRQ3**: Identify and assess methods and tools used to deliver activities planned under the previous strategy for public awareness on disaster risk reduction
	RQ4: How to ensure the effectiveness and sustainability of the newly proposed strategy?	**SRQ4**: Determine availability and access to technologies and build on actors' relation to the technologies

4.2   Study design

This study is built on a mixed method approach (Creswell, 2009; Creswell & Plano Clark, 2007; Greene, 2007; Johnson & Onwuegbuzie, 2004; Teddlie & Tashakkori, 2009; Creswell, 2007). With regards to the context of the study and objectives to be achieved, a mixed method approach (qualitative and quantitative) seemed to be the best way to address the research problem and enhance the integrity of the findings (Bryman, 2006). The use of the mixed method approach helped to tackle the issue under discussion from a variety of point of views. Qualitative research method has been used to describe the multiple ways in which participants generate meaning to their experiences whereas quantitative method has been used to elaborate on qualitative analysis (Creswell, 2009). If to determine the impact of each method on the work, results from this study build mostly on a qualitative analysis, whereas a quantitave analysis of the data is useful only to bring more power to results from the qualitative analysis. In other words, the work does not dig into inferential statistics.

The study makes use of two sets of data namely primary and secondary data. Secondary data consists of various sources: results from previous research works on the management of disasters and risks in Cameroon, reports from international organizations such as United Nations Statistics division (UNSTATS), UNESCO, GIZ among others, statistics from national census provided by the National Institute of Statistics (NIS) in Cameroon, policy documents from government, syllabus from higher education institutions like the University of Buea, as well as yearly reports from Cameroon Civil Protection on the state of civil protection in Cameroon. Secondary data have been used to help answer the first research question (RQ1). The above-mentioned sources helped to determine reasons behind the failure of the pre-existing strategy of public education and public awareness implemented in Cameroon, as suggested in previous research works.

Primary data was collected during two field trips in the country. Each of the field trips has been carried out following specific aims. Objectives of the first field trip were to (1) perform a self-evaluation of DRR public awareness and public education activities implemented by the government, so as to validate information provided by the literature review; (2) identifying various actors involved in DRM in Cameroon as well as their role, and assess their specific needs, so as to understand where current strategies fail to be effective. The aim of the second field trip was to (3) determine awareness methods

implemented, and technologies used to support related activities so as to assess their adequacy; and (4) investigate on availability and accessibility of infrastructures and technologies that could be used for the new model based on information and knowledge sharing so as to ensure its sustainability.

4.3   Data collection procedures

Primary data have been collected on a six months' field trip in Cameroon planned in two phases. The first phase ran from November 2013 to February 2014, and the second phase ran from December 2014 to March 2015. This section develops the process that has been followed to collect primary data. It describes techniques used to select the sample population (4.3.1.), tools used to collect data (4.3.2.), and ethical issues faced in the process of data collection (4.3.3.).

4.3.1   Sampling process

Cameroonian population constitutes the target population in this work. This target population has been narrowed to a study population constituted with the government, its partners in the implementation disaster risk management policies and support of the disaster risk reduction activities, and population of areas more prone to hazards. As for the population that built up the sample, two main techniques for data sampling have been used: the purposive sampling technique (Palys, 2008; Oliver & Jupp, 2006) and the Respondent Driven Sampling (RDS) (Morgan, 2008). Each method has been used respectively to: select the geographical scope of the study (4.3.1.1.), and to select participants for the study (4.3.1.2.). This section also provides information on possible limits related to the choice of the sampling procedure (4.3.1.3.).

4.3.1.1   Geographical scope of the study

Cameroon represents the geographical scope of this study. The country is made up of about 22,179,707 inhabitants (BUCREP, 2015)[15] spread across ten regions. Due to

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[15]Bureau Central de Recensement et d'Etude de la population au Cameroun: created by Decree No. 99/230 of 4 October 1999 and reorganized by decree No. 2005/309 of 1 September 2005, the *Central Bureau of the Census and Population Studies*' mandate is to assist governments and other development actors to take into account demographic phenomena in the development and implementation of social development strategies in accordance with the priorities set by the Government. It provides collection, exploitation, analysis and dissemination of socio demographic information from different angles: demographic, social, economic, migration, etc.

technical reasons, time constraints and financial limitations, it has not been planned to cover the whole country, hence the reason to identify areas that could play as representatives of the situation countrywide. The first sampling strategy therefore consisted in reducing the surface area to be covered during the fieldwork. The purposive sampling technique (Palys, 2008; Oliver & Jupp, 2006) guided the process of narrowing the geographical scope of the work from a country scale to a more local scale. Reports from governmental structures dedicated to disaster management and fight against climate change and environmental related risks in Cameroon (such as the Directorate for Civil Protection), have been useful for that purpose. Based on reports such as the cartography of environmental risks in Cameroon, geographic areas to be covered have been selected. The figure below is a map of the geographical coverage of areas visited during fieldwork.

Figure 5: Geographical coverage of areas selected for fieldwork

Notes: Areas visited are colored in yellow[16].

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[16]The map was adapted from:
https://upload.wikimedia.org/wikipedia/commons/thumb/8/82/Cameroon%2C_administrative_divisions_-_de_-_monochrome.svg/512px-Cameroon%2C_administrative_divisions_-_de_-

These areas were selected following the steps described below:

Step 1: The country was divided into three agro-ecological areas as proposed by the Demographic and Health Survey program's final report on Cameroon (EDS-MICS, 2012) namely: the forest zone (Centre, East, Littoral, South and Southwest regions), the Sudano-Sahelian zone (Adamawa, North and Far-North regions), and the West highlands (West and Northwest regions).

Step 2: In each of these three zones, a cross analysis of the regional map and the cartography of most at risk areas as proposed by the Ministry of Territorial Administration and Decentralization (MINTAD) helped to come up with a list of six national regions: Far-North, North, Centre, South-West, West, and Littoral.

Step 3: Based on the same cartography of most at risk areas in Cameroon, one area in each of the regions was selected, for a total of six areas namely Maroua (for the Far-North region), Lagdo (for the North region), Yaoundé (for the Centre region), Douala (for the Littoral region), Limbe (for the South-West region), and Foumbot (for the West region). Criteria used for the selection of the above-mentioned areas also cover the types of risks identified in every national region, such as flood, epidemic, water and/or air pollution, volcanic eruption, drought, landslides, etc.

Step 4: Finally, with regards to the similarities between the types of hazards identified in each of the areas (MINTAD/DPC, 2013), four cities have been selected to account for the variety of hazards identified in the country.

The four selected cities include the following:
- Yaoundé, the city capital;
- Maroua which is the fifth city of the country in terms of population and development. It consists of a mix of urban and rural area due to the recent creation of a state university (Presidential decree n° 2008/208 of the 9 August 2008) and a public vocational training school (Presidential decree n° 2008/208 of the 9 August 2008);
- Foumbot, a remote rural area;
- Limbe, a seaside city renowned as a touristic place in Cameroon.

The figure below summarizes the above-mentioned selection process.

Country	Geographic zone	Areas	Possible cities	Types of hazards	Selected cities
Cameroon	Sudano-sahelian zone	Far-North	Maroua	Flood, Drought, Epidemic	Maroua
		North	Lagdo	Floods Landslides	
	Forest zone	Centre	Yaounde	Floods Landslides	Yaounde
		Littoral	Douala	Landslides Pollution	
		South-West	Limbe	Floods Volcanic eruption	Limbe
	West Highlands	West	Foumbot	Epidemic Drought	Foumbot

Figure 6: Summary of the geographical sampling of the research area

4.3.1.2 Selection of participants

Climate change and environmental risks represent a complex multi-stakeholder network in Cameroon. Based on results from the literature review, four categories of actors involved in the fight against climate change impact and environmental related problems in Cameroon have been identified: Decision-makers, Non-Governmental Organizations, Educational institutions, and Communities. In order to achieve a meaningful detailed analysis later on, these actors have been categorized into two main groups: group A which includes Decision-makers, Non-Governmental Organizations and Educational Institutions, is described in subsection, and group B which refers to communities.

➤ **Group A: Decision-makers, Non-Governmental Organizations, and Educational Institutions**

Group A constitutes the expert panel in this study. They are considered experts in the domain of disaster risk management in Cameroon due to the role they play in DRR activities, and based on information collected from the review of the literature. *Decision makers* are people involved in the formal and informal decision-making process in

Cameroon. This refers to the two main strata of the government namely the central administration and decentralized institutions. As concerns *Non-Governmental Organizations*, they refer to government's partners who are engaged in development cooperation in the field of environment and climate change in Cameroon. This includes international organization, as well as national and more local associations. As for *Educational Institutions*, it refers to actors from the educational spheres, who share a commitment to the fight against climate change impacts in Cameroon. Educational institutions that have been taken into account in the analyses range from primary education system to higher education system in both public and private sectors.

Information has been collected on the field with the help of 183 respondents located in the four selected cities (Yaounde, Maroua, Limbe and Foumbot). Among the 183 participants, 31 belong to group A (further referred to here as experts). They are distributed as follow:09 experts working for the Government, both in central and decentralized institutions; 06 experts from Non-Governmental Organizations, United Nations institutes and national associations; 06 experts from public as well as private Educational Institutions, and 10 teachers of a public elementary school (in the city of Bafoussam).

In each of the stakeholders' category, the purposive sampling technique has been used to identify individuals to be selected for the study. The choice of the purposive sampling in this case is motivated by the need of getting valuable information on the management of disasters and risks in Cameroon, by selecting people most likely to have the expertise to provide accurate observations. (Denscombe, 2010). Each group of experts has been constituted as follow:

Experts from the government

Civil protection activities in Cameroon are regulated by the Ministry of Territorial Administration and decentralization (MINTAD), through its Directorate of Civil Protection (DCP). While looking for experts in the management of disasters and risks at the level of the government in the country, one should first refer to DCP staff, then to staff from partner-ministries including the Ministry of Health and the Ministry of Post and Telecommunications (MINPOSTEL). Experts interview in this category were:

- At the level of central administration: the Director in charge of National Risk Observatory (NRO) activities and 01 expert from MINPOSTEL in charge of Community Telecenters[17]

- At the level of regional divisions: 03 NRO focal points, 02 Sub-Divisional Officers (SDO), 01 expert from the Ministry of Health (MINSANTE), and 01 manager of a TCP.

The table below summarizes the distribution of experts' group from the government.

Table 4: Distribution of experts from the government

	Experts	Admin. level	City	Area of expertise
01	MINTAD/DCP	Central	Yaoundé	NRO activities coordination
01	MINTAD/SDO	Regional	Maga	Implementation of development policies
01	MINTAD/SDO	Regional	Limbe	Implementation of development policies
01	MINTAD	Regional	Buea	NRO activities (focal point)
01	MINTAD	Regional	Bafoussam	NRO activities (focal point)
01	MINTAD	Regional	Maroua	NRO activities (focal point)
01	MINSANTE	Regional	Bafoussam	Health awareness activities
01	MINPOSTEL	Central	Yaoundé	TCP evaluation
01	TCP	Regional	Bayangam	ICT facilities provider

Experts from Non-Governmental Organizations

Experts from this category have been selected based on availability, among already identified partners of the DCP. They include:

- Non-Governmental Organizations: 01 expert from GIZ, 01 expert from French Red Cross, 01 expert from CIPCRE[18]

- United Nations Institutes: 01 expert from UNESCO, 01 expert from WHO

- National Association: 01 expert from an association related community radio

The table below summarizes the distribution of experts' group from the government.

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[17]Known as TCP: Telecentre communautaire Polyvalent.
[18]Cercle International pour la Promotion de la Création is an NGO of Christian obedience dedicated to the task of bringing people (men and women), especially farmers to take charge of their own development with regards to ecological issues in general.
http://www.cipcre.org/index.php?option=com_content&view=article&id=47&Itemid=54&lang=en

Table 5: Distribution of experts from IOs, NGO and national associations

	Experts	City	Area of expertise
01	UNESCO	Yaoundé	ICT facilitations provider (Community Radio project)
01	WHO	Maroua	Public awareness on health issues
01	GIZ	Maroua	Environmental sensitization for farmers
01	French Red Cross	Maroua	Public awareness on health issues
01	CIPCRE	Bafoussam	Environmental sensitization for farmers
01	Community Radio	Buea	General information relay in national languages

Experts from educational institutions

Experts from this category have been selected to account for primary, secondary and higher education. In higher education, experts come from private as well as public institutions. These public institutions cover vocational training schools and state universities. They all include:

- Higher education: 03 experts from state universities, 01 expert from a private institute, 02 experts from public vocational training schools
- Primary education: a Focus Group Discussion (FGD) was carried out with 10 teachers (02 men, 08 women) from a public primary school.

The account for secondary education has been embedded in interviews of experts from vocational training schools, as they train essentially secondary school teachers. The table below summarizes the distribution of experts' group from the government.

Table 6: Distribution of experts from Educational Institutions

	Experts	Position	City	Area of expertise
01	University of Yaoundé 1	Administrative staff	Yaoundé	Implementation of the virtual university
01	ENS Yaoundé	Lecturer	Yaoundé	Geography
01	University of Buea	Administrative staff	Buea	NRO activities
01	University of Buea	Head of department/ Lecturer	Buea	Communication and Journalism
01	ENS Maroua	Head of department/ Lecturer	Bafoussam	Geography
01	InstitutSupérieur du Sahel	Lecturer	Maroua	Environmental studies
10	Public primary school	Teachers	Bafoussam	Primary school environment teachings

➢ **Group B: Communities**

This group refers to urban and rural population, who represent the most vulnerable group and the first victims when it comes to disastrous impacts of climate change in the Cameroon. Respondents from group B have been selected based on the Respondent Driven Sampling method. Also known as snowball sampling it uses a small pool of initial informants to nominate, through their social networks, other participants who meet the eligibility criteria and could potentially contribute to a specific study (Morgan, 2008).

The research initially planned to select respondents from communities following the purposive sampling technique as well. During testing phase of the survey, the number of people refusing to be interviewed rendered the collection of data difficult. As a way to remedy the situation, the research sampling technique has been replaced by the snow ball sampling technique. Population surveyed, was more open to answer question when the researcher was recommended by someone they trust. Following this method, the survey triggered a cumulative approach to build up the sample size of the sample until sufficient information were collected (Denscombe, 2010).

Based on this sampling procedure, 152 respondents have been surveyed. They are distributed as follow:
- 39 respondents in Yaoundé
- 51 respondents in Maroua
- 39 respondents in Limbe
- 23 respondents in Foumbot

The following table summarizes the distribution of respondents from group B by city.

Table 7: Distribution of the community sample population by city

Characteristics of the area	City	Number of respondents
City capital / urban area	Yaoundé	39
Mixed (urban/urban) area	Maroua	51
Touristic area	Limbe	39
Rural area	Foumbot	23
TOTAL	**04**	**152**

4.3.1.3 Limitation to the sampling procedure

The snowball sampling technique for collecting data using members of the communities' group was rather forced onto the research process by the reality on the field. Therefore, criteria related to age, gender, level of education, occupation, etc. were not taken into consideration in the selection of respondents, which no longer depend solely on the researcher. However, in the analysis of data collected, these criteria have been evaluated in order to determine a possible impact on the design of the solution proposed in this work.

4.3.2 Instruments for data collection

This section provides information about the selection and design of data collection tools (4.3.2.1.) and their mode of administration (4.3.2.2.).

4.3.2.1 Instruments' design

The choice of data collection instruments has been highly influenced by the characteristics each group respondents belong to and the type of information to be collected. Four tools have been design here to support data collection: semi-structured interview, focus group discussion, qualitative survey and direct observation.

➢ **Interview (Semi-structures interview)**

To understand strategies and attitudes developed on the basis of traditions and experiences stemming from climate change impacts in Cameroon, the research made use of semi-structured interviews. The expected output is to gather a depth of information useful for obtaining the story behind stakeholders' experiences (McNamara, 1999) and to uncover the meaning of these experiences (Kvale, 1996). Semi-structured interview was administered to the experts' category.

The interview guide follows a thematic structure. Questions were mostly of open ended types, and prepared in relation with the four research questions posed in the work. The five main parts described below constitute the interview guide:

- Interview identification: provided information on survey ID, date, place, name of interviewer, language of the interview, need (or not) of a translator, data entry person and date;

- Experts identification: provided information on name of the interviewee (not compulsory), name of the organization, position held, responsibilities, and contact (RQ2);

- Risk identification: mostly to constitute a database for comparing answers provided by communities;

- Problem validation: to validate problems identified in the literature namely experts' support, qualified personnel, strategies for education and training, collaboration between all actors, and technical infrastructure (RQ1, RQ3, and RQ4);

- Curriculum design: only addressed to experts from educational institutions, questions on curriculum design were useful to identify adequate tools for training and awareness to serve as a database for comparing answers from experts' from NGOs and government (RQ3).

➢ **Focus Group Discussion**

Focus group discussion (Krueger & Casey, 2009) has been used to get both individual and group opinions in an interactive environment. The expected output here is to appraise interactivity between members of the same community and gather some proposal of solutions that will serve as guidelines for the development of a learning model. For reasons related to time constraints and lack of supporting staff, focus group discussion has been carried out only once and with respondents from group 2 (educational institutions). As with interviews, a template for focus group discussion has been designed. Guidelines for the focus group discussion are provided at the end of the work (Annex 3). The focus group discussion guide was based on the one proposed in the research protocol and field guide for the UNU-EHS and CARE International project "Where the rain Falls" (Rademacher-Schulz, et al., 2012).

➢ **Qualitative Survey**

As Jansen (2010, p. 4)put it, the use of survey in qualitative research does not aim at "establishing frequencies, means or other parameters but at determining the diversity

of some topic of interest within a given population". The survey has been used in this research to capture the diversity of group of people within the sample population in terms of habits, culture, level of education, beliefs, etc. The aim was not to count the number of people with the same characteristic, but rather to analyze how this diversity in the characteristics of the population within communities influence the acceptance of strategies and technology tools used for public awareness and public education on Disaster Risk Reduction. Results from survey analysis provide simple summaries (in the form of graphs) about the sample and the measures (Jansen, 2010). The questionnaire used for the survey is provided at the end of this work (Annex 4).

The design of the survey guide as made based on the one proposed in the research protocol and field guide for the UNU-EHS and CARE International project "Where the rain Falls" (Rademacher-Schulz, et al., 2012).Some questions related to the evaluation of availability of technology tools (computers, internet access) were inspired by the English questionnaire proposed in Osman (2014, p. 328). The survey followed a thematic structure. It has been divided into five main parts described as follow:

- Survey identification: provided information on survey ID, date, place, name of interviewer, language of the interview, need (or not) of a translator, data entry person and date;
- Household identification: provided information on name of the interviewee (not compulsory), gender, age, level of education, occupation, ethnic group, religion, mother tongue and contact (not compulsory) (RQ2);
- Risk perception: to evaluate communities' knowledge of hazards occurring in their region, and understanding on whether it is related to climate change (RQ1);
- Sensitization situation: to evaluate methods and tools used during previous awareness campaign and evaluate communities' attitudes towards technology tools (RQ3);
- Technologies: to assess availably of and access to tools, as well as communities' acceptance of technologies (RQ4).

The survey made used of multiple choice questions mostly when gathering respondent opinion, and yes or no questions were used to validate some of the problems identified in the literature.

