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INSTITUTIONAL FRAMEWORK FOR GREEN HYDROGEN PROJECT IN WEST AFRICA

THE CASE STUDY OF CÔTE D'IVOIRE

Jury Members

Chair: Prof. Mohamed Ben Omar Ndiaye

Major Supervisors: Pr. Letmathe, Peter

Co-Supervisor: Dr. Fama Gueye

Presented the 20/08/2023 by

KAKOU, Amalan Evora Vanessa

DEDICATION

I dedicate this master's thesis to the memory of my beloved father, who has always longed to see me one day become, as he always said, a great lady of the country.

"You can do everything others do, but you can do better than others".

I will carefully keep your advice and try to apply it all over my life.

You will be forever in my heart.

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ACRONYMS

ANARE-CI	Cote d'Ivoire Electricity Sector Regulatory Authority
CDM	Clean Development Mechanism
CI-ENERGIES	Côte D'Ivoire Energies
CIE	Compagnie Ivoirienne d'Electricité
CO2	Carbon Dioxide
COP	Conference Of the Parties
DAC	Direct Air Capture
DGE	Direction Générale de l'Energie
DGH	Direction Générale des Hydrocarbures
ECOWAS	Economic Community of West African States
EIA	Energy Information Administration
FID	final investment decision
GDP	Gross Domestic Product
IEA	International Energy Agency
IMF	International Monetary Fund
IMP-EGH	International Master's Program in Energy and Green Hydrogen
INS	Institut National des Statistiques en Côte d'Ivoire
IPPs	Independent Power Producers
IRENA	International Renewable Energy Agency
MNCs	Multinationals Corporation

MW	Megawatt
ND-GAIN	Notre Dame Global Adaptation Initiative
NDC	Nationally determined contributions
PAEMIR	Project to Improve Access to Electricity in Rural Areas
PDCI	Democratic Party of Cote d'Ivoire
PPPs	public-private partnerships
PV	Photovoltaics
SOE	Solid Oxide Electrolyzer
TWh	Terawatt-hour
UEMOA	The West African Economic and Monetary Union
UNDP	United Nations Development Programme
VOA	Voice of America

CONTENTS

ABSTRACT

This study aims to identify the inhibitors and facilitators within the institutional framework of Côte d'Ivoire concerning the implementation of green hydrogen projects, specifically the DRYHY project. We clarify the definitions of institutions and derive a definition applicable to the institutional framework in this study's context. Through an extensive analysis of the literature, employing grounded theory for a structured literature review, we present an empirical and theoretical literature review on the topic.

We have identified corruption, political instability, bureaucratic red tape, investment risks such as macroeconomic stability, and a lack of infrastructure and technology as the main challenges within the Ivorian institutional framework. These findings were further validated through seven interviews with energy stakeholders from Côte d'Ivoire.

Our literature reviews indicate that Côte d'Ivoire possesses the potential for such a project. However, challenges persist within the institutional framework. While the government has initiated efforts to address these issues, experts remain skeptical about the project's feasibility. Concerns are raised due to the maturity of green hydrogen production technology and the absence of clear policies and regulations favoring renewable energy, especially in terms of feed-in tariffs, tax incentives, production targets, and support mechanisms for renewable energy initiatives. Additionally, skepticism surrounds the government's ability to combat corruption effectively.

This thesis underscores the pivotal role of the institutional framework's quality in green hydrogen project implementation within the region. To improve it, we propose measures such as creating regional markets, digitalizing systems, staff training, establishing an independent regulatory agency, and fostering public-private partnerships.

KEYWORDS: Green Hydrogen, Institutional Framework, Côte d'Ivoire, Renewable Energy Projects, Institutional Barriers, Sustainable Development, Energy Policy, Corruption, Political Instability, Infrastructure, Technologies, Regulations, Public-Private Partnerships.

RESUME

L'objectif de cette étude est d'identifier les inhibiteurs et les facilitateurs au sein du cadre institutionnel de la Côte d'Ivoire en ce qui concerne la mise en œuvre de projets d'hydrogène vert, en particulier le projet DRYHY. Nous avons clarifié les définitions associées au terme "institutions" et en avons déduit une applicable au contexte de cette étude. À travers une analyse approfondie de la littérature, en utilisant la théorie ancrée pour une revue structurée de la littérature, nous présentons une revue de la littérature empirique et théorique sur le sujet. Nous avons identifié la corruption, l'instabilité politique, la bureaucratie, les risques d'investissement tels que la stabilité macroéconomique et le manque d'infrastructures et de technologies comme les principaux défis dans le cadre institutionnel ivoirien. Ces résultats ont été validés par sept entretiens avec des acteurs de l'énergie en Côte d'Ivoire. Notre revue de littérature indique que la Côte d'Ivoire possède le potentiel pour un tel projet. Cependant, des défis persistent au sein du cadre institutionnel. Bien que le gouvernement ait entrepris des efforts pour résoudre ces problèmes, les experts demeurent sceptiques quant à la faisabilité de tel projet. Des préoccupations sont soulevées en raison de la maturité de la technologie de production d'hydrogène vert et de l'absence de politiques et de réglementations claires favorisant les énergies renouvelables, en particulier en ce qui concerne les tarifs de rachat, les incitations fiscales, les objectifs de production et les mécanismes de soutien aux initiatives en matière d'énergie renouvelable. De plus, le scepticisme entoure la capacité du gouvernement à lutter efficacement contre la corruption. Ce mémoire souligne le rôle central de la qualité du cadre institutionnel dans la mise en œuvre des projets d'hydrogène vert dans la région. Pour l'améliorer, nous proposons des mesures telles que la création de marchés régionaux, la numérisation des systèmes, la formation du personnel, la création d'un organisme de réglementation indépendant et la promotion des partenariats public-privé.

MOTS-CLÉS : Hydrogène Vert, Cadre Institutionnel, Côte d'Ivoire, Projets d'énergie Renouvelable, Obstacles Institutionnels, Développement Durable, Politique Energétique, Corruption, Instabilité Politique, Infrastructures, Technologies, Réglementations, Partenariats Public-Privé.

INTRODUCTION

Since the acknowledgment of climate change and its anthropogenic cause, renewable energies such as wind and solar energy have emerged as crucial technologies for combating climate change. They are gradually replacing traditional fossil fuel power plants, signaling a shift toward fairness and equality, especially for regions that lack fossil fuel resources but possess renewable resources, enabling them to access basic services like electricity. But also, green hydrogen produced through the means of these renewable resources plays an important role in the decarbonization process and represents the energy carrier that will put an end to the era of fossil fuels. However, to effectively establish the infrastructure for green hydrogen supply, speed, and renewable energy expansion must be considered. Smart Government support, management, and careful prioritization throughout the process are essential to success in this endeavor (Rosenkranz & Jürgen, 2022).

The concept of institution became important shortly after North's seminal work "Institutions, Institutional Change, and Economic Performance " in 1990, where he defines institutions as the rules of the game that shape human behavior, including both formal (laws and regulations) and informal (norms and customs) institutions, as well as the organizations that enforce these rules (North, 1990). William Riker argues that *"We cannot simply study tastes and values; we must also study institutions"* (Ostrom, 1986).

However, when empirically analyzing these assertions in the context of project implementation, researchers have not consistently obtained significant findings regarding the inhibiting and facilitating factors within the institutional framework that influence project implementation. This situation can be attributed to the challenge of defining the term "institution" itself and exploring the empirical characteristics and institutional variables, often derived from qualitative indicators. Nevertheless, recent enhancements in the accessibility of institutional data and a rising interest in the role of institutional factors in explaining economic development have contributed to addressing these limitations (Assane & Grammy, 2003). How much technological progress has been made in our time, and how much of the trajectory of that progress has been shaped by the institutional framework chosen to facilitate it? Western industrialized countries' adoption of an institutional framework that encourages ongoing innovation and competition within a capitalist system, combined with democratic structures that accommodate diverse perspectives and ideas, has significantly contributed to their rapid development and the successful implementation of new

technologies. The institutional structure, therefore, has enormous implications for the productivity and pace of economic development (Scully, 1988).