➢ **Direct observation**

Direct observation has been used in this research to evaluate the implementation of community radio and community telecenter as technology tools used within communities for capacity development by the government in Cameroon. "Participant observation puts you where the action is and let you collect (…) any kind of data that you want." (Bernard, 2006). It has proven to be the best method for data collection with communities, especially rural communities. Direct observation has been useful in understanding and evaluating the acceptance of technology tools as educative support in rural areas. The expected output here is to appraise interactivity between population, especially students in rural areas and technology tools, mainly computers and internet access, in the context of a community telecenter. The design of the event observation form was made following recommendations and based on the template provided in Denscombe (2010, p. 202).

4.3.2.2 Administration of data collection instruments

Data collection on the field was performed in each of the areas by a research team constituted with the researcher, a research assistant and a field guide also used as translator when necessary. The same research assistant remained until the end of the study, whereas a different field guide was selected in each of the cities. The research assistant was carefully selected based on the following criteria: level of education, experience in research, fluency in English and French (the two official languages spoken in the country). Each field guide was selected based on level of education as well (minimum of secondary school), and fair knowledge of the two official languages; preferably a native of the area with mastery of the local language, so as to be able to play as translator as well. However, experience of field research was not required. This selection aimed at reducing the rate of data lost during translation from one language to any other (Temple & Young, 2004).

Questionnaire guides used for interviews and qualitative survey have been pre-tested in order to check their validity. As Katz (1940, p. 279) puts it, the idea is to "avoid phrasings which will be unintelligible to the public and to avoid issues unknown to the man on the street". Conventional pre-tests have been carried out in each of the four selected areas. Once pre-testing phase was done, results from data collected pre-analyzed, effectiveness

of tools checked and necessary amendments made accordingly, the data collection phase started.

The Informed Consent Form

An informed consent form has been designed in order to ensure respondents were fully informed about the aim of the study, their mode of participation, and other relevant information. The informed consent form has been administered during pre-testing phase as well as proper collection phase. It provided information on the following: introduction to the aim of the study, possible risks or discomfort for the respondent, benefits gained from the research, confidentiality in data collection – analysis – reports, possibility (or not) for a compensation as a participant, and contact of the research in case of any further information needed, as well as verification of the identity of the researcher. Details about the administration of the ICF and some related ethical consideration related to it are presented in (4.3.3.).

Interview

Questionnaire guide for interviews with experts was tested with only one representative from each group: one staff member from the Directorate of Civil Protection, one member of the PROPSFE project from GIZ, and one lecturer in the Department of Geography of the Higher Teachers' Training college of Yaoundé. The reason is that few numbers of experts were available from NGOs and educational institutions, and it was very difficult to gain access to experts from the government. The assumption here is that questionnaire problems would be signaled by the kind of answers that the questions elicit, or the attitude of the interviewees, as described by interviewers during debriefing (Presser, et al., 2004). As concerns the administration of the interview to the intended informants, the interview took place at each expert's office. Location and time were determined by the interviewee. A request for audience was submitted prior to each appointment. Each interview lasted 30-60 min. Questions were administered following a guide provided in annexes. Notes on interviewee's attitude were taken down as the interview progressed. It is worth mentioning here that, at the beginning of each interview, the interviewee was asked for the authorization to record the discussion, then the researcher introduced the topic and aim of his research, as well as the research assistant accompanying her. As for the informed consent, it was administered under specific conditions, as explained in (4.3.3.).

Qualitative survey

Questionnaire guide (provided in annex) for the qualitative survey was tested with four to five selected people in the streets. The idea was to capture the diversity of the population under study as much as possible during the pre-testing phase. Results from the analysis of results obtained, as well as difficulties encountered during the collection of data raised the issue of wording. For instance, questions contained in the survey were written in a formal way, but respondents who had quite a low level of education (no secondary school attended), requested an explanation of the question. The updated version of the survey was written using a less formal language. As concerns the mode of administration, some of the respondents requested to fill the form by themselves, whereas others preferred to be asked questions. Time spent to perform the survey was also shortened or extended depending on respondents' attitudes or even mood. With regards to location, people were surveyed were they were located (house, office, market, health center, street, etc.). Notes on the attitude of the people surveyed were taken down for a later cross analysis with the answer actually provided. No recordings were planned for surveys. Here again, the administration of the informed consent form was performed under specific conditions explained in (4.3.3.).

Focus group discussion

One exception applies in this research with the use of the focus group discussion. It was not tested due mostly to technical reasons (time constraints from the researcher, availability of interviewee, administrative procedures, etc.). The primary school where the FGD occurred was selected based on recommendations from one of the experts. Request for audience was addressed to the director of the school who determined teachers who will attend the discussion group based on their availability. The venue was a classroom proposed by the director, who also introduced the research team (researcher and an assistant). The researcher requested permission for recording the discussion to each of the participant orally, and once granted proposed topics to be discussed and moderate discussions while the research assistant was in charge of taking down notes. The FGD lasted for about 2 hours and refreshments were proposed to the group at the end of the discussion. A FGD protocol is provided at the end of this work.

Direct observation

Direct observation of performed at the Community Telecenter (name shortened as TCP) of Bayangam. Like focus group discussion, it has not been possible to test the direct observation method. This is related to two reasons: the project on TCP is still at the pilot phase. As such, very few of the TCP are functional. The TCP in Bayangam was one of the two TCP almost functional in the time the field trip took place. The second reason is related to the availability of the manager (who is the one in charge of opening the center). Three visits were planned. The first visit was unsuccessful, the second visit aims at interviewing the TCP manager as an expert, and the third and last visit therefore was used to collect data. Observation of interaction between students and between students and technologies (internet, computers, printers, copiers) was performed from 09:15 am to 17:30 am in 3 phases: (1) from 09:15 am – 10:30 am, (2) from 12:30 am – 13:30 pm), and (3) from 15:30 pm – 17:30 pm. These three time frames correspond respectively to the first break in school, lunch break and end of school day. The choice of these periods was motivated by the high probability for students to rush to the TCP to prepare homework, print course materials, organize team work for group presentations, etc.[19]information about relevant background matters whenever they use a schedule (Galton et al. 1980). Detailed notes were taken down on an event observation form. At the beginning of each new observation period, information about relevant background was noted down as reminder (Galton, Simon, & Croll, 1980).

4.3.2.3 Limits related to administration of data collection instruments

This section describes some of the limits related to the administration of data collection instruments. Focus group discussion was performed in French, as all participants were French speakers. As for interviews and surveys, the main version used for the research was prepared in English and administered in English, except for cases where the respondent was French speaking. In this case, a prepared translated version in French of the tool was administered.

Another limit is related to the influence of the researcher perceived during the administration of data collection tools. In fact, the attitude of the respondent is influenced by the personality of the researcher (level of education, dressing code, nationality, etc.)

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[19]This observation is based on personal experience.

(Denscombe, 2010). To lessen the effect of these biases, self-presentation of the researcher has been done with caution: for instance, the research team adopted the dressing code of each of the cities visited. As concerns involvement into the topic of discussion during interviews, researcher's attitude varied from neutral to friendly on the type of information the interview sought to collect and depending on the personality of the interviewee (Oakley, 1981).

4.3.3 Ethical considerations

One significant element that embodies ethical codes in data collection tool is the use of the Informed Consent Form. The experience in collecting data on the field raised the question: "how *honest* do we actually have to be about our research purpose?" (Punch, 1994, p. 89).

The general idea behind the use of the Informed Consent Form is the right for an informant to be informed about the nature of the research and his/her right to withdraw from the research at any time (Weppner, 1977, p. 41). As stated earlier, data were collected using four categories of informants namely decision makers (government), Non-Governmental Organizations, educational institutions and communities (rural and urban).

Initially, the informed consent form was planned to be administered to all informants equally both during pre-testing phase and during data collection itself. But based on informants' attitudes during pre-testing and the influence this had on the quality and amount of data collected, the informed consent from has finally been administered in two different ways.

Phase 1: pre-testing

During this phase, selected respondents were fully informed about the research, the type of information to be collected, and the collection process, then were requested for their consent using either a paper version of the form, or it was read to them. A significant observation was made on the attitude of these respondents once there were fully informed. Two main behaviors were registered: (a) from communities 'group, and (b) from the experts.

(a) Respondents willingly (or not) answered questions depending on "what" was announced in the informed consent form. E.g.: respondents were highly sensitive to information related to their "benefits" or "compensation".

(b) Representative from government group and experts from NGOs and educational institutions rather willingly (or not) answered questions depending on "if" the informed consent form (paper version) was accompanied with an official authorization from their respective administrative hierarchy, which is time consuming for the researcher. Besides, some respondents were highly sensitive to information related to "confidentiality". Questions like "how confidential is that confidentiality? How can I trust you?" were addressed.

Phase 2: data collection

From the experience with the previous phase, here (a) either the content of the informed consent form has been altered, or (b) the informed consent form was not used.

(a) In this case, some parts of the form were deliberately omitted. E.g. Parts on "benefits", and "compensation" were either not read to respondents or deleted from the paper version, so that respondents will not be tempted to request remuneration for the answers they provide.

(b) Here, the official authorization letters from an administrative authority, and the university hosting the research were provided in replacement of the informed consent form. Additional information on how confidentiality of the work will be handled was also provided.

With the specific case of the participant observation, groups of people observed were not aware of the fact that they were being observed. However, the person in charge of the group and the one responsible for the tele center, have been duly informed and a proper consent form filled on behalf of the group.

Despite these ethical issues, data collected, analyzed and interpreted resulted in a deeper understanding of the categories of learners involved, and helped draw the solutions proposed in this work, for the design of a technology enhanced model of learning for capacity development towards climate change impact.

4.4   Data management and analysis

This section describes the handling of data collected, including transcription of interviews, focus group discussion and observation, and transfer to data analysis software (4.4.1.). It also describes data analysis procedures used to sort out data in order to achieve comprehensive results (4.4.2.).

4.4.1   Data management

Secondary data from literature and reports constituted documents that were simply uploaded to MAXQDA, software for qualitative data analysis. Primary data collected through recordings were categorized according to data source and stored in separate folders into separate storage devices (researcher's computer and external hard drive). Data collected from interviews, focus group discussion and direct observation hard drives transcribes on a daily base (Lacey & Luff, 2001) with the help of the research assistant. This first transcription was done manually. Transcription has been double checked in order to avoid data loss using notes taken down on observation made during interviews, and audio recordings (McNamara, 1999). Prior to field trip, the survey template was design into Epi info software. Surveys were therefore transferred on a weekly base to the software to avoid a huge volume of data to be transferred later on at the end of fieldwork. Transcriptions were transferred to MAXQDA. During data transfer to respective software, questionnaire for interview was name removed. Each name was linked to an ID number and stored in separate excel sheet. Interviews were identified:

- *Identification ID*:
    - INT for interview
    - OBS of observation and
    - FGD for focus group discussion
- *Identification number*:
    - INT1, 2, …, 11 to refer to the number of interviews collected
    - FDG and OBS because there were only one focus group discussion and one observation exercises
- *Description text*: to provide specific information on variable (topic of the information collected) or the position of the informant

- INT1, NRO S-W R (interview n°1, expert from the National Risk Observatory for the South-west region)
- OBS, Use (Observation day n°1, ability to use ICT tools)

As concerns surveys, the same scheme was followed with a slight difference on the significance of the numbers following the ID.

- *Identification ID*: HH for household survey
- *Identification number*: based on a 3-digits code
  - First digit refers to the city where the data were collected (1- Yaoundé, 2- Maroua, 3- Limbe and 4- Foumbot)
  - Second and third digits refer to the number of surveys collected for a maximum of 99 surveys collected in each area.
    Eg: HH101: survey number 1 collected in Yaoundé

    HH202: survey number 2 collected in Maroua

    HH310: survey number 10 collected in Limbe

    HH420: survey number 20 collected in Foumbot

Once all data were transcribed and transferred to software with the help of research assistant and control during the last week on the field in Cameroon, the phase of data analysis could start.

4.4.2 Data analysis

Data analysis in this work has been performed following an inductive approach. Detailed readings of primary data were done in order to derive concepts, themes, and then a model through interpretations made from these raw data (Thomas, 2006). Analysis of data also took into account the type of tools used to collect data (Flick, 2008). For instance, the main method for data analysis was the qualitative analysis. However, primary data were also collected using a survey. Therefore, some quantitative data were collected and analyzed with the help of descriptive statistics (Prem S. Mann, 1995).

Questionnaire guide used for the survey was already designed following a thematic structure. Analysis of the survey followed two main stages:

(1) Once data transferred to Epi Info software in a questionnaire template designed (prior to the field work), answers to every question asked was

generated under the form of a graph (usually histogram charts). Each question referred to a sub variable. Then the result obtained was interpreted with regards to its impact on the research questions it related to;

(2) A deeper analysis using a combination of two variables was performed in order to discover new patterns useful to draw a solution for the research question.

The following table provides an example of the survey analysis:

Table 8 : Example of variables analysis with the survey

Main variable	Sensitization rate on Disaster Risk Reduction			
Step 1	Analyzing sensitization rate in Cameroon based on all respondents			
Indicators	Yes		No	
Results	32,50%		67,50%	
1st conclusion	The number of people sensitized in Cameroon on DRR is very low.			
Step 2	Adding sub-variable: *place of survey*			
	Limbe		Foumbot	
Indicators	Yes	No	Yes	No
Results	12,82%	87,18%	52,17%	47,83%
2nd conclusion	Sensitization rate in not equally distributed in the country			
Interpretation	Awareness campaigns should be planned in every cities in the country			

With regards to documents that constitute secondary data, as well as transcriptions from direct observation, interviews, and focus group discussion have been transferred to MAXQDA software for qualitative data analysis. The analysis process has been performed in two main steps as well: (1) coding, then (2) categorization and analysis.

➢   **Coding**

Coding refers to the categorization of text segments of the interview protocols with the aim of inductively identifying emerging patterns and themes in the data (Cope 2009: 468 cited by (Abeling, 2016)). For reasons related to time constraints and geographical scope to be covered during fieldwork, only data transcription and data transfer to the software

were carried out on the field. The process of coding took place later on, once back from the field trip, after all transcriptions were double checked in order to add missing information if applicable.

A step by step analysis has been performed from raw data to emerging themes (Auerbach & Silverstein, 2003). Documents as well as transcripts were uploaded to MAXQDA software in terms of data sources, each source corresponding to a folder (DRR policies, interviews, observation, focus group discussion, Cameroon country profile, etc.).

As in the case of the survey, interview guides as well as focus group discussion guide were designed following a thematic structure based on the research sub questions. Therefore, main variable used to give an orientation to the analysis had been identified before data collection. However, data collection process with open ended questions present in the interview guide allow for new emerging variables that could have not been taken into account by the researcher. Moreover, the thematic structure of the questionnaire guide was performed simply as a guide for the researcher to keep track of the kind of events, facts, information she had to look for.

A first reading of transcriptions and documents using the software allowed the identification of relevant texts. Relevance of the texts here refers to the usefulness of information provided in the text with regard to the research questions. Then recurrent ideas were identified and coded, avoiding but word-by word or line-by-line coding. The coding process was performed on all transcriptions one by one.

➢ **Analysis of data**

A second reading of the transcriptions already coded, and a comparison between documents sources (especially transcription of focus group discussion and interviews) allowed the discovery of similar ideas shared among informants from different categories of stakeholders. This help clustering of ideas to form themes, inducing a second level of coding that helped structuring all data (May, 2011). Once coding procedure was done, a last reading of the code matrix allowed identifying cross variables that emerged between interviews. Then, initial results obtained between different data sources were compared based on informants' triangulation, space triangulation, sources triangulation, in order to ensure a better accuracy of conclusions (Denscombe, 2010, pp. 348-349), as well as a better understanding of the full picture of the research problem and solutions to be

proposed. Results were compared to the initial thematic structuring of the guides, in order to determine similarities or new patterns. The selection of quotes to be used as evidences in the work stems from a deliberate choice from the researcher

The following figure summarizes the research process:
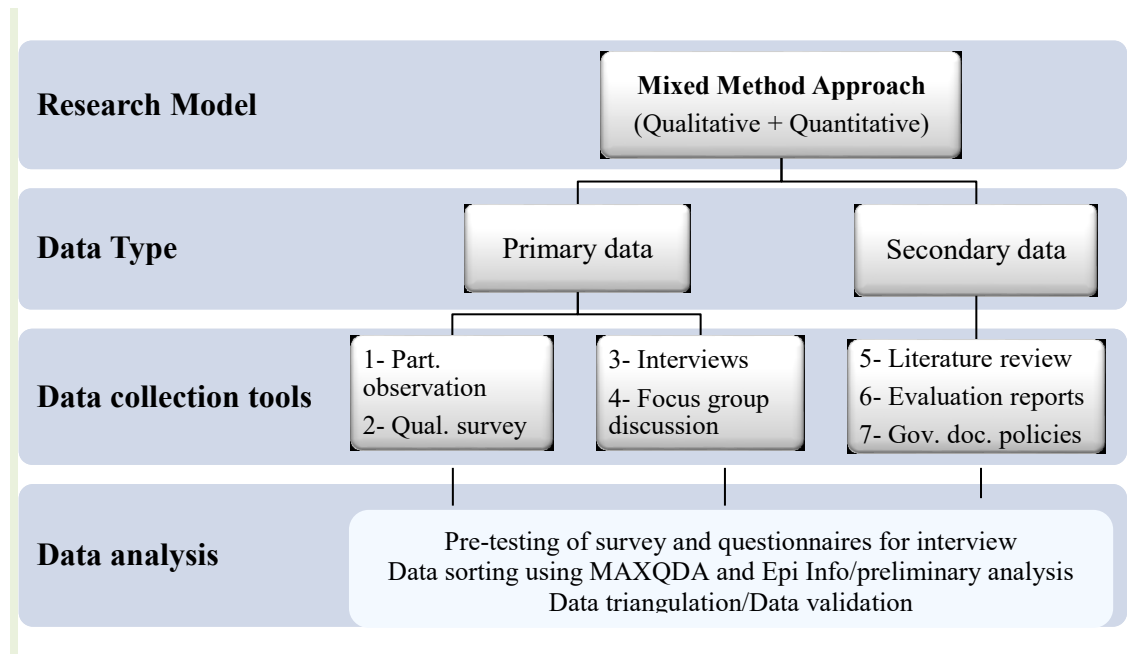
Figure 7: Framework for data collection & analysis

It is worth mentioning here that quotes used in the next chapter (5. Results and Discussion) of this work are not direct quotes from respondents. They are rather a paraphrasing made by the researcher of actual statements of respondents, sometimes delivered in English or French. Original statements in French have been translated by the researcher to remain consistent with the language of the work and facilitate the reading process.

5   Results and Discussion

This part presents results from the analysis of data collected. It answers the four research sub-questions addressed in chapter four of this work. Results are presented into four main sections, each corresponding to each research sub-question. Answers are therefore proposed to the following questions:

- RQ1: What are the reasons for the failure of the pre-existing public education and public awareness strategy implemented in Cameroon?
- RQ2: How to assess educational needs and capacities of each category of actors?
- RQ3: What are the most appropriate instructional methods and tools to support learning activities?
- RQ4: How to ensure the effectiveness and sustainability of the newly proposed strategy?