Despite the prevailing belief that institutions determine investment and economic growth, the assessment of their influence comes up against the timeless challenge of reverse causality. On one hand, capital injection has the potential to strengthen institutions, resulting in economic prosperity. Conversely, strong institutions can attract investment and foster economic development. Moreover, it is conceivable that the current quality of institutions acts as a magnet for investors, making the country an attractive destination for revolutionary projects, including green hydrogen projects. Nevertheless, it is important to recognize that institutional policies are increasingly emerging as a means of strengthening global competitiveness. It is therefore imperative to undertake a comprehensive assessment that encompasses various factors (inhibitors and facilitators), such as government measures, market dynamics, and technological advances, to truly understand the impact of institutions on green hydrogen initiatives (Hartog, 2015).

A strong institutional framework promotes transparency and trust among stakeholders, thus creating a conducive environment for successful project implementation. It provides the structure, procedures, and mechanisms for project activities.

Governments around the world have recognized the potential of hydrogen, resulting in increased investment in research and development. Projects based on hydrogen production continue to grow. In 2021, it was estimated that there would be a total of 522 projects worldwide related to the global development of green hydrogen scheduled to occur between 2021 and 2030, with 43 of these projects classified as megaprojects in the field of green hydrogen (Statista, 2021).

This rapid progress offers opportunities for job creation and economic growth in the renewable energy sector, which is crucial given the Russian conflict in Ukraine and rising gas costs (Thijs, 2022).

West Africa is an important region with a vast potential for sustainable energy. An IRENA study found that Côte d'Ivoire, for example, has abundant renewable energy resources, such as solar and wind power, which can make a significant contribution to increasing energy access for all citizens (IRENA, 2021). Capitalizing on this opportunity could lay a strong foundation for the country's future as a preferred destination for energy-related investment in West Africa. According to the according to IEA, more than 30 countries have launched or are planning public hydrogen technology projects. However, only 4% of projects are currently under construction or have reached

a final investment decision (FID). Key reasons include weak demand, lack of management systems, and an accessible framework to deliver hydrogen to end users (IEA, 2022).

Table 1:Renewable Energy Resource Potential In CI

Renewable resources	Technical potential (MW)
Solar	28 920
Wind	2550
Biomass	3260
Small hydro	41

Source: (IRENA, 2021)

By conducting a comprehensive assessment of the Ivorian institutional system, this study aims to identify the inhibitors and facilitators within the Ivorian institutional climate. Evaluate the current issues, holes, difficulties, and open doors. This study will shed light on the areas that require attention and improvement, as well as the specific requirements and processes for enhancing policy effectiveness.

I.1. Problem Statement

The impact of institutional quality is crucial for developing countries to attract investors and facilitate project implementation. The lack of safeguards to protect assets in a host country increases the risk that investments will be confiscated, leading to higher investment costs. Poor institutional frameworks also create uncertainty in commercial transactions, a particularly sensitive aspect of the implementation of green hydrogen projects (Hartog, 2015). Despite its growing interest in renewable energies, its clean energy potential, and its desire to be the regional energy hub, Côte d'Ivoire lacks an institutional framework that meets the requirements and standards for the development and implementation of green hydrogen projects (Ballo et al., 2022). This hinders its ability to fully exploit the potential of this clean energy technology and contribute to both its national energy needs and its regional sustainability goals in West Africa. This study aims to investigate the institutional framework required for the implementation of green hydrogen projects, such as the DRYHY project in West Africa. Using Côte d'Ivoire as a case study, this research will examine the barriers and/or facilitators, as well as the specific requirements and strategies for improving policy coherence, strengthening the regulatory framework, and promoting public-private partnerships.

I.2. Research Contribution

Despite the clear and fundamental need for further investigation, there is a lack of research that focuses on this topic. This study offers a different perspective on the effective implementation of green hydrogen projects: rather than focusing on the economic or technical aspects of such projects, as most previous work has done, we have a more specific understanding of institutions, highlighting their close link to project implementation through various aspects such as political instability, corruption, infrastructure, and excessive bureaucracy. Rather than simply examining existing statistics or documents, our research takes the analysis a step further by using interviews to obtain the views of entrepreneurs on the process.

I.3. Research Questions

The research questions to be addressed are stated as follows:

- What is the importance of an institutional framework for green hydrogen project implementation in Côte d'Ivoire?
- How does the institutional framework accelerate and/or inhibit the market for hydrogen technology in Côte d'Ivoire?
- To what extent can these institutional frameworks be improved to facilitate the smooth implementation of the DRYHY project in Côte d'Ivoire?

I.4. Thesis Structure

The following part of the research will help to get a deep understanding of the topic and is structured as follows:

- Chapter 1 state of the art, gives the background of the topic followed by the findings from the literature review.
- Chapter 2 Research Methodology, outlines the methodology used from the data collection to the analysis.
- Chapter 3, presents, interprets and explains the various findings.
- Conclusion summarizes the key findings and insights obtained from the study.

CHAPTER 1 : STATE OF THE ART

II. BACKGROUND

II.1. The Concept of Institutions

The subject matter of this study is of central importance and a major challenge, mainly because of the multifaceted nature and diverse uses of the concept of institutions. In 1990, North conducted a study that highlighted the central role of institutions in driving economic development, influencing transaction costs, property rights, and incentives, and emphasizing the importance of their proper functioning. From North's perspective, institutions are defined as the societal rules and constraints that shape human interaction and incentives. They play a crucial role in shaping the development of societies. While institutions and organizations may appear similar in some contexts, North argues that institutions and organizations work together to create the foundations and structures that facilitate human cooperation. The norms, values, and rules provided by institutions guide the actions and decisions of organizations. Despite their dynamic nature, institutions serve to create a stable environment within societies and play a paramount role in driving economic development. In other words, "institutions matter" (North, 1990). According to William Riker, *"We cannot simply study tastes and values; we must also study institutions"* (Ostrom, 1986). Throughout social thought, the concept of institution has been widely used and has evolved, taking on new and different meanings over time (Scott, 2008). Institutions provide a framework for decision-making and ensure consistency and fairness in society. They help to establish order, enforce laws, and protect the rights and interests of individuals. Charles Plott argues that institutions are "the rules for individual expression, information transmission, and social choice" (Ostrom, 1986). From North's perspective, "institutions are the rules of the game in a society or, more formally, the humanly devised constraints that shape human interaction" (North, 1990). Their role is to maintain order and stability (Ng et al., 2015). An analogy can therefore be drawn with the physical concept of inertia. Just as inertia is the resistance of an object to change its state of motion, institutions can create a similar resistance to change and chaos, leading to a new definition of the institutions as a set of established formal/informal constraints that seek to resist change and chaos and provide the necessary structures and mechanisms for the execution and operation of a project (Hossein, n.d.).

The Solow model, developed by Robert Solow in the 1950s, also known as the neoclassical growth model, explains long-term economic growth. The model suggests that sustained economic growth can be achieved through investment in physical capital, improvements in technology, and policies that encourage population growth. The Solow model assumes diminishing returns to capital, which means that as capital increases, each additional unit of capital has a smaller impact on output. This helps us to understand how changes in physical capital growth affect economic growth in the long run. Indeed, if this theory is taken into account, sustained economic growth, in the long run, will depend more on technological progress and an expanding labor force than on capital stock alone. In the short run, faster capital accumulation will lead to higher output levels, but diminishing returns to capital may limit the benefits of further capital accumulation. Institutions play a crucial role in influencing technological progress, and differences in technological progress across countries affect investment rates and efficiency. Ignoring the initial impact of institutions on technical efficiency can lead to an overestimation of the role of investment in driving economic growth. Developing countries have specific infrastructure, property rights, and regulatory and tax requirements that institutions affect before production can take place. These variables pose a challenge to ensuring constant returns. It is, therefore, crucial to incorporate country-specific institutional variables into any project implementation, not only to mitigate risk but also to maximize the potential for long-term success in promoting economic growth in developing countries (Aron, 2000). The environmental framework influences the existence, operation, and proper functioning of projects. These environmental factors can be internal or external. They can be defined as a set of external conditions that are not related to the capabilities of the project team, but whose impact may hinder the existence of the project. (*PMBOK Guide*, 2017).