For each question a guideline has been provided as follow:

- SRQ1: Evaluate pre-existing public education strategy;
- SRQ2: Identify and analyze actors in play;
- SRQ3: Identify and assess pre-existing methods and tools for information and knowledge sharing
- SRQ4: Determine availability, access and acceptance of pre-existing education methods and tools

5.1   Evaluation of the DRR strategy implemented in Cameroon

Some of the reasons behind the failure of existing disaster reduction strategies have been reviewed in the literature (Ayanji, 2004; Bang, 2008; Bang, 2013; Buh-Wung, Tongwa, Burnley, & Zouh, 2012), but few of them actually address the lack of well-designed public education and public awareness activities within the government's strategy. A self-assessment has therefore been carried out in this work to try to unveil education and awareness related weaknesses of the current DRR model, in order to propose tailored solutions.

Results from the analysis of data show that: information and communication activities for community awareness are not sufficiently planned and carried out during preparation phase[20] (5.1.1.); most of the training sessions organized to enhanced communities' response capacities are done by external partners and delivered only at the level of central government institutions (5.1.2.), and there is a need for collaboration in terms of field interventions and information sharing between various actors (5.1.3.).

5.1.1 Population awareness in disaster risk prevention

The Directorate of Civil Protection (DCP) in Cameroon organized in 1986 is in charge of all activities related to the protection of civilians in disaster risk situations, whether in terms of prevention, response, recovery or mitigation. In reports produced by DCP since 2002, various activities have been implemented. For instance, DCP reports from 2009-2010 states that:

> "In 2009, a total of 59 people out of 407 cases declared in September died of cholera (…). This year, the majority of cases have been recorded in the localities where access to health care is difficult. This epidemic is by far the deadliest of the last five years (…). Between January 2004 and June 2005, cholera killed about 514 people throughout the whole country." (DPC, 2010, p. 40)

Activities implemented to prevent a reoccurrence of such consequences included promotion of health and medical education through population sensitization. Public awareness tools involved broadcasting of essential information on personal and food safety, potable water, hygiene and sanitation practices, etc. (DPC, 2010, p. 44). But end of 2011, a new cholera outbreak has been reported by WHO, with more reported cases and even more casualties.

> During 2011, 9 regions out of 10 have been reporting cases (except for Est). The most affected are Centre, Extrême Nord, Littoral, Nord, Ouest and Sud Ouest whereas the highest CFRs were reported in Adamaoua, Nord Ouest and Sud. As of 11 December 2011, 22 762 cases including 786 deaths have been reported. (WHO, 2012)

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[20]Refers to the first phase of the Disaster Risk Management Cycle

Furthermore, a paper from Bang (2013) evaluates the governance of Disaster Risk Reduction in Cameroun. It focuses on local government's lack of ability to manage disaster risks adequately and comes out with the following recommendations to local governments: ensure that disaster victims, survivors and beneficiaries, and vulnerable populations are incorporated into the disaster management planning and decision-making process that concerns them, and recruit skilled personnel to work in DRR among others.

To appraise involvement of vulnerable population in the decision-making process, a survey of 152 people selected within urban and rural communities in most at risk areas, reveals that 146 of the respondents (96.05%) were not even aware of the existence of a special unit of the government that is in charge of civil protection activities, as the graph below shows.
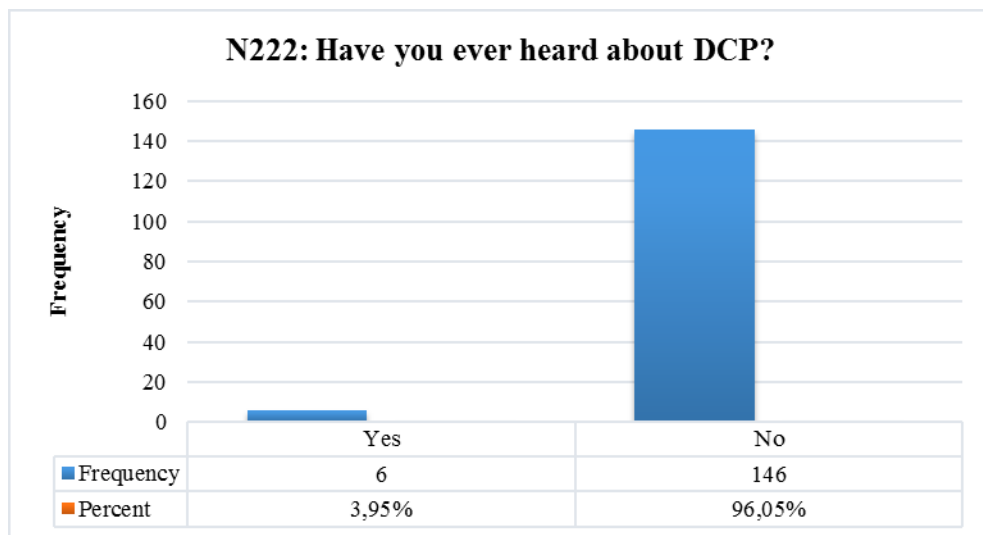
Graph 1: Rate of population aware of the existence of a DCP

Moreover, an evaluation of the effectiveness of awareness campaigns from the DCP and their partners on the field shows that: only about 34% of the sample population admitted to have been sensitized about environmental related problems, whereas more than 65% claimed to have never been sensitized at all.

However, there is a slight difference concerning population awareness in the rural area of Foumbot in the Western region, where more than half of the population (52.17%) has been sensitized. This is due to frequent epidemics outbreaks, which happened in the region, resulting in joint awareness campaigns performed by the Ministry of Health and

their partners. As opposed to the situation in Foumbot, the region of Limbe, in the South-West region recorded the lowest rate of population awareness (about 13%) with a score of more than 87% of the population, who claim to have received no sensitization, despite the high risk of flooding and landslides due to the proximity to the sea. In the two other areas, Yaoundé and Maroua, more than half of the population received no sensitization (respective scores are 56.41% and 64.71%).

The graph below summarizes the sensitization situation among the communities surveyed in the four different regions.

N201. Have you ever been sensitized about environmental related problems? (answer = No)

	Yaoundé	Maroua	Limbe	Foumbot
■ Frequency	22	33	34	11
■ Percent	56,41%	64,71%	87,18%	47,83%
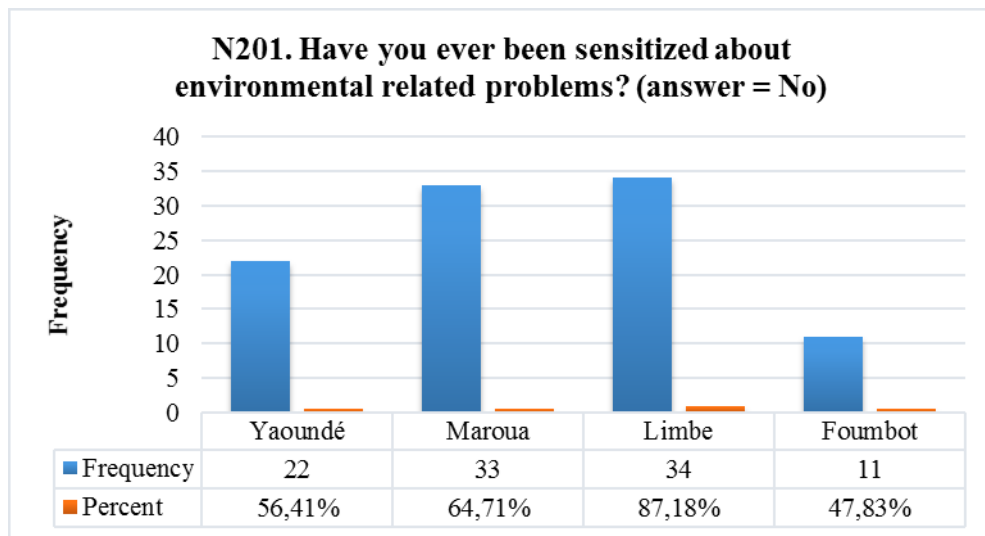
Graph 2: Sensitization situation in the four regions surveyed

Will regards to early warning, the population is informed through a series of directives published by the MINTAD. For instance, in its reports from 2011-2012, DCP published a series of safety instructions to be followed in case of a large variety of disasters like fire, seismic activities, volcanic eruptions, flooding, epidemic, etc. (DPC, 2012, pp. 77-92). Unfortunately, access to these reports is not made easy for the population. However, at a more local level, information is shared through a structured channel.

In case of a disaster's warning like:

Eruption/Seismic activities:

> There is a detector around Mount Cameroon whenever there are volcanic activities. The observatory immediately informs the competent administrative authority who immediately refers to the hierarchy till the central unit in Yaoundé. Then instructions come from the central unit and are transmitted to local authorities and local representatives (chiefs) who are responsible for informing the population. (INT01, NRO S-W. R.)

Epidemics:

> "In case of risks, NRO focal point in the governor's office receives an administrative brief from MINTAD informing about the risk. The NRO focal point passes the information to DOs, and DOs to SDOs, SDOs to local chiefs, and local chiefs to communities. Some of the measures to be undertaken are already explicitly suggested by the central unit into the brief. DOs, SDOs and Mayors are the one to sensitize the population. Activities are carried out in market places and population is also informed through TV and radio". (INT02, NRO W. R.)

Flooding:

> "Population is informed through radio and TV." (INT08, SDO S-W. R.)

This shows that, there are nonetheless early warning strategies already implemented. Beside information sharing, there is also a need to ensure adequate capacities to respond to an occurring disaster.

5.1.2   Decentralisation in the planning of NRO activities

Buh-Wung Gaston, Aka F. Tongwa, Clementine Burnley, and Zouh T. Isabella (Buh-Wung, Tongwa, Burnley, & Zouh, 2012), in a paper entitled "Local governance in Disaster Risk Reduction in Cameroon", analyze progress in the implementation of the Hyogo framework from the civil society perspective, particularly the role of local governance. The authors determined significant scope for improvement on the role of individual local governance. They concluded that an effective improvement of DRR at a

local level depends on a series of factors among which enhancement of capacity of local authorities and local communities to prepare for and respond to all types of disasters.

In fact, the decentralization process in terms of staff training is planned but not evenly available in each of the ten regions of the country. For instance, National Risk Observatory (NRO) committees in regional offices are not sufficiently equipped in terms of staff training.

From top (Ministry) to down (local population), there is supposed to be a national focal point for NRO, 10 regional focal points for NRO, 01 NRO focal points in each of the Divisions, and 01 local focal point for NRO in each of the Sub-divisions. On the field, the situation is as follow:

> "There is only one focal point for NRO in the region. There are no focal points at the level of divisions or sub-division, hence the urgent need of trained personnel." (INT01, NRO S-W. R.)

> "I am the only focal point at the level of the region and I work in collaboration with the Ministry. There should also be focal points at the level of divisions and sub-divisions, but until now, I am still waiting for designated focal points to show up, in order to discuss about the risk prevention strategy for the region." (INT02, NRO W. R.)

However, as concerns health related issues, the hierarchy is better organized and effective. The Ministry of Health is a partner of DCP and has competencies with regards to all health-related issues like epidemics. The decentralization process is made easier through the use of the already existing health information system.
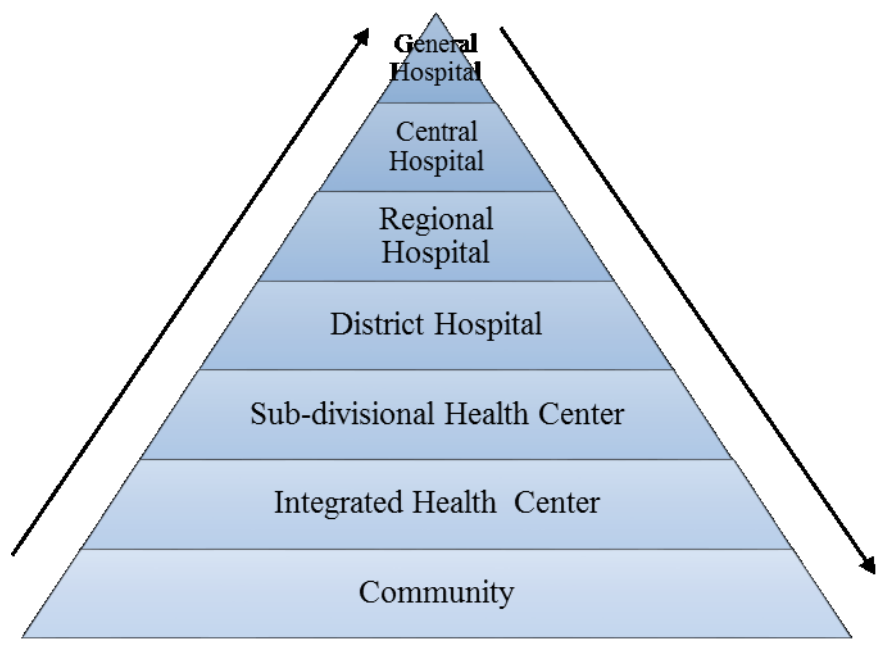
Graph 3: Pyramid of Health Information System in Cameroon (Author's own mapping)

There is a communication focal point at every level, which is in charge of relaying health information.

5.1.3 Collaboration between stakeholders

Due to the fact that the Ministry of health already benefits from well established relationships with a wide range of international partners, staff training and joint interventions on the field are ensured with organizations like WHO, Red Cross, GIZ, etc. and trainings are organized on a regular basis.

> "There are training sessions under the form of meetings, working sessions, with regular partners of the Ministry (WHO, Red Cross, etc.) and GIZ (for family planning). Major axes of awareness campaigns are discussed and some representatives ("mobilisateurs") will be trained. These focal points I turn will ensure the training of sensitization staff at local levels." (INT03, Expert Min. of Health)

> "WHO is technical advisor to the Ministry of Health. It is also the coordinator for all health partners. In case of joint actions however, the lead is ensured by the MINTAD." (INT04, Expert WHO)

However, the national report[21] on the implementation of the Hyogo Protocol in Cameroon published in December 2014 highlights the fact that there is no harmonization of interventions in awareness campaigns among various actors.

Insufficient collaboration is observed mostly among actors from the educational sector. For instance, actors from national education institutions complain about not being involved in the design phase of environment and climate change related projects proposed by international partners.

> "Geography lecturers should be consulted during the design phase of projects that focuses on environment and climate change awareness in Cameroon, especially as concerns the content of the message to be delivered. Unfortunately, international partners design, implement and evaluate their projects based on their own agenda and once the work is done, they simply invite us to share and approve the results." (INT13, Expert Dep. Geo.)

Such an attitude from NGOs could be explained by the intrinsic nature of the concept of NGO itself. In fact, a non-governmental organization is a non-profit organization, which is not subject to international law. NGOs are generally financed by private funds and are characterized by the nonprofit of its action; financial independence; political independence; and the notion of public interest. Because they operate with private funds, they work on a project base approach and within specific time-frame and are mostly evaluated by their donors.

In a report, the World Bank observes that NGOs are increasingly involved in economic and social development process in countries. Results from World Bank studies on national NGO sectors identified "imprecision, restrictiveness, arbitrariness, or unpredictable application of laws relating to NGOs" as "major problems hampering the development of the sector and preventing individual NGOs from achieving their potential" (World Bank, 1997; World Bank, 1997-9).

In a nutshell, the different nature of partners' institutions, coupled to their way of functioning that are not similar may hamper the possibility of joint actions, hence the

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[21]Rapport national de suivi sur la mise en œuvre du Cadre d'action de Hyogo (2013-2015) – Interim : accessible viahttp://www.preventionweb.net/english/hyogo/progress/reports/National

necessity to find a new way of collaboration between partners that will involve sharing information, experience and best practices while keeping each one's individuality.

5.2   Identification of actors involved in DRM in Cameroon

As mentioned earlier in the work, actors involved in DRM in Cameroon belong to four categories: government, NGOs/IOs, Educational Institutions and local Communities. For an easier analysis and a smooth presentation of results, they have been classified into two groups A and B, as already explained in (5.1.).

5.2.1   Group A stakeholders

Group A stakeholders has been analyzed following criteria like actor's category/institution, actor's position and role in the management of disasters and risks in the country, risks identification, problem identification and needs assessment.

➢   **Actors' category, position and role**

Criteria **actors' category/institution** and **actors' position and role in the management of disasters and risks in Cameroon** represent one of the criteria underlying the selection of Group A stakeholders. Therefore, these criteria were presented in the description of raw data (5.1.). In order to avoid redundancy, a summary table of all experts selected for the research, including their distribution per city and their areas of expertise is presented below without further details.

Table 9: Group A stakeholders' typology and role in DRM in Cameroon

Stakeholder's category	Institution	Role in DRM
Government	MINTAD/DCP	- Decision making on development policies - Civil protection policies - Risks identification and DRR activities
	MINPOSTEL	- Ensure public access to ICT facilities (community radio and TCP projects)
	MINSANTE	- Decision making on health-related policies - Public health awareness activities and training
NGOs/IOs	UNESCO	- Public education and public awareness - Access to ICT (community radio project)
	WHO	- Public health awareness activities and training (of MINSANTE staff and population as well)
	GIZ	- Training activities for farmer on climate change
	French Red Cross	- Public health awareness activities and training (mostly with population)
	CIPCRE	- Training activities for farmer on climate change
	Bona Kana Community Radio	- Broadcasting of national and international information in local languages
Educational Institutions	UY 1	- Implementation of training programmes of the virtual university - Maintenance of equipment
	ENS Yaoundé	- Vocational training of Geography teachers for Secondary schools
	University of Buea	- Decision making on staff and teaching policies - Design, implementation and evaluation of the teaching programmes at the University
	University of Buea	- Training of university students in communication and journalistic skills - Experts support for the training of community radio staff at MINPOSTEL (project based)
	ENS Maroua	- Vocational training of Geography teachers for Secondary schools
	ISS	- Training of university students in environmental sciences

> ➤ **Actors' perception of hazards**

The Directorate of Civil Protection in Cameroon published the cartography of most at risk areas, and the National Risk Observatory is in charge of providing a national map on risks identified in each region of the country. These facts could account for the cohesion in the identification of risks as perceived by the government, Non-Governmental Organizations and educational institutions. A classification of environmental related risks, at a national level according to information collected from the above-mentioned stakeholders; show that floods and landslides are the most occurring disasters. As concerns health risks, cholera, and malaria are the predominant epidemics. These results are summarized in the graphs below:

Environmental risks' identification

	Floods	Landsli des	Drought	Hot wings	Eruptio n	Deforest ation	Pollutio n	Other
■ Frequency	17	11	9	8	7	5	4	2
■ Percent	80,95%	52,38%	42,86%	38,10%	33,33%	23,81%	19,05%	9,52%
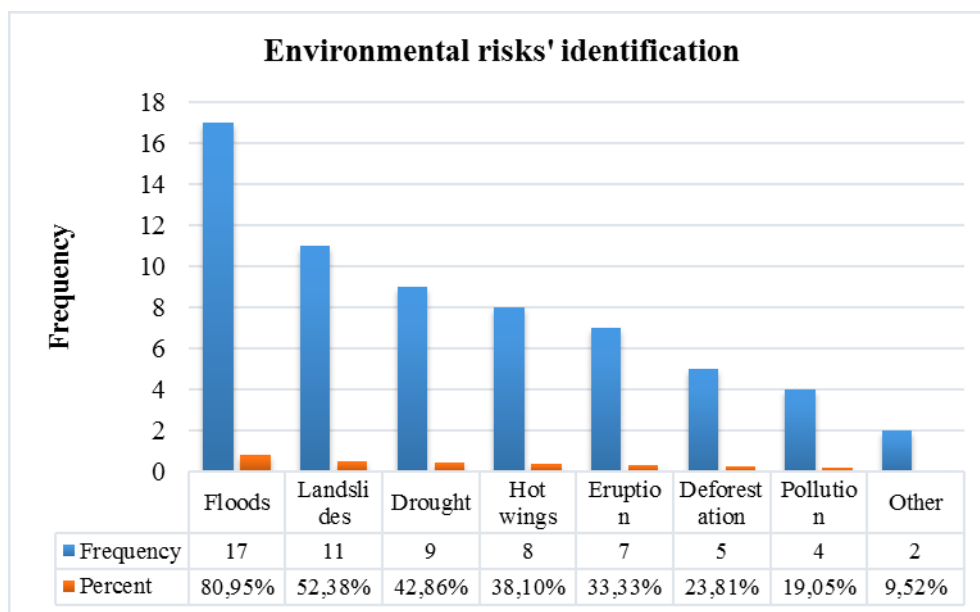
Graph 4: Environmental risks' identification according to Group A stakeholders
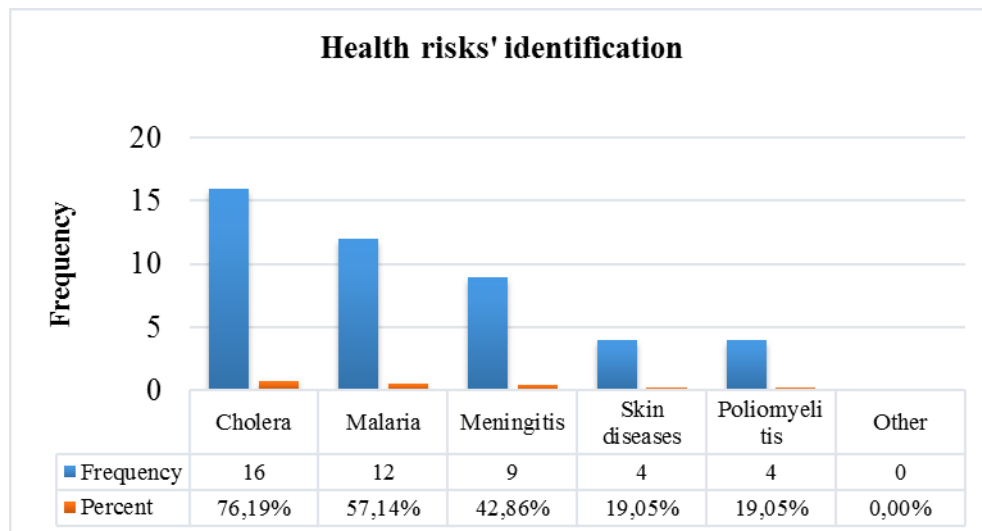
Graph 5: Health risks' identification according to Group A stakeholders

According to these stakeholders, exposure of the population to such risks results in casualties, diseases, financial and material loss, migration, psychological trauma, road accidents, food and water scarcity, air as well as water pollution, etc.