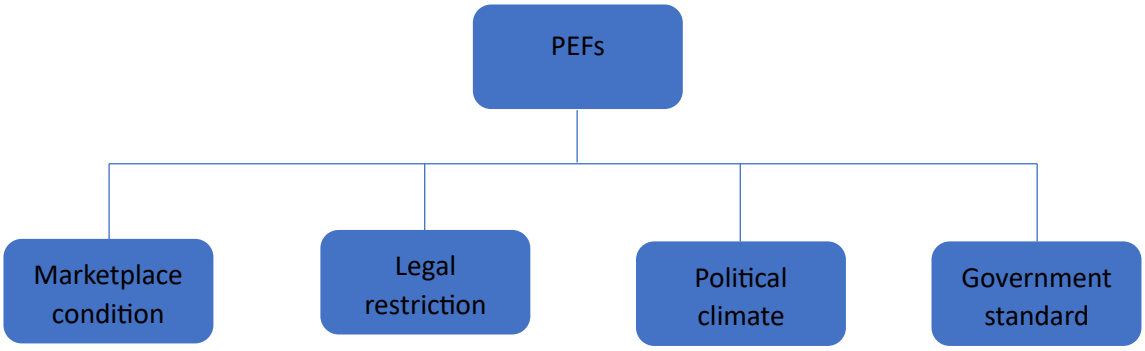


Figure 1:External Project Influences

II.2. Definition of the institutional framework

Institutions have always been an unfamous topic until the 1990s when North and his peers brought them to the forefront of economic research. Their work emphasized institutions' crucial role in shaping economic outcomes and development. Since then, there has been a growing body of literature exploring the relationship between institutions and economic growth, with many studies finding a positive correlation between strong institutions and higher levels of economic prosperity. Institutions are the determinants of economic growth (Ndiaye, 2011).

Institutions are at the center of our lives, defining the rules and behaviors necessary for human interaction. However, it was only in the 20th century that institutional framework gained prominence, with researchers of public choice exploring the role of institutional framework in the analysis, conception, and development of policy such as of Oliver E. Williamson with the publication of his book entitled "The Economic Institutions of Capitalism," a cornerstone of the New Institutional Economics (NIE) field, which presents a groundbreaking analysis of the role of institutions in shaping economic transactions and organizations within a capitalist framework around several concepts such as transaction costs, governance structure, asset specificity, and bounded rationality (Williamson, 1985), also the work done by Ronald H. Coase on transaction costs and the theory of the firm for the field of law and economics, where Coase's emphasized the importance of institutions in facilitating efficient economic exchanges and highlighted the need for clear property rights and well-defined contracts to reduce transaction costs and promote economic growth (Coase, 1960). These empirical studies were then deepened and developed over the last fifteen years, specifically under different theories such as public and social choice theories (Polski & Ostrom, 1999). Nevertheless, the analysis of the institutional framework often remains neglected due to specific challenges, including the variety of meanings associated with the term "institutions". These meanings vary depending on the field of study and are sometimes used interchangeably with other related concepts such as organizations or rules (Polski & Ostrom, 1999). However, understanding the role and impact of institutions and, therefore, the institutional framework is crucial for a comprehensive analysis of economic systems and their functioning. Previous studies have shown that scholars have been increasingly focusing on clarifying and defining the concept of institutions to ensure a more rigorous examination of their effects on transaction costs, economic growth, and development (Shirley, 2008).

One of the scholars' most widely used definitions of institutions comes from the work done by Douglas North in 1991, where he defines institutions as *"the humanly devised constraints that structure political, economic, and social interaction. They consist of both informal constraints (sanctions, taboos, customs, traditions, and codes of conduct) and formal rules (constitutions, laws, and property rights). Institutions create order and reduce uncertainty in exchange. Together with the standard constraints of economics, they define the choice set and therefore determine transaction and production costs, and hence the profitability and feasibility of engaging in economic activity"* (North, 1991). This definition points out the crucial role that institutions play in shaping the trajectory of societies and economies through formal and informal rules. This definition emphasizes the intrinsic relationship between institutions, economic growth, and social outcomes. Furthermore, in his book titled "New Institutional Economics," Oliver E. Williamson presents a comprehensive framework for understanding institutions, which he divides into four distinct levels of social analysis (see Figure 2). The first level, known as embeddedness, encompasses all informal rules and institutions associated with social theory. The second level, the institutional environment, consists of formal rules recognized by political theorists to ensure effective organization and execution. The remaining two levels are governance and resource allocation. Significantly, Williamson underscores the interdependence of all these levels, with each level exerting influence on the one directly below it. In this dynamic, higher levels impose constraints on the immediately lower levels, while the lower levels provide feedback that impacts the higher levels (Williamson, 1985). Regarding this research, the definition of the institutional framework can be translated into the set of structured rules, regulations, policies, and organizational structures put in place to guide, facilitate, and govern the development, implementation, and operation of green hydrogen initiatives. Thus, encompasses legal, economic, and governance mechanisms designed to support and incentivize investments, promote sustainability, and ensure the successful integration of green hydrogen technologies into the energy landscape of West Africa.