From the analysis of data, one interesting fact has been observed about possible causes or aggravating factors to consequences of the above-mentioned risks. Despite the fact that government, Non-Governmental Organizations and educational institutions agree on the types of risks faced by population in most at risk areas and their consequences, they do not share the same opinion when it comes to the reasons behind such a bad impacts of climate change risks. Divergence of opinions arises between to aggravating factors especially: stubbornness and ignorance.

In fact, government representatives believe that the population fails to overcome impacts of environmental and health risks because of a denial of their existence, but most certainly because of stubbornness.

> "Population is informed about risks of flooding due to the bad condition of the dam. Those living near the dam were requested to relocate themselves elsewhere but they refused. With the help of armed forces, there were forced to leave the area close to the water stream but few days later, we realized that most of them settle back to the areas at risk. There is a constant fight between armed forces and the population who proved to be very stubborn." (INT11, SDO Maga)

100

On the contrary, NGOs think that the population fails to overcome impacts of environmental and health risks because of ignorance, hence the need to intensify awareness campaigns. As concerns experts from Educational Institutions, both stubbornness and ignorance are responsible for population failure to overcome such a situation. They believe that population stubbornness is aggravated by their ignorance. Therefore, the focus should be put on awareness through formal and informal means of education.

The graph below schematizes the above-mentioned divergence of opinion between the stakeholders.
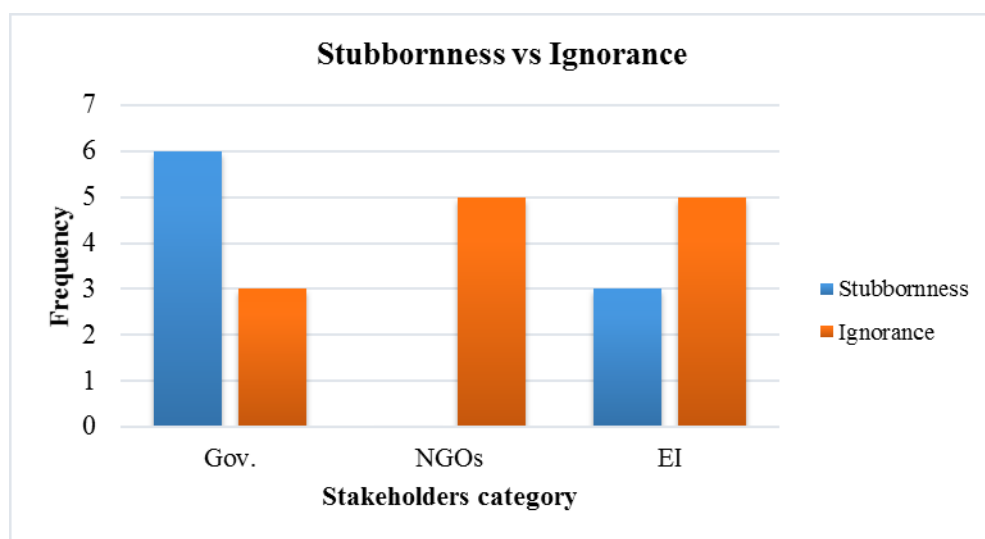
Graph 6: Stakeholders' disagreement on reasons behind population lack of adaptive capacities

➤ **Problem identification and needs assessment**

Based on results from the literature, five main problem areas had been identified as reasons for the failure of pre-existing DRR strategy in Cameroon, namely experts' support, adequate educational strategy, technical infrastructures, qualified staff, and collaboration between stakeholders. Interviews of experts from the government, Non-Governmental Organizations and educational institutions aimed to validate these problems.

Results from the analysis of interviews validate the above-mentioned problems, but also show that government, Non-Governmental Organizations and educational institutions

express needs in different areas. In fact, government and educational institutions complain about a lack of adequate technical infrastructures whereas for Non-Governmental Organizations, availability of technical infrastructures is not an issue at all. The same applies for the availability of qualified staff.

As regards adequate educational strategies, educational institutions and Non-Governmental Organizations face fewer issues than government. This is due to the fact that international organizations like UNESCO, Red Cross, GIZ, etc. have a long experience of public education and public awareness. Educational institutions (because of the nature of their activities) possess qualified staff and are well equipped in terms of education competences. Unlike these two, government is more into decision making and elaboration of policies. Unfortunately, all stakeholders agree on the problem of collaboration between all of them. This low level of collaboration may account for the lack of adequate public awareness and public education strategies into government's DRR activities.

5.2.2   Group B stakeholders

Criteria selected to analyze group B (communities) include: age, gender, academic background, occupation, ethnic group and religion, risk perception and experience.

Communities are the first victims of climate change impact in general. Communities under study in this research work live in most at risk areas in Cameroon. As described in the research design and the description of raw data, the sample selected to represents this group of people is distributed in four main areas as follow: 39 respondents an urban area (Yaoundé, city capital), 23 respondents in a rural area (Foumbot), 39 respondents in a coastal area (Limbe, touristic city), and 51 respondents in a dry area (Maroua), for a total population of 152 informants. Analysis of this category of stakeholders, in the light of the above-mentioned criteria, shows the following results:

➢ **Age range**

The age criterion is important in the selection of adequate instructional methods and tools. Younger students usually adapt more easily to methods that may not match their learning styles while older may need more matching strategies. According to Partridge's (1983), learner's age is a criterion that educators should consider while selecting instructional

strategies. In this study, respondents range from the age [<20, 71+] following an interval of 10 years. For legal reasons[22], respondents of age <20 are not younger than 18 years old. Despite the fact that results show that the sample population is not evenly distributed between age intervals and between cities, the majority of respondents belong to interval [21-30]. The graph below summarizes the age range criteria of the sample population:

Age distribution

	Under 20	21-30	31-40	41-50	51-60	61-70	71+
Frequency	26	73	27	20	4	1	1
Percent	17,11%	48,03%	17,76%	13,16%	2,63%	0,66%	0,66%

Age range
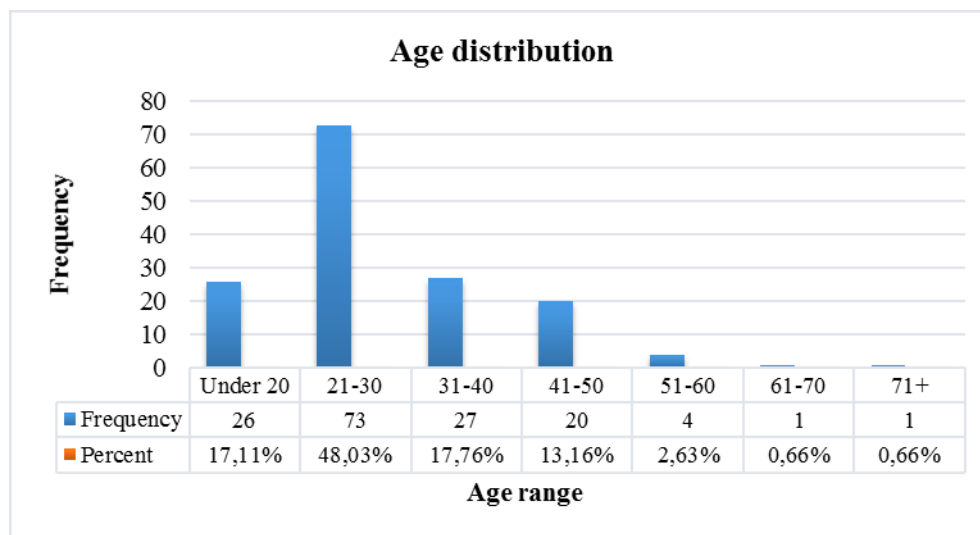
Graph 7: Age distribution of communities' group

➢ **Gender**

The gender criterion has been taken into account here as it has an impact on the choice of materials and technologies. For instance, women are more open to the use of TV programs as means of communication whereas men will mostly prefer Radio programs. This will be discussed in more details later in (5.1.3.). As the sample population is almost equally distributed as the graph below shows, this will provide a more balance point of view in the selection of adequate methods and/or tools.

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[22]In Cameroon, the age of majority is 21 years old. Under the age of 21, a parental advice is required, except for criminal responsibilities where the majority age is 18 years old.
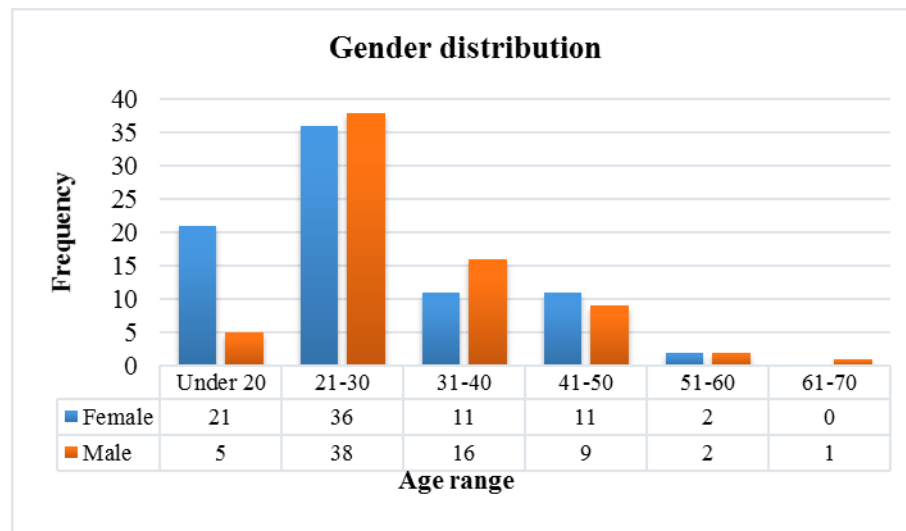
Graph 8: Gender distribution of communities' group

> ## Academic background

Literacy rate in Cameroon by gender from age 15 and above is 67.9% for male and 82.6% for women (MICS5, NYP)[23]. This shows that more than 75% of the population has a minimum of primary school level of education. Results from the analysis shows 84.95% of the total sample population have at least attended secondary school and among them almost half of them have a university level. A deeper analysis shows that those with a university degree are located in cities where can be found at least one of the state's universities: Yaoundé and Maroua. In Limbe also, a fairly good range of people (33.33%) attended university: this is due to the proximity of the University of Buea (one of the state universities) in the neighboring city Buea[24]. On the contrary, in Foumbot which is a rural area, more than 95% of people surveyed have a level of education of secondary school or less. The graph below summarizes level of education of the surveyed population.

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[23] Enquête par grappes à indicateurs multiples (MICS5), 2014, initial report from July 2015. Final results are not yet published.

[24]Distance between Limbe and Buea is about 39km. Travelling from one city to the other with local transportation lasts about 20-30 min.
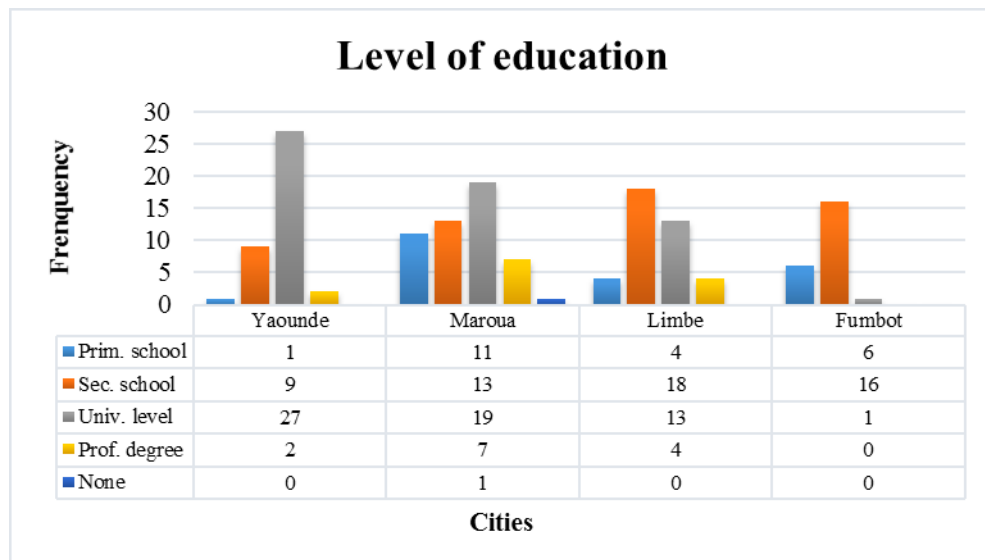
Graph 9: Distribution according to level of education

➢ **Occupation**

Occupation is a criterion that is also useful in determining whether occupational activities of the population that represents the learners influence their availability and acceptance of a specific method or tool for knowledge sharing. For instance, the use of radio broadcasting as a means for community awareness depends on the occupational activities of the listeners. About 47% of the sample population is students who need to leave their homes by 06:00 am to get to school, and most of the parents and elders in rural areas are farmers or traders who usually leave their homes early in the morning. Radio programs meant for these categories of people will be broadcasted depending on their availability.

> "A large majority of our audience is constituted by farmers and traders. When we are planning our radio programs, we deliver awareness messages between 05:00 am – 09:00 am when they prepare to leave their homes and 04:00 pm – 09:00 pm when some of them are already back from their daily activities." (INT12, Head of Programs - Community radio).

➢ **Ethnic group and religion**

As stated in chapter four, Cameroon hosts about 279locallanguages from various ethnic groups. The country is divided into two main religious groups: Christian 40%, and Muslim 20%. The remaining 40% of the population practice indigenous beliefs. These two concepts of religion and ethnicity are in a way interrelated as religion and ethnicity

put together build up people's cultural identity. As stated by Jenkins (2008), "religion is one of the factors that help define culture, and thus ethnicity. There are cultures in which the religious identity is a primary defining factor."

In Cameroon, each tribe has stereotypical traits associated with it. Although it seems adventurous to take into consideration such stereotypes with such a huge number of tribes, the success or rather say acceptance of a learning model by communities also depends on all those elements.

For instance, doing something as simple as asking a question in Cameroon can lead to a quite tricky situation as it is commonly acknowledged that *Cameroonians always answer a question by asking another question[25]*.

Another example is when trying to evaluate people knowledge of a topic:

> "Cameroonians will rarely say I don't know to a question, and will instead give a very vague or even inaccurate answer. Asking open-ended questions (do you know how far the next town is?) will allow you to gauge the sureness of an answer more so than a closed-ended one (is the next town 50 km from here?)"[26].

Formal as well as informal communication is also influenced by the cultural and religious background of the people involved in the communication process. For instance, "in informal situations touching can be an important part of communication. Both men and women rest their hands on each other's knees/legs when sitting and sometimes hold hands when walking"[27]. From an "outsider" point of view, this can be true, but usually in more urban areas where people from different cultural backgrounds live together and are more "open" due to globalization. However, in remote rural areas where cultural habits are still strongly expressed in people's behaviors, touching while discussing between women and men is considered somehow unacceptable, because too intimate.

These few cultural related examples account for the fact that cultural (meaning ethnic and religious) aspects are important while designing a learning model a community as diversified as the one under study.

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[25]This sentence has even become a joke in between African communities.
[26]http://www.intercultures.ca/cil-cai/ci-ic-eng.asp?iso=cm#cn-3
[27] Idem

➢ **Risk perception and experience**

In a paper presented at the Summer Academy for Social Vulnerability at the United Nations University-Institute for Environment and Human Security (UNU-EHS) in Germany in 2008, Henry Bang (Bang, 2008) analyzes social vulnerability and risk perception to natural hazard in Cameroon. His paper was based on the case study of the Lake Nyos Disaster that occurred in 1986. It sought to unveil the social nature of vulnerability and explain how risk is viewed based on perceptions.

In the same perspective, it is necessary to understanding pre-existing knowledge and community members' experience on the problem of climate change and environmental related issues in the country, in order to propose adequate learning objectives for the design of a CoP on climate change awareness. Local communities represent the first victims of climate change and environment related disasters. To develop relevant policies to ensure their safety, it is necessary to evaluation their perception of the risks they are exposed to.

It appears from the analyses, that the population surveyed has quite a good knowledge of climate change related problems in their respective regions. When asked about what they know of the concept of climate change, most of the respondents identified climate change as a change in weather conditions, seasons (having irregular season occurrences and lengths), and defined climate change by providing a list of risks they are exposed to, and that they consider as impacts from a change in the climate. Despite the fact that some areas are more prone to a specific category of risks, the graph below shows a summary of perceived risks at the national level by communities. A specific typology of risks in each of the region surveyed is not really relevant for the analyses, as the emphasis is put on risks types in order to identified possible topics for awareness messages.

Types of risks

	Floods	Landslides	Drought	Pollution	Hot wings	Deforestation	Eruption	Other
Frequency	52	29	22	21	11	4	2	2
Percent	34,21%	19,08%	14,47%	13,82%	7,24%	2,63%	1,32%	1,32%
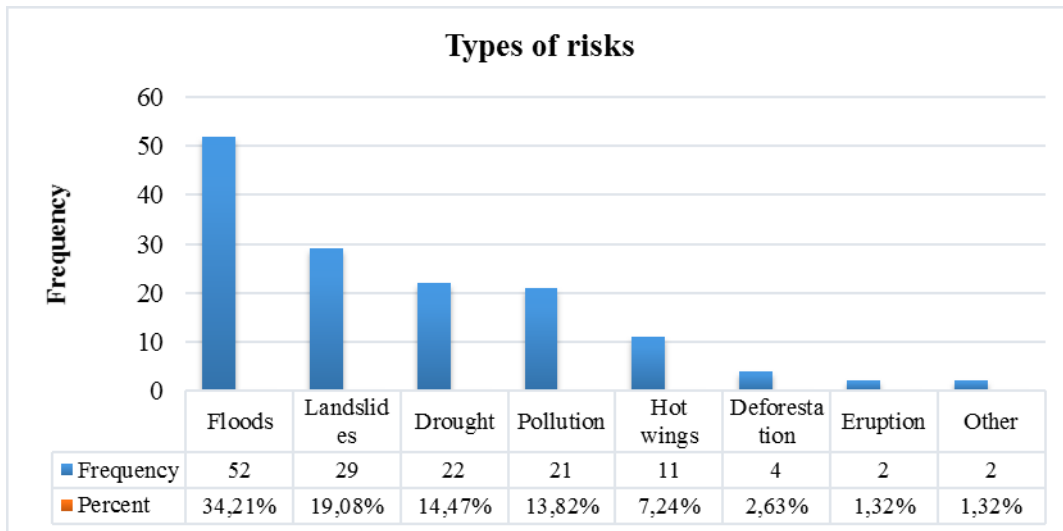
Graph 10: Types or climate change risks as perceived by the communities

Communities also identified health related problems as results from the above mention risks. Just like types of risks, information on environmental related diseases communities are suffering from, is useful in determining the content of health-related awareness messages. Some epidemics are registered more frequently in specific areas, but again the graph below shows a summary of health risks as perceived at the national level by communities.

Types of diseases

	Cholera	Malaria	Meningitis	Polio.	Other	Skin diseases
Frequency	63	55	22	10	6	2
Percent	41,45%	36,18%	14,47%	6,58%	3,95%	1,32%
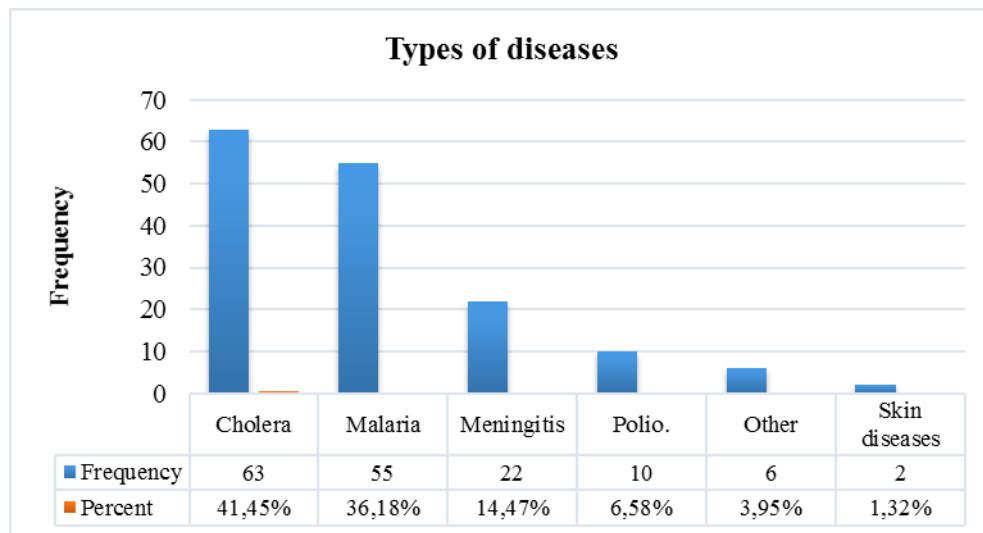
Graph 11: Types or health risks as perceived by the communities

When asked about adequate knowledge on what do to in the event of a disaster, whether environment related or health related, in all the four cities, respondents answered "no"

with the following scores: 97.44% in Yaoundé, 74.51% in Maroua, 87.18% in Limbe and 100% in Foumbot. In a nutshell, more than 87% of the population surveyed isn't sure of what to do in case of a climate change or health related disaster. Results are summarized in the graph below:
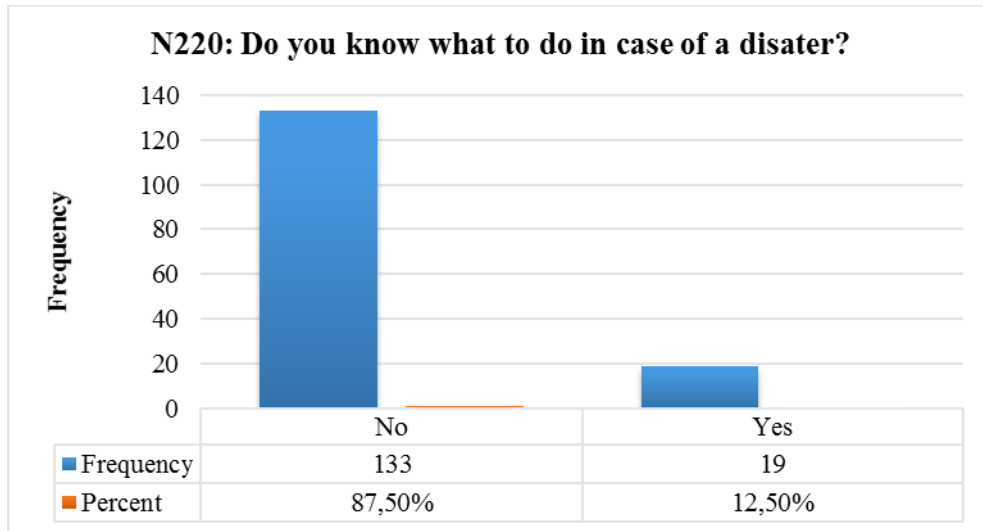
Graph 12: Communities' knowledge of disaster response

As most of communities' members have no proper knowledge on how to respond to disasters, their adaptation strategies are based on self-experience and this varies from one household to the other.

5.3 Identification and assessment of pre-existing information and knowledge sharing methods and tools

An assessment of pre-existing methods and tools for public education and public awareness is necessary in order to select adequate strategies for communities' awareness and technology tools to support knowledge sharing among all stakeholders involved in Disaster Risk Management in Cameroon. In the DRM strategy implemented in the country, two distinct dynamics can be observed: on the one hand, there is the knowledge sharing system between stakeholders group A (Government, Non-Governmental Organizations and Educational Institutions) among themselves (5.2.3.1.). On the other hand, there is the dynamic of knowledge sharing between stakeholders group A and stakeholders group B (communities) (5.2.3.2.).

5.3.1 Information, communication and knowledge sharing system among actors from Government, NGOs and Educational Institutions

The current part describes the collaboration system between NGOs, educational institutions and government. From the analysis of data collected on the field, the communication system and knowledge sharing among these stakeholders, could be analyzed through the following relationships: Central Government and decentralized institutions, Government and NGOs, Government and Educational Institutions, and finally NGOs and Educational Institutions.

➢ **Government: between central administration and decentralized representations**

This relationship describes the communication mechanism and knowledge sharing system between central administration and its decentralized representations. Central administration communicates with its decentralized representations with the means of administrative mail/e-mails, instructions from ministries to its delegations, official statements, decisions, decrees, laws, field visits, etc. For instance:

> "In case of cholera epidemic for instance, the Ministry of Health will alert all regional delegations through internal administrative courier, stating the steps to take in order to fight the epidemic back. Sometimes instructions are already given in the documents so we just have to implement decisions taken at the level of the central administration." (INT03, Expert Min. of Health).

> "During field visits of the Ministry in the region, we generally seize the occasion to address our complaints. For example, during his last visit, we addressed the need for a training center for NRO staff in the region to the Minister of Territorial Administration and Decentralization." (INT02, NRO W. R.).

- ➢ **Between Government and NGOs**

This relationship describes the communication mechanism and knowledge sharing system between government and NGOs. Cameroon has created a framework for NGOs and Civil Society Organizations (CSOs) to operate legally. This framework allows creation of NGOs and CSOs under the Law on Freedom of Association[28]. (Tsanga, 2013).

Moreover, a national dialogue framework between the Government and CSOs has been created under the authority of the Office of the Prime Minister, Head of Government. The dialogue framework is led by the Prime Minister, Head of Government as chair-person and the Minister in charge of issues related to NGOs as vice chair-person. It also comprises one (01) representative of several other Ministries. One of the goals of the dialogue framework is to serve as an appeal body for the civil society in times of need (Agora Consulting, 2015). In this regard, communication between government and NGOs is mostly done through calls for expression of interest.

From NGOs to government, knowledge sharing is done mostly through the organization of joint meetings by any of the two parties. NGOs also provide experts support for training workshops proposed to government institutions in order to share knowledge for capacity building. Also, in case they are recommendation to be addressed to the government by NGOs, they provide consultancy services, and produce evaluation reports on joint actions implemented with the government as well as reports on their own activities in the country.

- ➢ **Between Government and Educational institutions**

Whether from the public sector or from the private sector, government interact with all of its partners using almost the same channels. In the case of Educational institutions, government communicates through the creation of educational policies to be implemented at the national level. Ministry of Higher Education (MINESUP), Ministry of Secondary Education (MINESEC) and Ministry of Basic Education (MINEDUB) are the three (03) government partners in charge the educational system of the country. They determine educational programmes to be implemented in the country following proposals from Educational institutions. To foster communication between these ministries and educational institutions, there are decision committees at the level of each ministry

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[28]Law N0 90/053 of 19 December 1990 and the Law relating to Co-operative Societies or Common Initiative Groups (Law 92/006 of 14 August 1994)

constituted by members from all parties, and who are in charge of design, and evaluation of educational policies. For instance, in MINEDUB there are the National Commission on Accreditation of School Textbooks and Training Materials, the National Commission for Programs and Diplomas. Decisions from ministries are made available to educational institutions through speeches and official releases[29].

From educational institutions to government (ministries), information and knowledge sharing is made through working sessions, meetings, consultative committees, etc. for instance, before implementation of new teaching programs at state universities, programs' content are proposed by lecturers from each department, then sent for evaluation to the Faculties, then to the Rectorate and finally to the ministry for validation.

➢   **Between NGOs and Educational institutions**

Just like with government, information and knowledge sharing from NGOs to Educational institutions can be described in terms of experts support and facilitators support for training workshops. For instance, actors from educational institutions are invited to collaborate to projects from NGOS, to attend seminars, meetings, or workshops organized by NGOs in order to share information, provide feedbacks, etc. NGOs share information on their activities under the form of reports available and accessible to their educational partners. NGOs also provide consultancy on programme evaluation like the National Commission of UNESCO at the Ministry of Basic Education.

From Educational institutions to international NGOs, collaboration is expressed through partnerships agreements that may express institution's needs in terms of experts' support, technological support, financial support, etc. With national NGOs or local associations, Educational institutions provide experts to support training activities, and perform peer evaluation among others. Information and knowledge sharing's dynamic works in a different manner when communities are concerned.

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[29]http://www.minesec.cm/index.php?p=gouvernance&hl=en_US

5.3.2 Knowledge sharing between communities and stakeholders group A

Information and knowledge sharing between communities and stakeholders group A can be appraised through the analysis of three (03) relationships: Communities/Government, Communities/NGOS, and Communities/Educational institutions. Results from the analysis of data collected show the following results:

➢ **Between Communities and Government**

Information and knowledge sharing between stakeholders group A and communities, is mostly a one-way relationship, especially with this category of actor. Government usually plays the role of information provider, whereas communities play the role of receiver. Communication between government and communities is done through various means, including radio announcements, TV announcements, awareness campaigns (during fairs and expositions), publications, or even oral speeches delivered by administrative authorities.

> "Awareness campaigns and information sessions are organized by DPC during celebrations like the International Day of Civil Protection, during national and international fairs, in markets, etc." (INT10, NRO Coordinator)

> "Divisional Officers, Sub-Divisional Officers and Mayors are the one to sensitize the population. Activities are carried out in market places and population is also informed through TV and radio." (INT02, NRO W. R.)

> "Population sensitization is the task of the Communication Focal Point. From what I know, we make use of radio and TV most of the time because it is very useful to touch a wide range of the population. Focal points from decentralized institutions (divisional and sub-divisional offices) work hand in hand with focal points in health districts." (INT03, Expert Min. of Health)

> Staff members from the Sub-Divisional Office are sent to the Lawal[30] generally because he is the one directly in contact with its population. (INT05, SDO F-N R.)

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[30]Local chiefs also assimilated to head of quarters.

Communities are not involved into the decision-making process, sometimes even on topics related to their own well-being. Because there is no dialogue between the two actors, communication fails to be effective. As a result, to this lack of communication, methods and tools used by the government to share information with and train communities are not adapted to communities' needs. Sometimes, communities simply reject any communication attempt from the government.

For instance, a comparative analysis of information sharing methods and tools as used actually (proposed) by the government during campaigns, and information sharing methods and tools expected (preferred) by communities shows that: government uses mostly oral presentations, publications, and demonstrations scenario to share information with communities. They barely make use of TV or radio programs. On the contrary, communities prefer radio and TV programs and are not really interested in reading publications.

Proposed vs. Preferred sensitization methods/tools

	Publications	Audio/Vid.	Social med.	Mobile	Demonst.	Games	TV prog.	Radio prog.	Oral pres.
Proposed	51	33	11	9	76	21	0	0	119
Preferred	37	93	9	50	0	0	85	90	103
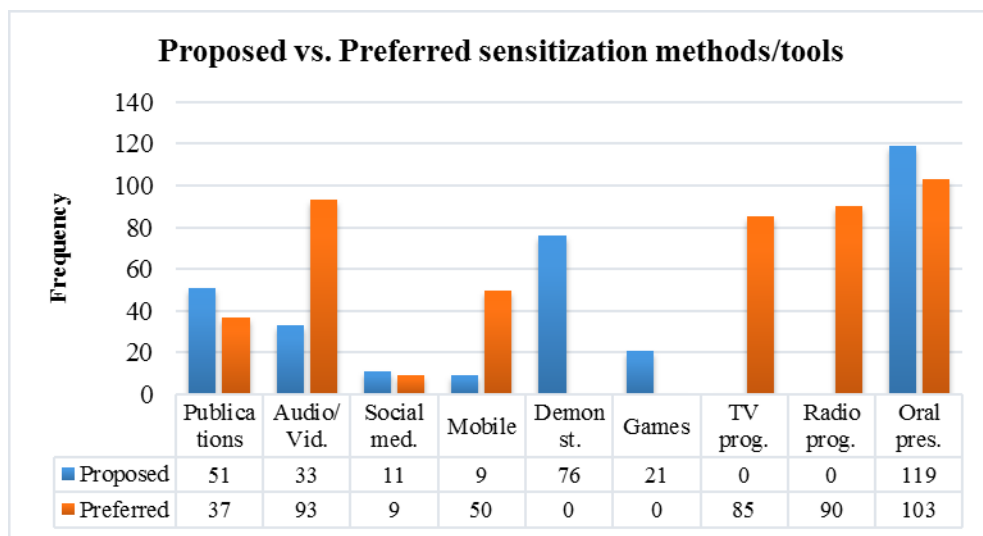
Graph 13: Example of inadequate information sharing method/tools between Government and communities

In the same way, during awareness campaigns, the government is using English and/or French as language for communication, whereas communities prefer the use of their national languages, or at least the dominant national language in the region as the graph below shows:

Proposed vs. Preferred sensitization language

	English	French	Local
■ Proposed	3	44	4
■ Preferred	18	25	56
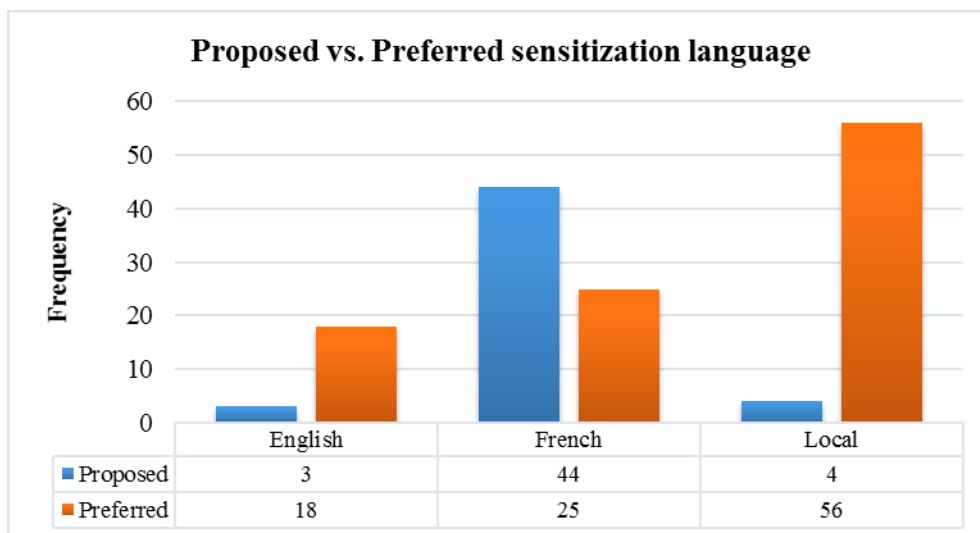
Graph 14: Example of inadequate choice of language during awareness campaigns

Moreover, communities do not believe in the message delivered by the government because they do not trust the speaker selected by the government. Whereas government will choose the administrative authority to deliver the awareness message, communities will rather prefer to listen to a local leader, a local chief or a religious leader, as the graph below shows:

Proposed vs. Preferred speaker

	Adm. Author.	Expert	Doctor	Local or religious leader/chief	Teacher	Other
■ Proposed	17	13	8	7	5	2
■ Preferred	32	17	9	41	0	1
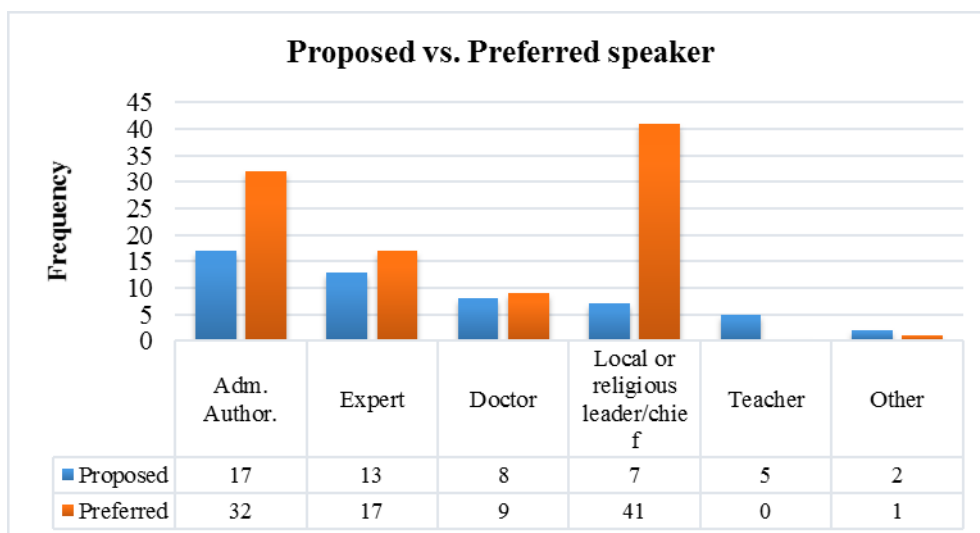
Graph 15: Example of inadequate choice of the speaker during awareness campaigns

This divergence of opinions between communities and government, results in a loss of interest from communities about awareness campaigns organized by the government. As cascading effect, communities share the belief that government does not take their situation seriously. To overcome this situation, it may happen that some members of the community organize themselves into small association and collect complaints from the rest of the community in order to submit them to administrative authorities. As Bang (2013) stated:

> "Generally, disaster survivors have no influence on the decision-making process that affects their well-being. To make their voices heard, social groups (…) have emerged from within the disaster-affected community" (Bang 2009 cited by (Bang, 2013).