Enhancing the institutional framework is a crucial step in advancing innovative technologies, particularly in the current context where climate change and the growing energy demand are central concerns. Encouraging the uptake of hydrogen-based solutions to tackle energy and environmental issues is a viable approach. However, this strategy faces various hurdles that must be overcome, with the most significant obstacle being the absence of a conducive institutional framework (Broekstra, 2023).

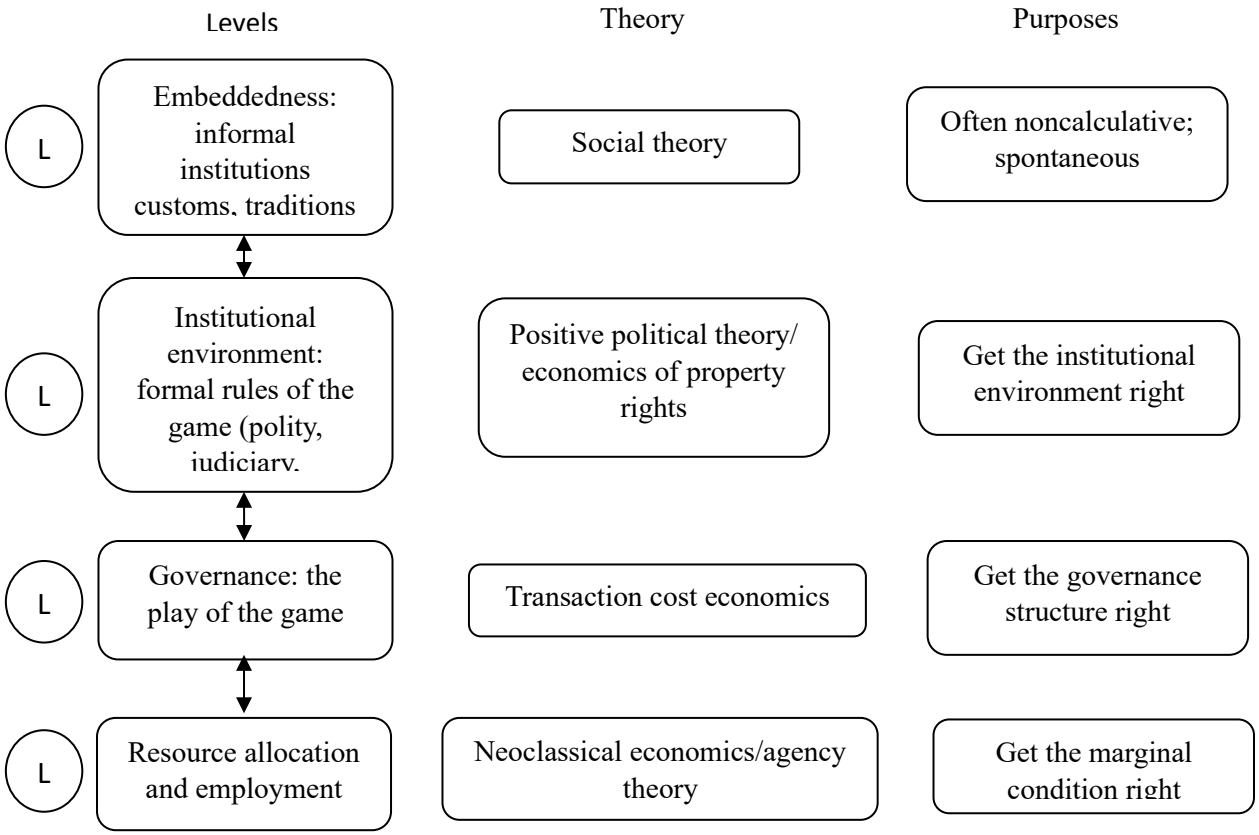


Figure 2: Institutional Framework According to Williamson

II.3. Empirical finding

In the domains of environmental science, energy, and more recently, green hydrogen, the examination of institutions has not garnered significant attention. Historically, the primary emphasis has been on technological progress, market dynamics, and policy measures (AbouSeada & Hatem, 2022). Nevertheless, as the significance of green hydrogen continues to rise, it's becoming increasingly evident that institutional frameworks play a pivotal role in molding its progress and acceptance. Economists have speculated about the factors that drive foreign investment and what elements can be particularly appealing to attract investors. Investors typically aim to minimize external costs that might arise when entering new or foreign markets (the informal institutions), as highlighted by Williamson. However, they tend to be more open to markets where the three other levels of social analysis exist and the OIL advantages are satisfied (Ownership, Internalization, and Locational Advantages). But importantly, the relevant elements remain exchange rates and capital flows, as well as institutional and political stability (Bevan & Estrin,

2004). Previous studies primarily concentrated on examining the institutional framework governing global project organization such as the study of Scott (2012). In his research on global infrastructure construction projects, Scott observed that the expansion of these projects has triggered corresponding developments in the public and non-profit sectors which are actively contributing to the establishment of new governance systems within this domain. Scott's work likely contributes to our understanding of how global project organizations are shaped by their institutional environments. and provide valuable insights into the role of institutions in project management and governance. But does not include empirical studies or case analyses, nor does it provide practical examples or evidence to support its theoretical arguments. His conclusion is specific to the case of construction infrastructure projects. The methodologies used do not allow for the identification of specific factors within the institutional framework that can help smooth the implementation of such projects and have been focusing on diagnosing situations rather than providing concrete guidance for action. Assane & Grammy (2003) have been interested in the relationship between the "quality" of the institutional framework and the country's