➢ **Between Communities and NGOs**

Communication between communities and NGOs is better managed. Due to their long experience in public awareness and public education, and because of their target oriented projects, NGOs are more aware of communities' needs and expectations. The means of communication par excellence is awareness campaigns, but NGOs also perform field visit inside communities to assess their needs, based on in-house projects. As they also work with volunteers from the community itself, it is easier to community members to address complaints to local representations of NGOs in their rural areas.

> "Before the last flooding, members of our vigilance committee observed that the dam was about to break down at Maga. They informed the Lawal, who addressed a letter of complaint to the SDO. In the letter, he explained that the community needed equipment to dig gutters in front of the houses to facilitate the flow of water before the dam breaks. The SDO claimed that roads are public infrastructures therefore, permission could not be granted. Once the flooding happened, we needed help to clear the way from used water in front of our houses. Again, we did not receive a feedback from the SDO. We then addressed a letter of complaint to the Red Cross, in order to request their help. It is finally with the help of the Red Cross that we managed to save whatever was left from our belongings." (HH247, Counselor to the Lawal of Maga)

One of the issues faced by NGOs during information and knowledge sharing is related to the use of local languages.

> "We also carried out information and training sessions with farmer in remote villages. We usually possess all the necessary equipment. The difficulty we usually face is the language problem. Training materials like videos, image box, etc. are written in either English or French. We need to translate them into the local language of the farmers we are training." (INT09, Expert from CIPCRE)

As a way to solve this problem, NGOs make us of translators.

➢ **Between Communities and Educational institutions**

Educational institutions' interaction with communities (population) is confined to the formal education system. Whether from public or private educational institutions, they provide formal school based interventions in a classroom.

At the level of elementary school, knowledge sharing about climate change related topics is done through environment related lessons. For instance, there are lessons on cholera, climate, seasons, etc. these lessons are supported by demonstration exercises performed by teachers or experts invited from the corresponding ministry. At the level of secondary school, topics related to climate change issues are developed into the curriculum of Geography. These geography teachers have been trained in vocational training schools, where they acquired the adequate training. At the level of higher education, there are also departments of Geography and environmental studies.

At all levels, educational institutions implement the national education policy as decided at the level of the government through respective ministries. Methods for communication and knowledge sharing include: lectures, workshop, group presentations, field visits, experiments, etc. Tools for content delivery include: hands-on learning materials, standalone courses, case study exercises, oral presentations, textbooks, audio/video materials, resources for DVD/CD-Rom/USB, etc.

The above-mentioned dynamic of information and knowledge sharing among all categories of stakeholders is summarized in the table below:

Table 10: Information and knowledge sharing system among stakeholders

Sharing system	Actors	Means of communication
Between Stakeholders' Group A	Central Government / Decentralized Representations	- Official courier, administrative instructions, speeches, field visits, decrees, decisions, laws, etc. - Complaints
	Government / NGOs	- National Dialogue Platform, call for expression of interest - Joint meetings, workshops, consultancy, publications, etc.
	Government / Educational Institutions	- Policies, Decision committees, official courier, speeches, field visits, decrees, decisions, laws, etc. - Working sessions, meetings, consultative committees
	Educational Institutions / NGOs	- Partnership Agreements - Workshops, meetings, publications, consultancy
Between Stakeholders' group A and Stakeholders' group B	Government / Communities	- Campaigns, speeches, TV and/or radio announcements, publications, etc. - Local associations, complaints
	Educational Institutions / Communities	- Formal school education (teachings, hands-on learning materials, textbooks, etc.) - Formal school education (exercises, experiments, groups presentations, demonstration, etc.)
	NGOs / Communities	- Field visits, campaigns - Local associations, complaints

5.4 Access to technical infrastructures, capacity to use technology tools and acceptance of the use of technology to support information sharing channel

The current section seeks to provide an answer to the question on how to ensure the effectiveness and sustainability of the new strategy for information and knowledge sharing on climate change and environment related problems in Cameroon? The guideline proposed for this question is to determine and improve availability of technical infrastructures, capacity to use technologies, and community's acceptance of technology

tools. The section will therefore assess the availability of technical infrastructures in Cameroun in section (5.2.4.1.), then results of the assessment of stakeholders' capacity to use these tools will be described in (5.2.4.2.). Finally, an analysis of communities' acceptance of technology tools as information sharing channels is provided in section (5.2.4.3.).

5.4.1   Availability of technical infrastructures in Cameroon

Availability and access to technical infrastructure is one of the major problems for the implementation of technology based learning system in Cameroon. Technical infrastructure here mainly refers to computer equipment, internet access, training equipment, training rooms, and telecommunication network.

As already mentioned in (5.2.2.1.), technical infrastructure is not really an issue for NGOs. However, for government, educational institutions and communities' availability and access to technical infrastructure is still an issue.

With regards to government and educational institutions, to each of the questions: a) Does your institution provides training rooms? b) Training equipment? c) Reliable electricity supply? d) Reliable internet access? Results from the analysis show that, more than 80% of the respondents answered with "most of the time". This shows that indeed technical infrastructure is available, but stakeholders have to deal with uncertainty on whether there will be accessible on a regular base.

As for communities, analysis of surveys collected shows that in Yaoundé and Maroua, more than 80% of the population possess mobile phones, TVs, radios, and computers (laptop and desktop). Whereas in Limbe and Foumbot, major technology tools that the population possesses are TVs, radios and mobile phones. In a nutshell, the main technology tools that all respondents have in common are TV, radio and mobile phones. This is summarized in the graph below:
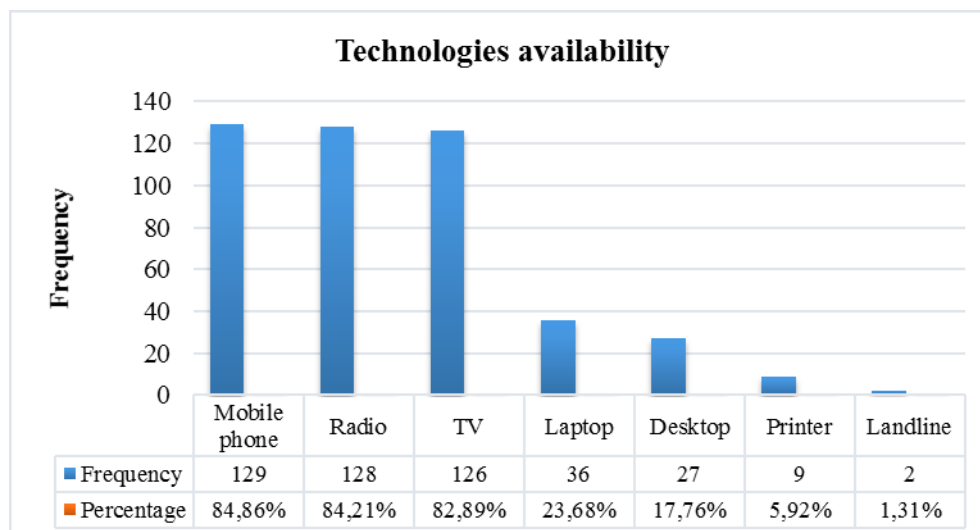
Graph 16: Technologies availability among the population

5.4.2 Capacity to use technology tools

Government, NGOs and Educational institutions are exposed more often than communities to the use of technology tools. In this regard, assessment of the capacity to actually use the above-mentioned technologies has been carried out mostly with communities group.

To perform an assessment of the capacity to use technologies among community members, these later were asked how many people in their households could actually use the above mentioned technology tools. Results from the analysis show that:

- Mobile phones, TV and radio: in all of the four cities, more than 95% of the people surveyed certified that they know how to use mobile phones, TVs and radios.

- Computers and internet access: in Yaoundé, respondents certified that almost everyone in the household knows how to use a desktop or a laptop and internet access. In Maroua and Limbe the situation is balanced: about half of respondents agreed that at least one person in their household could use a computer and internet access, whereas the remaining half said that no one could. In Foumbot on the contrary, less than 10% of the respondents agreed that at least one person in the household can properly use a computer and

internet access, whereas the remaining 90% said no one in the household knew how to use a computer or internet access.

Based on these results, one could be tempted to focus on the above-mentioned technologies as the major means of information and knowledge sharing in the proposed solution.

5.4.3 Communities' acceptance of technology tools as information sharing channels

To assess community's acceptance of technology tools, respondents surveyed where ask the following question: You prefer receiving awareness related information via which of the following tools? The question allows multiple answers and a list of technology tools was provided. Analysis of the answers shows the following results:

Technologies availability

	Campaigns	Video/Audio	TV progr.	Radio progr.	SMS	Publications	internet/Social media
Frequency	94	52	49	41	37	29	10
Percent	61,84%	34,21%	32,24%	26,97%	24,34%	19,08%	6,58%
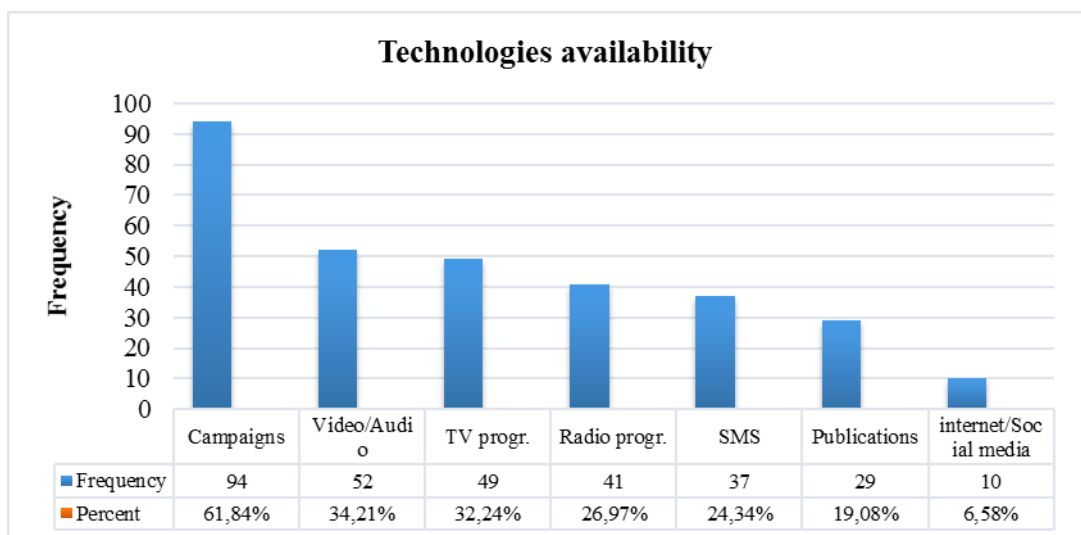
Graph 17: Technology tools acceptance by communities' members

As described on the graph, communities are not interested at all in receiving information via internet, including emails, social media, etc. and very few of them are interested in receiving reading materials. They rather still widely prefer awareness campaigns. As for video and audio materials, as well as TV, radio programs, and SMS (mobile phones) acceptance rate is below 50%.

Information provided by such a result somehow contradicts the fact that these last three tools scored the highest availability rate, considering also the fact that more than 95% of

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the population surveyed certified of their capacity to use the above-mentioned technologies.

5.5 Design of a Community of Practice on Climate Change Awareness in Cameroon

This part consists in setting up canvas and designing a template for the creation of an offline Community of Practice on *Climate Change Awareness in Cameroon.*, rather than designing a fully detailed Community of Practice. The model used for the design of the CoP is based on the three components of a Community of Practice as proposed by Wenger (1998), namely the domain (5.3.1.), the community (5.3.2.) and the practice (5.3.3.). Elements developed for the design of the CoP are based on guidelines proposed by Brault (2010) and EDUCAUSE.

5.5.1 The domain

A CoP refers to a group of people that share information about a common concern. Determining the domain of the CoP therefore, consists in answering three main questions:

1. What is this community's vision?
2. What are the major topic areas to be discussed inside the community?
3. What are the benefits of the community for the stakeholders?

➢ **Vision of the Community of Practice on Climate Change Awareness in Cameroon**

The idea for the creation of a *Community of Practice on climate Change Awareness in Cameroon* stems from the fact that climate change is a threat to the sustainable development of the country as it may result in hazards and disasters that put the country's institutions, environment, economy and population at risk. At the country level, strategies and policies have been put in place to lessen the adverse impacts of climate change. The aim was to develop the capacity of the whole system to anticipate, respond and continue functioning even after the disaster. Several stakeholders are involved into the fight against climate change impacts in the country. Unfortunately, a lack of adequate capacities of some; lack of sufficient knowledge for others; and mostly lack of collaboration between stakeholders hamper the effectiveness and efficiency of possible solutions to the problem.

As a way to overcome such situations, (Kaiser, Köhler, & Weith, 2016) argue that, "one possibility to strengthen actors' cooperation and communication is to establish a knowledge platform to support the implementation and transfer of knowledge stocks". In the context of this research work, the platform proposed to help solve the issue is the design of a Community of Practice that aims to achieve resilience to climate change impacts at the national level through climate change awareness.

> **Learning objectives of the Community of Practice on Climate Change Awareness in Cameroon**

Learning has been defined in this work as "the process of acquiring new, or modifying existing, knowledge, behaviors, skills, values" (Merriam-Webster, 2009). It also refers to a collective construction of knowledge within social interactions (Gasper, 1999). Major topic areas to be discussed inside the proposed community derive from an analysis of the needs of actors involved in disaster risk reduction in Cameroon. A first stock was taken of these needs through a problem identified through a review of the literature (Ayanji, 2004; Bang, 2013; Bang, 2008; Buh-Wung, Tongwa, Burnley, & Zouh, 2012). These problems have then been validated by results from the analysis of data collected on the field. They all converge towards a same goal: develop the capacities of all stakeholders involved through information and knowledge sharing.

Based on these analyses, four main objectives emerge as goals for the proposed CoP:

- Achieve public education on Climate change impacts through information and awareness strategies;
- Foster informed decision making process with regards to DRM policies;
- Collect and promote expertise in the area of climate change education;
- Promote collaboration among the four categories of actors involved in the fight against climate change in the country.

➤ **Benefits of the proposed CoP for members**

The community offers the possibility for *government* to:

- Make more informed decisions: as the needs of all parties concerned will be addressed within the community and taken into consideration during decision-making;

- Enhance coordination during planning and implementation of DRR activities between central administration and decentralized representations;

- Enhance synergies between government and international partners as well as national partners during joint interventions related to DRM;

- Network to keep current on new trends with regards to climate change related educational policies;

- Develop trust in relationships with the communities. As stated by Mc Dermott (2000) cited by (Mitchell & Wood, 2001), "frank and supportive discussions of real problems frequently build a greater sense of connection and trust between community members".

For *NGOs,* the community offers:

- Opportunity to build a scheme of best practices that will facilitate their work on the field: as all partners, can share experience on what awareness strategies work best and what do not;

- Build alliances with other NGOs and/or local associations in order to be more effective and efficient on the field;

- Opportunity to recruit more volunteers to support activities on the field, which is time and cost efficient;

- Access to representatives of rural communities in order to gather information on communities' needs;

- Access to representatives of rural communities in order to address educational and activity support (translators, field guides, etc.).

To *educational institutions*, the community provides:

- Opportunity to build partnerships in order to capitalize more on cooperative education: as the platform creates strong links and trust among members;
- Opportunity to improve communication with CSOs in order to transfer knowledge from tacit to explicit ((Kaiser, Köhler, & Weith, 2016);
- Opportunity to improve communication with peers to enhance professional reputation;
- Networking to keep current on new trends in terms of climate education programs, theories, etc.

To *communities*, the CoP:

- Offers a unique opportunity to express their opinions on decisions and policies that have noticeable impact on their security: as the platform grants them direct31access to decision-makers;
- Access to first-hand information (early warning);
- Access to expertise;
- Access to help in solving everyday problems;
- Provide support in changing habits (farmers trying new varieties of crops, etc.);
- Access to material and financial support from government, NGOs, and local associations;
- Militate for new policies with regards to agriculture, education, land management, etc.;
- Develop a sense of care, a sense of belonging (Benotti, 2002), and in a certain extent patriotism/

Benefits for members of the proposed community have been presented above but none need to know who constitute those members.

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[31] From a personal experience doing research on people's acceptance of government policies, the population especially in rural areas share the idea that their opinions are not taken into account during establishment on state policies, because local administrations do not relay their complaint to the central administration which they considered to be the "real" decision-makers.

5.5.2   The community

This section describes the composition of the Community of Practice that is being designed. It answers the following questions:

1. Who are the community important stakeholders?
2. How to acquire membership?
3. What could be their roles?

➢   **Identification of member of the CoP**

The CoP in this design is constituted with the four categories of stakeholders studied in this research work. Making no distinction between stakeholders in terms of importance is a deliberate choice. The reason is that, each of the stakeholders is concerned about the community should be willing to help achieve (each in its own way) the vision of the CoP. This includes:

- Government: central administration and decentralized representations;
- Non-Governmental Organizations, including national organizations and other entities from the civil society;
- Educational institutions: from the private and public sector, and from primary, secondary and higher education,
- Population from rural as well as urban communities in Cameroon

➢   **Acquisition of membership**

Membership to the CoP is free. Any organization or individual wishing to be part of the CoP should be willing to respect some rules[32], among which:

- Operate around the principles of participation, transparency, responsiveness, effectiveness and efficiency;
- Be willing to learn and educate peers;
- Create an environment of trust and promote non-threatening discussion of ideas and experiences;

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[32] Based on a document:" xAPI CoP Charter Template" retrieved online at http://adlnet.gov/wp-content/uploads/2014/10/xAPI-CoP-Charter-Template.doc" on 12 March 2016.

- Respect decisions taken collectively, as well as by the management board of the community;
- Be respectful and use appropriate language in group discussions and to listen and respond to each other with open and constructive minds;
- Commit to search for opportunities to develop the community;
- Be ready to build on each member's strengths, and help each other improve their knowledge and skills, etc.

➢ **Roles of the members**

Members in a CoP have a role to play in order to share a sense of belonging to the community. Moreover, large communities need a core members group that will be in charge of ensuring its sustainability; their main task is to favor the launching and implementation of the CoP; to establish the root of a platform for information and knowledge exchange; and to motivate members in order to make the CoP evolve.

The proposal for a "core group" is based on the strategy for engaging stakeholders proposed by Network for Business Sustainability (NBS, 2012), as well as results from the identification of stakeholders (5.2.). Rather than identifying different roles for member of the community, the idea developed here is to design the community structure in terms of level of participation. This is detailed in the next part.