economic growth. Their study aims to show from an international perspective that differences between less and more developed countries are the result of the quality of the institutional framework by extending the Solow model and going a step further by including the institutional framework in the model as a determinant of development. They find that a good institutional framework is particularly helpful for developing countries to achieve a conventional level of development, rather than in developed countries where physical capital formation is more important. However, the data consists of a cross-section of observations for 110 countries, which is too large to establish a causal relationship. Therefore, further research using a more comprehensive method of analysis based on identified factors is needed to identify the critical factors within the institutional framework that also act as barriers or facilitators to development and project implementation. The body of empirical research in the field predominantly consists of studies conducted in developed countries, Ganesh Devkar et al. (2020) for instance employed a case study approach, focusing on four specific cases located in India and Austria. Their objective was to demonstrate the influence of institutional frameworks on the implementation of public-private partnership (PPP) projects. Mahalingam, A. (2005), conducted research centered on the impact of institutional challenges on global project costs with selected four case studies involving segments of significant railroad projects. These projects included collaborations with companies from Japan, Korea, Germany, and India. Michael Opara et al. (2010)

utilized a case study approach based in Canada to gain insights into the influence of institutional frameworks on project outcomes. Javernick-Will, A. N., and Levitt, R. E. (2010) conducted exploratory research through interviews with 15 international construction and engineering companies. These companies were actively engaged in projects across 10 different countries, located in the USA, Europe, and Asia. Their research highlighted the pivotal role of institutional elements in project initiation and execution. Some studies are specifically centered on the topic of corruption and its implications for projects. For example, Locatelli et al. (2017) conducted research on corruption within public infrastructure megaprojects. They conducted a comparative case study involving megaprojects associated with Europe's and Italy's high-speed rail programs.

In the field of green hydrogen, the majority of significant empirical studies have primarily focused on aspects related to the hydrogen economy (Harichandan et al., 2023), hydrogen infrastructure (Hoelzen et al., 2022), defining challenges and assessing benefits (Beaucamp & Nforngwa, 2022; Velazquez Abad & Dodds, 2020), policies and regulation (Bianco & Blanco, 2020; IRENA, 2020), as well as production methods and techno-economic evaluations (Dincer, 2012; Nami et al., 2022). All this emphasizes the relevance and importance of our topic.