5.5.3 The practice

As stated earlier in this work, the Practice is "a sort of mini-culture that binds the community together" (Wenger, McDermott, & Snyder, 2002, p. 39). Elements related to practice for the CoP could be developed around the following questions:

1. How is the community organized?
2. What kind of activities is implemented for information and knowledge sharing?
3. How to communicate with the outside in order to make the community visibility?

➢ **Structure of the community**

This part discusses the level of participation of members inside the community. "Communities of practice usually involve multiple levels of participation, as do most social learning spaces" (Wenger, 2011). The scope of the CoP is national and involves Stakeholders involved in the fight against climate change impact in Cameroon.

The figure below gives an overview the organisation of the CoP based on the structure proposed by Wenger.
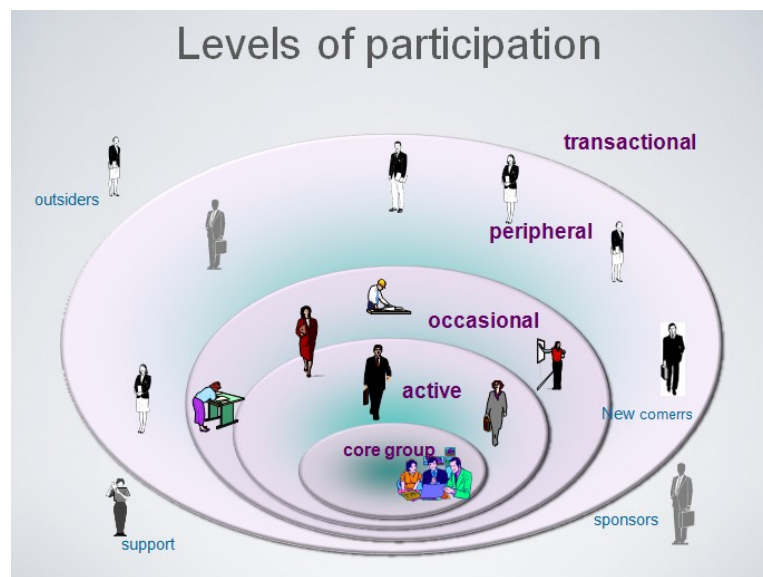
Figure 8: Levels of participation in a CoP

Core group refers to a small group of people whose commitment nurtures the community. In the case of the CoP developed in this work, the core group is made up of representatives of each category of stakeholders, to ensure equity and transparency, and ensure trust among all members. The Core group is constituted as follow:

- Government: Directorate of Civil Protection
- NGOs: a representative of each of the international and national partners of the DCP (Le PNUD, UNICEF, HCR, WFP, UNFPA, WHO, UNESCO, FAO, IFRC, SOS Catastrophes, etc.)
- Educational institutions: representatives of state universities and private universities (to focus on research for a beginning)
- Communities: traditional leaders

As mention earlier in this work, participation to the CoP is not compulsory. The above mention people simply represent categories of people that can be part of the core group.

Active participants are members who are considered experts in the domain covered by the CoP. This includes:

- Experts from NGOs: those working in climate change and environmental related projects, and experts from education oriented NGOs;
- Researchers from Educational institutions: mostly actors from higher education institutions for a start;
- Experts from government: especially decision makers in charge of designing policies on Disaster Risk Management, as well as decision makers involved in designing educational policies.
- Expert by experience in Communities: refers to whoever steps out to show interest in playing an active role in the life and activities of the community?

Occasional participants refer to members who only participate when the topic is of special interest, when they have some specific to contribute, or when they are involved in a project related to the domain of the community. This level of organization may include:

- Armed forces, fire brigades, who may not be regular members and attend all meetings, but still, who are partners of DCP during response interventions on the field in case of a disaster;

Peripheral participants refer to people who do not have as much personal commitment to the practice. They may be active elsewhere and carry the learning to these places. They may experience the community as a network. This may include prospective members (experts in other domains, from any of the above-mentioned categories of stakeholders, and who would like to observe the community and try to get some points of interest for personal development)

Transactional participants: this level of participation includes outsiders who interact with the community occasionally, but who are not members. Their benefits from the community is to receive or provide a service, this may include:

- Insurance company: who would like to acquire knowledge on impacts climate change on people's insured or not insured assets;
- Banks who support agricultural initiate for example and which are curious to better appraise the risks face by its customers (members of the CoP);
- Sponsors, etc.

Above are presented levels of participation of members in the community, and categories of members that constitute each level. However, the structure of a CoP is not static. The dynamic in members' participation allows movements across levels (Wenger, 2011). Therefore, the composition of each level of participation is subject to change.

One important aspect to be discussed here is also the sphere of influence of the community.

The sphere of influence of the CoP is understood in this work as various levels in the society where the community could be implemented. As the goal of this Community of Practice is to achieve climate change awareness in Cameroon, the first scope of the CoP is **national**. Decentralization process is not a new concept to members of the community: - Government and NGOs are familiar to having representations offices at national level as well as regional level and even local level. - As regards educational institutions, despite the fact that state universities and private universities do not systematically cover the country in a balanced way, educational institutions from basic education to higher education can be identified everywhere. - Finally, population in Cameroon is spread across quite a huge number of different tribes and they all have one point in common: they are organized around a traditional leader (for rural communities) and around a head of quarter (for urban communities). In a nutshell, everywhere there is this sense of hierarchy. The proposed CoP could therefore operate at national level, regional level, and local level.

- National level involves operating at central units;
- Regional level involves operating through regional representatives;
- Local level involves operation in sub-divisions or even villages.

➢ **Activities planned to support achievement of objectives**

This section describes activities that could support information sharing and knowledge exchange among members of the community. The following table is a matrix information and knowledge sharing among members of the CoP, including activities, technology tools and expected outputs.

Table 11 : Activities matrix of the CoP

CoP topic	Learning objectives	Provider of the knowledge	Activities	Tools/Technology to support activities	Beneficiary of the knowledge	Expected outputs
Climate Change Awareness in Cameroon	Achieve public education on Climate change impacts through information and awareness strategies	Government	- Field visits - Campaigns - TV programs - Radio programs - Video shooting	- Mobile pones (SMS) - Image box - Games - Radio/TV - Camera - Speech	Communities	Population will build knowledge on climate change and will be ready to face hazards
		NGOs				
		NGOs	- F2F workhops - F2F meetings - Group discussions - Consultancy	- Mobile pones (SMS) - PPT presentations - White board - Computer / - Note taking - Reports book	Education institutions	Educational experts will benefits from the experience of their peers from NGOs
					Government	Government staff will receive training on the conduct of civil protection activities
		Educational institutions	- Formal school curiculum - Informal strategies	- PPT presentations - Computers - Black bord - Handouts - Speech - TV/Radio	Communities	Students will know about climate change, its impacts and can relay the information at home
	Foster informed decision making process with regards to DRM policies	Government	- F2F meeting - Field visit	- Courier - Recorders - Speeches - Decisions/Decrees/Laws - Computer	Government	Government will make decions on new policies or adjust existing policies taking into account recommendations from educational institutions and NGOs, and theu will also consider their impacts on rural and urban communities
		NGOs	- Consultancy - F2F meetings	- PPT presentations - Reports book		
		Educational institutions	- F2F workshops - F2F meetings - Feedbacks	- White board - Computer / - Notes taking - Recorders - Camera		
		Communities	- F2F meetings - Local associations - Group discussion	- Complaint courier - Story telling		

Climate Change Awareness in Cameroon	Collect and promote expertise in the area of climate change education	Communities	- Story telling from experience - F2F meetings	- Oral presentations - Note taking	NGOs	All the beneficiaries will gather expertise and experiences from each other and build a best practice scheme that could be publish as a report.
		Educational institutions	- F2F workshops - F2F meetings - F2F forum	- PPT presentations - White board - Computer / - Note taking - Reports		
		NGOs	- F2F workshops - F2F meetings - F2F forum	- PPT presentations - White board - Computer / - Note taking - Reports	Government	
					Education institutions	
	Promote collaboration among the four categories of actors involved in the fight against climate change in the country	Government	- F2F meetings - Call for expression of interest - Concultancy	- National Dialog Platform - Agreements - Reports - Celebrations	NGOs	Joint actions on the field during response activities to disasters will be more effective and efficient
			- F2F workshops - F2F meetings - F2F forum	- Agreements - Reports - Celebrations	Education institutions	Educational institutions will contribute to the design of educational policies they have to apply in schools
			- Field visits - F2F meetings	- Speech - Celebrations	Communities	Communtity have a great opportunity to voice their complaints
		NGOs	- Concultancy - F2F workshops - F2F meetings - F2F forum	- Celebrations - Agreements - Reports	Education institutions	Both will build a good professional reputation that will promote their image outside of the CoP
		Communities	- F2F meetings - Discussion forum	- Celebrations - Games - Evaluations	Educational institutions	Educational institutions will improve their scientific speeches in order to better communicate their findings to "non-experts" people

> ➤ **Making the community visible**

The above mentioned activities relate to the internal organisation of the Community of Practice. Some activities could work to promote, and maintained communities visibility outside the community of Practice. Activities envisioned to promote the commuity of Practice on climate Change Awareness in Cameroon include:

- Door Open Days: they allow visitors to learn about the areas of intervention, actions and perspectives of the CoP. it is an opportunity to familiarize to better communicate the missions of the CoP and interact with external people in order to assess the concordance between the expected impact of the CoP and the real needs of populations;

- Presentations during international celebrations and fairs.

- Road map: this refers to a simplified graphical representation of communicating effectively and sharing strategic objectives of the CoP. Publication of a road map of the community will help mobilizing support (financial as well as technic) from external donors. It could also offer the opportunity to exchange with other communities of practice sharing similar concerns in order to coordinate efforts of stakeholders to achieve respective objectives;

- Using TV spots and radio spots is one of the best way to promote visibiity of the CoP. TV and Radio constitutes tools for wider communication par excellence. Moreover, they give the opportunity to communicate in local langauges using the channel of community radios to attract new members from the population;

This list is not exhaustive. The idea develop here is to make the community visible at inside and outside its geographical scope, which is one of the main crtiteria that contributes to the sustainability of a coP.

5.5.4 Sustainability of the CoP

To ensure the sustainability of a Community of Practice, one should rely on the evaluation of its design. The evaluation of a CoP relies on the assessment of activities used to maintain the CoP and foster its evolution. To achieve evolution, one may refer to the seven principles proposed by Wenger, McDermott and Snyder (2002) for cultivating a Community of Practice. Rossett and Sheldon (2001) define evaluation as "the process of examining a program or process to determine what's working, what's not, and why. It determines the value of learning and training programs and acts as blueprints for judgment and improvement". There are two main types of evaluation namely, formative evaluation and summative evaluation. The distinction between the two types lies in the fact that formative evaluation aims at promoting development and improvement within an ongoing activity, whereas summative evaluation, is used to assess whether the results of the object being evaluated meet the goals that were pre-defined (Scriven, 1967). Both kinds of evaluation are used in this CoP.

➢ **Formative evaluation**

The formative evaluation is performed through feedback provided by members at the end of each activity organized by the CoP. Whether inside smaller units or during regular formal meetings of the CoP (organized by the core group at regional or national level), an evaluation is required as a way to promote trust among members of the community.

➢ **Summative evaluation**

An evaluation of the CoP on the field has not been performed, due to time and financial constraint. However, a summative evaluation of the designed CoP has been performed on the base of the seven principles proposed by Wenger, McDermott and Snyder (2002):

- Design for evolution: two main elements account for this criterion. The design community has been structured around a core group who is in charge of launching and sustaining the community, by organizing activities that cover interest and answer learning needs of the members.

- Open a dialogue between Inside and outside perspectives: during regular meeting with the core group, as well as internal activities (eg. Training

sessions), experts from external networks of some members (eg. International partner of an NGO) could be invited as facilitator, or guest speaker;

- Invite different levels of participation: the organization of meetings or training sessions on the field benefits from the help of volunteers met on the spot. Whether an active member of the CoP or a peripheral member, an expert or simply a member of the local/rural community, the competence of the individual can be useful during the implementation of the activity (eg. A translator, a field guide, etc.). Participation in any king is welcome;

- Develop both public and private community spaces: Participation to the life of the community is based on free will. Members can join or leave the community as they wish. Besides the regular groups known to the core group of the CoP, members are free to build even smaller units with more specific interest (eg. Within the CoP, a group of experts/researchers from educational institutions is formed. Inside this group occurs a smaller unit made up of geography teachers, and an even smaller one constituted with geography teachers from a specific geographical area, etc.);

- Focus on Value: during face to face meeting organized at the CoP national level, or more regional levels, and even local levels, every member is welcome to provide a feedback, address a request, a complaint, etc. his opinion is noted in the meeting report, which is made available to regional units then relayed to the national unit. This process aims at giving a chance to every member of the community at any level of participation, to be an agent of change;

- Combine Familiarity and Excitement: sporting events, fairs, excursions, are organized among community members. As the level of administration of the CoP is highly decentralized, these activities can happen even in local units. The aim is to bring members together, promote the creation of more personal bounds, and attract new members;

- Create a rhythm for the community is quite a challenging task, due to the size of the community. For a beginning a quarterly meeting of the core group of the CoP is foreseen. Also, the organization once in two years of a convention is projected, but that will request a huge investment in terms of funding and

equipment, etc. The organization of this kind of events will highly depend on availability of sponsors or donors.

In a nutshell, evaluation for the designed CoP had been taken into account during the design phase. In fact, the seven principles for cultivating a CoP has been embedded within the design right from the beginning.

6 Conclusion

This chapter synthesizes the key findings of this work (6.1.). It also critically reflects on the use of learning communities as a multi-stakeholder approach to solving climate change and environmental related issues (6.2.). Finally, it provides some limitations to the work (6.3.) and outlines some opportunities for further research (6.4.).

6.1 Key findings

The present work sought to understand reasons behind the failure of public education and public awareness strategies implemented by the government in order to develop country's capacity to fight against climate change impacts in Cameroon. The aim of the work was to build on the already existing strategy, by identifying areas for improvement, in order to propose a new model for information and knowledge sharing among all stakeholders involved in climate change and environmental related issues in the country.

Results from the analysis of data collected on the field from the four categories of actors involved show that, the government strategy was unsuccessful because it failed to take into account these actors' background, experience, needs and competences. In fact, information and communication activities for community awareness were not sufficiently planned and carried out as prevention measures; decentralization in the planning and implementation of NRO activities, especially staff training, was not effective. As a result, most of the training sessions planned were carried out exclusively at the level of central administration, whereas decentralized institutions needed qualified personnel. Also, the lack of effective collaboration between some of the actors, especially NGOs and educational institutions generated a context of frustration which resulted in a loss of trust.

Analyses also found that a good knowledge on stakeholders involved in DRR in the country, including understanding of their roles, identification of their needs and experience, was essential to design an adequate strategy for information and knowledge sharing. For instance, identification of communities' level of education and perception of risks were useful to determine the most appropriate content and delivery methods of awareness messages. Assessment of stakeholders' communication and information sharing mechanism revealed that, communities' opinions were not taken into consideration in the decision-making process because of a lack of an exchange platform

between government and communities, hence the need to creation a platform for information and knowledge sharing.

Finally, results from the analysis of data show that, despite the problem of availability and access to "new" technologies especially computers and internet access, other technologies like radio, TV, mobile phones are highly available across the country, with the very good network spreading. Projects on the creations of community radios and community telecenters as the government strategy to gradually introduce population from all social background to the digital are slowly but successfully implemented in the country with the help of international partners. This later constituted the technology base of the propose learning model of this research work.

The table below summarized some of the key findings relating to each of the research sub-questions:

Table 12: Summary of key findings relating to the research questions

Research question	Key findings
RQ1: What are the reasons for the failure of the pre-existing public education and public awareness strategy implemented in Cameroon?	- Information and communication activities for community awareness were not sufficiently planned and carried out as prevention measures; - Decentralization in the planning and implementation of NRO activities, especially staff training, was not effective; - Lack of effective collaboration between some of the actors, especially NGOs and educational institutions generated a context of frustration which resulted in a loss of trust.
RQ2: How to assess educational needs and capacities of each category of actors?	- By identifying and analyzing the four categories of stakeholders and their characteristics (roles, experience, gender, age, level of education, etc.) For instance, identification of communities' level of education and perception of risks were useful to determine the most appropriate content and delivery methods of awareness messages.

RQ3: What are the most appropriate instructional methods and tools to support learning activities?	- It depends on the information and knowledge sharing system that exists between stakeholders: two distinct dynamics have been observed: on the one hand, there is the knowledge sharing system between stakeholders group A (Government, Non-Governmental Organizations and Educational Institutions) among themselves. On the other hand, there is the dynamic of knowledge sharing between stakeholders group A and stakeholders group B (communities)
RQ4: How to ensure effectiveness and sustainability of the newly proposed strategy?	- By developing critical infrastructures (improving access to technical infrastructures); - By developing capacity to use technologies tools; - By triggering community's acceptance of technology tools.

6.2   Implications for the theoretical framework

Findings presented in this research bring some fine distinction to two arguments developed in the theoretical framework.

In a multi-stakeholder context as it is the case in this study, effective communication and efficient knowledge-sharing mechanisms amongst key stakeholders are vital to narrow information gaps in the implementation of for Disaster Risk Reduction activities (WMO/TD, 2010). In this research, the innovative solution proposed to achieve a successful knowledge exchange among all stakeholders is the design of a Community of Practice. In the current digital era, the concept of Community of Practice is mostly applied in virtual environment. When discussing Communities of Practice, extensive literature is available for Online Communities of Practice or Virtual Communities of Practice (Dubé, Bourhis, & Jacob, 2005; Murillo, 2006; Zarb, 2006; Hara & Hew, 2007; Murillo, 2008). This seems obvious, as ICT is becoming the major driving forces of knowledge-based societies.

However, the current study considers the context in developing countries, and raise attention on the fact that even if availability rate and access rate to technologies, electronic

networks, computers, etc., goes increasingly, it is still an issue in some African countries like Cameroon. These technologies are still far beyond the reach of the majority. Nevertheless, as the concept of CoP advocates for the social construction of knowledge, the focus is put on the collaborative way of knowledge creation, which can be performed with or without the use of internet. Moreover, results from the current research support Oosting's (2009) opinion that, although internet and computers play a prevalent role in recent developments around CoPs, it is important to stress the offline "foundation" of CoP.

The current research also adds a nuance to the perception of the ASSURE model (Heinrich, Molenda, & Russell, 1989) as the model par excellence of educators to implement the use of technologies in teaching in school environment. Despite the fact that the ASSURE model is recommended mostly in formal education environment, the current work accounts for the fact that, the model proved to be useful also in informal learning environments. As an instructional design model, the ASSURE model aims to create "instructional experiences which make the acquisition of knowledge and skill more efficient, effective, and appealing." (Merrill, Drake, Lacy, & Pratt, 1996). It could therefore be extended to any learning process, whether through formal learning or informal (Lingstone, 1999). Moreover, the particularity of the model is the account for the utilization of technologies in the process of knowledge acquisition. With the use of new technology tools like social media, the learner in already engaged into informal learning processes. The above-mentioned characteristics help forging the conviction that the ASSURE Model for instructional design is appropriate to help design the learning model proposed in this work.

6.3   Limitations to the work

Limitations to this work primarily concerns methodological aspects. Some major aspects of the research design that rendered the achievement of this work challenging concern the data collection phase. The sampling method initially selected for the identification of the sample population among communities on the field in this research was the purposive sampling method (Palys, 2008; Oliver & Jupp, 2006). Because of the attitude of potential informants on the field, (most of them refused to be surveyed), the sampling technique has been switch to the Respondent Driven Sampling also called snowball sampling (Morgan, 2008). With regards to the use of the snowball sampling technique, one has to

acknowledge a possible selection bias. In fact, the variation in the sample population for communities may have been limited to a same network of people, as a result from the fact that the surveyed population was built up gradually on the recommendation of previous informants.

Another limit to this work concerns the ethical aspect. One significant element that embodies ethical codes in data collection tool is the use of the Informed Consent Form (ICF). During the pretesting phase of data collection tools, the ICF was administered to all informants. Because of the attitude of respondents (some respondents, especially from rural areas were more interested the "benefits", or "compensation" aspect rather than actually answering the questions), the ICF was either skipped and replaced by the authorization letter from the administrative authorities, or partially administered (omitting to provide information on benefits) on purpose. Issue of "honesty and transparency" here was overpowered by the need to preserve the continuity and effectiveness of the research.

One last issue faced in this work concerns the choice of information and knowledge sharing methods and tools for the proposed model based on the Community of Practice. Despite actors' un-acceptance of TV, radio and mobile phones as communication channels, these technologies were indeed selected as the best channel for communication among the community. This intentional choice has been motivated by the easy access and facility to use the said tools by the said community.

6.4   Opportunities for further research

The solution proposed in this work capitalizes on the use of already existing technologies available and actually accessible to the population to support information sharing and knowledge creation among stakeholders involved in the fight against climate change in Cameroon. The innovation in this work resides in the design of a knowledge sharing and knowledge creation system involving a variety of stakeholders, which rely solely on technologies that do not request an access supported via internet. In the context of developing countries where access to "new" technologies is still far beyond the reach of the majority, this type of Community of Practice gives an opportunity to people living in remote areas, far from the reach of networks, or even with rare access to electricity, to

get information and get a chance to be proactive in the development process of their own social structure.

In the current digital age, the concept of Community of Practice is mostly applied in virtual environment (Dubé, Bourhis, & Jacob, 2005; Murillo, 2006; Zarb, 2006; Hara & Hew, 2007; Murillo, 2008). The literature is very few on research works relating to offline or face to face Communities of Practice, compare to those available on Virtual Communities of Practice, or Online Communities of Practice. Those of the literature available that advocate for face to face communities, point out the fact that virtual Communities lack the "physical touch" necessary to build trust relationship (Handy, 1995 cited by (Kodama, 1957)). However, face to face activities still hold a good place even in VCoPs or OCoPs (Wenger, 2011). In an analysis of knowledge management in sustainability research projects involving a variety of stakeholders, Kaiser, Köhler and Weith (2016) came to the conclusion that "knowledge is best transferred during face-to-face meetings".

Results from the current research support Oosting's (2009) opinion that, although internet and computers play a prevalent role in recent developments around CoPs, it is important to stress the offline "foundation" of CoP. A good opportunity for further research could be to investigate the possibility of "offline" CoP to be applied in domains of interest other than climate change education; to solve society related issues like health, or gender equality among others.

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Appendices

Appendix 1: Informed Consent Form

Introduction
This field work is part of the PhD research of Ms. Sandrine Sidze who is a PhD student at Dresden University of Technology (TUD) and PhD Fellow at United Nations University-Institute for Environment and Human Security (UNU-EHS) in Bonn, Germany. The research aims to propose technology based strategies for capacity development of stakeholders involved in disaster Risk Management in Cameroon. The current field work is to investigate on the implementation of Disaster Risk Reduction strategies implemented by the government and its partners in Cameroon, especially activities for public education and public awareness.

Procedures
You will be asked to participate in a survey/interview. During the interview, I and a translator (if needed) will sit down with you in a comfortable place. If it is better for you, the interview can take place in your home or work place. If you do not wish to answer any of the questions during the interview, you may say so and the interviewer will move on to the next question. No one else but the interviewer will be present unless you would like someone else to be there. You may also request to fill out survey/interview yourself. In this case, you will be provided with a copy that we will collect later. If you do not wish to answer any of the questions included in the survey/interview, you may skip them and move on to the next question.

Risks/Discomforts
Risks are minimal for involvement in this study. However, you may feel emotionally uneasy when asked to make Judgments based on questions you are asked about. Feel free not to answer such questions.

Benefits
There are no direct benefits for participants. However, it is hoped that through your participation, researcher will learn more about attitudes stemming from experience on (personal) adaptation measures with regards to environment related problems.

Confidentiality
All data obtained from participants will be kept confidential and will only be reported in an aggregate format (by reporting only combined results and never reporting individual ones). All questionnaires will be concealed, and no one other than then primary investigator and assistant researches listed below will have access to them. The knowledge that we get from this research will be shared with participants: each participant may receive pictures taken during sessions if he/she wishes so. As a follow-up, we will publish the results so that other interested people may learn from the research.

Participation & Compensation
Participation to this study is based on free will and no compensation will be provided for participants. You have the right to withdraw at any time or refuse to participate entirely, even if you agreed earlier.

Questions about the Research
If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact the research assistant or me (Sandrine Sidze, 0023799878506, sidze@caramail.fr).

Questions for verifying the researcher's identity
If you have questions you do not feel comfortable asking the researcher, you may visit United Nations University - Institute for Environment and Human Security (UNU-EHS), EGECHS Section:
https://www.ehs.unu.edu/article/read/enhancing-graduate-educational-capacities-for-human-security-section

I have read, understood, and/or printed a copy of, the above consent form and desire of my own free will to participate in this study.

Signature of the participant:

Appendix 2: Interview guide

ID: _____   Date: _____/_____/_____   City: _____

Language of interview: _____   Translator:_____

Name of the interviewer: _____

INFORMED CONSENT

You have been fully informed (written or verbal form) about the goal of the study and you rights as a participant to the study. Please be assured that all your responses will be held in strict confidence and no statements used in the report of the results will be attributed directly to you. You understand that your participation is voluntary, and you may decline to answer any question or end the interview at any point.

Do you agree to continue?   Yes: _____   No: _____   Signature: _____

BEGINNING OF INTERVIEW

Introduction

Good morning Sir/Madam [*or as appropriate*]. Thank you very much for making time for this interview.

Interviewee Identification

Name (optional): _____

Name of organization: _____   Position: _____

In charge of: _____

Tel: _____   Email: _____

General questions (apply to all categories of experts)

101.   To your opinion, what types of environmental problems could be identified in the region? _____
_____

102.   What consequences can be observed in the region? _____
_____

103.   According to you what factors emphasize these consequences? _____
_____

Problem validation (apply to all categories of experts)

Based on results from literature review, the following problems have been identified into strategies for capacity development using technology enhanced learning. Do you agree?

A. Qualified personnel   Yes _____   No _____

B. Technical infrastructure   Yes _____   No _____

C. Strategies of education and training   Yes _____   No _____

D. Collaboration between stakeholders   Yes _____   No _____

A. Qualified personnel

201. Are there training sessions for staff members in your
organization?   Yes _____   No _____

202. What category of staff members is
trained?   _____

203. How are training sessions for staff members in your institution organized? _____

204. Where are staff members trained? When?   _____

205. Is there an in-house evaluation for staff members that have   Yes _____   No _____
been trained?

B. Technical infrastructure

206. Does your organization possess:

    a. Training rooms?   Yes _____   No _____

    b. Training material?   Yes _____   No _____

    c. Experts/facilitator support?   Yes _____   No _____

    d. Reliable electivity supply?   Yes _____   No _____

    e. Reliable internet access?   Yes _____   No _____

    f. Provide computers for staff members?   Yes _____   No _____

    g. Provide computers for staff members?   Yes _____   No _____

C. Strategies for education and training (for staff)

207. Who oversees the organization of training programs with partners in your institution? _____

208. How is the topic of discussion/training chosen? _____

209. What language is used during training sessions? _____

210. How often are training sessions organized? _____

211. What is your /organization role during training sessions? _____

212. How long do training sessions last? _____

213. What type of in-service training is implemented for staff member? _____

214. What types of activities are selected to support training? _____

215. What kinds of tools are used to support training? _____

D. Collaboration with partners

216. Are there joint interventions on the field or during training between your institution and partner
institutions? _____

217. What category of partners are you working with? (UN, NGOs, national cooperatives,
communities' representatives, etc.) _____

218. How will you rate collaboration between your institution and partners? _____

Problem validation (apply to DCP experts only)

301. How are communities at risk informed about disasters' risks? _____

302. How are officials/decentralized institutions/partners informed about disasters' risks? _____

Problem validation (apply to experts from NGOs and Educational Institutions only)

401. Do you/your organization know about the Directorate of Civil Protection? _____

402. Is DCP a partner of your organization regarding training on environmental related issues? _____

Problem validation (apply to experts from Educational Institutions only)

501. Is there a curriculum designed for DRR in your institution? _____

502. Who develops the content of the curriculum? How? _____

503. What instructional approaches do you use to deliver the content of the curriculum? _____

504. What kind of tools do you think will be more efficient content deliveries? _____

505. Does your institution assess your teachings/curriculum? How? _____

506. Are students also asked to evaluate the curriculum and teachings? _____

507. Do you ever receive spontaneous feedback from the students? _____

Problem validation (apply to experts from Educational Institutions only)

601. What could be the needs for further development of a more effective public education and public awareness strategy? _____

602. Is there another point you would like to raise? _____

END OF THE INTERVIEW

Thank you for your time.

Appendix 3: Event Observation form

ID: Date of observation: 12-13 February 2015

Place: Community Telecenter Bayangam   Period of observation: 09:15 am – 17:00 pm

Name of the observer: PhD Researcher

Background information on the TCP

OBSERVATION				
Period	Time	Person observed		Brief description	
		Student (class?)	*Other* (identity?)	*Student*'s activity	*Other*'s activity
09:15 – 10:30					
10:30 – 12:30					
12:30 – 13:30					
13:30 – 15:30					
15:30 – 17:00					
END OF OBSERVATION					

Notes:

Periods during schools breaks (for breakfast and lunch)
Rest of the time

Appendix 4: Focus Group Discussion Guide

FOR PERSONAL USE: Focus Group Discussion identification

ID: _____   Date: _____/_____/_____   City: _____

Language of discussion: _____   Time frame: _____-_____

Name of translator (if applicable): _____

Name of the note taker: _____

Name of the facilitator: _____

INFORMED CONSENT

You have been fully informed (written or verbal form) about the goal of the study and your rights as a participant to the study. Please be assured that all your responses will be held in strict confidence and no statements used in the report of the results will be attributed directly to you. You understand that your participation is voluntary, and you may decline to answer any question or end the interview at any point.

If you agree to continue, kindly sign the sign in form that will be handed to you shortly.

BEFORE STARTING FGD

Introduction

Good morning everyone. Thank you very much for making time for this interview.

Process explanation

My name is Sandrine Sidze. I am a PhD student. I am doing my research about finding adequate strategies for public education on climate change impacts and environmental related problems in Cameroon. I focus especially on the use of new technologies to support information and education activities. I am here to collect your valuable opinion as educators. I will be assisted by a colleague who will take down notes during our discussion which I will moderate. The aim of this discussion is to gather information from you. We will use a list of sub topics as guidelines for the discussion. The discussion will last for about 1 hour so feel free to move around and help yourselves with refreshments.

Ground rules

- Everyone is highly encouraged to participate
- Information provided in the focus group must be kept confidential
- Stay with the group and please don't have side conversations
- Turn off cell phones if possible

If there are any questions before we start, feel free to ask them.

BEGINNING OF FGD

Self-introduction

Roundtable self-introduction of participants (name tags)

Questions

a. Let's start the discussion by talking about what you know about climate change.
   1. Have you ever heard about the word "climate change"? If yes, in what occasion?
   2. How will you define or explain climate change? Impacts?
   3. Have you ever heard about "Cameroon Civil Protection"? Where? What does it refer to?

b. Now let's discuss about Climate Change in your teachings
    1. Are there lessons related to climate change on the school program / in your teachings?
    2. Who propose the content of the lessons?
    3. Are you comfortable teaching these lessons? (do you feel knowledgeable enough for that?)
    4. Are there practice activities planned to support your teachings? Which activities?
    5. If yes who decide about the types of activities? Who organize them?
    6. Are the kids receptive to these activities? Do they look interested?
    7. Do you use new technologies to support your teachings? Which tools? How?

c. Let's close this discussion with your personal point of view.
    1. Do you believe in climate change?
    2. Do you believe in the potential of education to help reduce consequences of climate change by informing people?
    3. Do you think your school / or yourself are sufficiently equipped in terms of infrastructure or knowledge to teach on climate change issues?
    4. What support would you like to receive? From who?
    5. Is there anything, any idea

END OF FGD

That concludes our focus group. Thank you so much for coming and sharing your thoughts and opinions with us. We have a short evaluation form that we would like you to fill out if you time. If you have additional information that you did not get to say in the focus group, please feel free to write it on this evaluation form.

GROUP DISSCUSSION / Session n°_____

Date: _____/_____/_____   Time: _____-_____   Place: _____

Facilitator / Moderator: Researcher

Note taker: Research assistant

Translator if needed:

N°	Participant Name	Age	Sex	Class(es)	Contact	Signature
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						

Appendix 5: Qualitative Survey

ID: _____   Date: _____/_____/_____   City: _____

Language of survey: _____   Translator: _____

Name of the participant: _____

INFORMED CONSENT

You have been fully informed (written or verbal form) about the goal of the study and your rights as a participant to the study. Please be assured that all your responses will be held in strict confidence and no statements used in the report of the results will be attributed directly to you. You understand that your participation is voluntary, and you may decline to answer any question or end the interview at any point.

Do you agree to continue?   Yes: _____   No: _____   Signature: _____

BEGINNING OF THE SURVEY

Introduction

Good morning Sir/Madam [*or as appropriate*]. Thank you very much for making time for this survey.

Identification

Name (optional): _____

Gender: M/F   Age: _____   Occupation: _____

Religion: _____   Level of education: _____

Ethnic group: _____   Mother tongue: _____

Risk Perception

101. Have you ever heard about climate change?   Yes _____   No _____

102. If yes, where?
- ☐ TV
- ☐ Radio
- ☐ School
- ☐ Market
- ☐ Hospital
- ☐ Friends
- ☐ Church
- ☐ Meeting
- ☐ Other_____

103. Have you ever heard about Civil Protection?   Yes _____   No _____

104. If yes, where?
- ☐ TV
- ☐ Radio
- ☐ School
- ☐ Market
- ☐ Hospital
- ☐ Friends
- ☐ Church
- ☐ Meeting
- ☐ Other_____

105. What does it refer to? _____

106. What types of environmental problems do you face in the region?
- ☐ Floods
- ☐ Eruption
- ☐ Landslides
- ☐ Deforestation
- ☐ Pollution
- ☐ Hot winds
- ☐ Drought
- ☐ Other _____

107. What are the consequences of climate disasters?
- ☐ Road accidents
- ☐ Material loss
- ☐ Financial loss
- ☐ Air pollution
- ☐ Water pollution
- ☐ Water scarcity
- ☐ Food scarcity
- ☐ Diseases
- ☐ Trauma
- ☐ Migration
- ☐ Fire
- ☐ Casualties
- ☐ Other_____

108. What factors aggravate these consequences?

☐Ignorance ☐Lumbering
☐Stubbornness ☐Poverty
☐Insalubrities ☐Other_____
☐Risky behavior

109. What types of related diseases do you face in the region?

☐Cholera ☐Poliomyelitis
☐Meningitis ☐Malaria
☐Skin disease ☐Other_____

Sensitization/Awareness

201. Have you ever been sensitized about climate change? Yes _____ No _____

202. If yes, who organized it?

☐Adm. authority ☐Church
☐Hospital ☐NGO
☐School ☐Other_____
☐Community grp.

203. Who was the main speaker?

☐Religious leader ☐Teacher
☐Local leader ☐Expert
☐Doctor ☐Other_____
☐ Adm. authority

204. Do you trust this person? Yes _____ No _____

205. If no, who would have been the most appropriate speaker? _____

206. What was the topic of discussion? _____

207. What was your role during the activity?

☐Organization
☐Participant
☐Volunteer for demonstrations

208. What language was used? ☐English ☐French ☐Local

209. How often do awareness campaigns occur?

☐Rarely ☐Never
☐Often ☐1/week
☐From times/times ☐1/month
☐ On spec. occas. ☐1/year

210. How long do awareness campaigns last?
☐1-2 hours ☐less than 1 hour ☐Whole day ☐Whole week ☐More

211. How useful did you find the information delivered during sensitization?
☐Very useful ☐Useful ☐Neutral ☐Useless ☐Very useless

212. How likely is it that you take part to more awareness campaigns?
☐Very likely ☐Likely ☐Neutral ☐Unlikely ☐Very unlikely

Sensitization/No Awareness

213. If no, who could organize it?

☐Adm. authority ☐Church
☐Hospital ☐NGO
☐School ☐Other_____
☐Community grp.

214. Who could be the main speaker?

☐Religious leader ☐Teacher
☐Local leader ☐Expert
☐Doctor ☐Other_____
☐ Adm. authority

215. What could be the topic of discussion? _____

216. What could be your role during the activity?

☐Organization
☐Participant
☐Volunteer for demonstrations

217. What language could be used? ☐English ☐French ☐Local

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218. How often should awareness campaigns occur?

☐ Rarely   ☐ Never
☐ Often   ☐ 1/week
☐ From times/times   ☐ 1/month
☐ On spec. occas.   ☐ 1/year

219. How long should awareness campaigns last?

☐ 1-2 hours   ☐ less than 1 hour   ☐ Whole day   ☐ Whole week   ☐ More

220. Do you feel like you know what to do in the event of a hazard?   Yes _____   No _____

221. Will you willingly take part to awareness campaigns?

☐ Very likely   ☐ Likely   ☐ Neutral   ☐ Unlikely   ☐ Very unlikely

Availability, Access and Capacity to use technologies

301. What types of activities/tools were/should be used for sensitization?

☐ Oral presentation   ☐ Story telling
☐ Video   ☐ Publications
☐ Games   ☐ Textbooks
☐ Role Play   ☐ Mobile
☐ Guided discuss.   ☐ Social media
☐ Demonstration   ☐ Other _____

302. You would prefer to receive awareness related information via:

☐ Market   ☐ Church
☐ Hospital   ☐ Meeting
☐ Friends   ☐ Friends
☐ Friends   ☐ Other_____

303. In your household, you possess at least:

☐ TV   ☐ Printer
☐ Radio   ☐ PC
☐ Laptop   ☐ Mobile
☐ Landline/fax

304. Capacity to use TV/radio:

☐ No one   ☐ At least one person   ☐ Almost everyone   ☐ All the family

305. Capacity to use PC/laptop:

☐ No one   ☐ At least one person   ☐ Almost everyone   ☐ All the family

306. Capacity to use internet:

☐ No one   ☐ At least one person   ☐ Almost everyone   ☐ All the family

307. Capacity to use mobile devices:

☐ No one   ☐ At least one person   ☐ Almost everyone   ☐ All the family

308. Capacity to use printer:

☐ No one   ☐ At least one person   ☐ Almost everyone   ☐ All the family

309. Capacity to use landline/fax:

☐ No one   ☐ At least one person   ☐ Almost everyone   ☐ All the family

END OF THE SURVEY