II.4. Green Hydrogen and its Importance in West Africa

Green hydrogen has emerged as a promising solution in the global search for sustainable energy systems. In West Africa, the benefits of green hydrogen go beyond power generation. Green hydrogen represents a huge opportunity for the region to address its energy challenges while promoting sustainable development. When talking about the green hydrogen project, many factors come into play regarding its production, storage, distribution, and consumption. Assessing the potential for green hydrogen production in West Africa is one of the fundamental parameters to consider to understand the feasibility of hydrogen projects in the region.

II.4.1. Definition And Significance of Green Hydrogen

Hydrogen, the most abundant element in the universe and the lightest element in the periodic table is a remarkable energy resource. It exists in almost all compounds, has safety properties, and exists in unlimited quantities (*Hydrogen Explained*, 2023). Often referred to as a colorless energy carrier, hydrogen production methods are classified into different colors, including green, grey, and blue/turquoise, each representing a different approach to its production. In addition to being a

versatile energy source with applications across a range of energy sectors, 'after years of being touted as a potential game-changer and the fuel of the future, green hydrogen is now recognized by both governments and investors as a key component of a realistic long-term net-zero economy' (sbai, 2022). Indeed, green hydrogen refers to hydrogen produced through the process of electrolysis, where water is split into hydrogen and oxygen using electricity generated from renewable sources such as solar or wind power (IRENA, 2020). The growing interest in hydrogen as a new energy source can be attributed to the challenges associated with fossil energy resources. Green hydrogen, although different in its production and application, has the potential to address these challenges, contribute to the creation of new jobs, and promote economic growth.

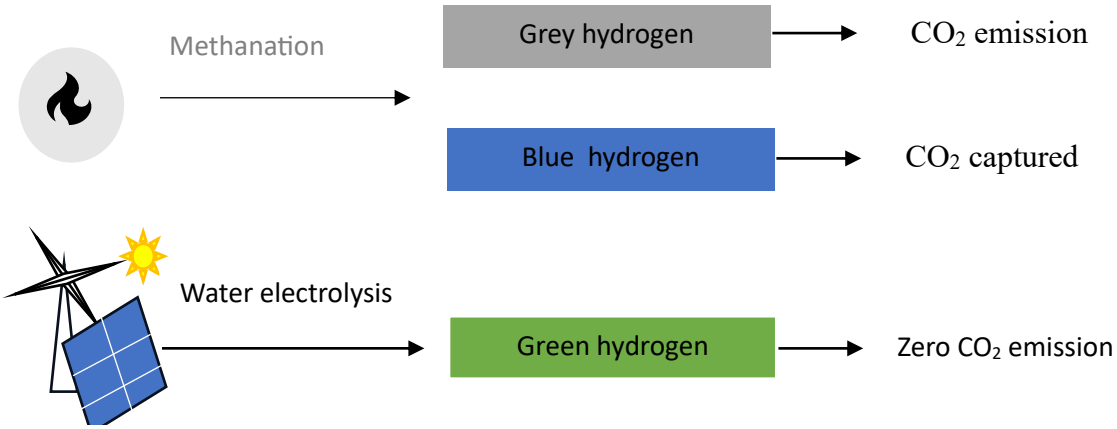


Figure 3:Hydrogen's Production Methods,

Source (IRENA, 2020)

Africa stands out as a continent with a wealth of renewable energy potential, ranging from abundant sunshine to hydroelectricity, which are essential elements in the production of green energy (Business, 2022). In West Africa, for example, H2atlas Africa estimates that solar and wind energy could help produce up to 165,000 TWh of green hydrogen per year. More than 2/3 of this amount can be produced at a cost of less than 2.50 euros (*H2 Atlas Africa*, 2021). Indeed, green hydrogen offers several compelling benefits and opportunities for West Africa, starting with stimulating economic diversification, expanding educational opportunities, and enhancing energy security. It can also ensure reliable water supplies and improved livelihoods in the region (Beaucamp & Nforngwa, 2022). However, considerable effort and cooperation is required (IRENA, 2020).

II.4.2. Overview of the Energy Landscape and Challenges in West Africa

West Africa is a region comprising 15 countries, each characterized by unique geographical features and locations with a population of over 340 million, while approximately 60% of them live in rural areas (*Energy Situation Report – West Africa*, 2016). From Mali and Niger to coastal regions like Cote d'Ivoire, Ghana, and Senegal, the region exhibits a range of climatic conditions. Unfortunately, many of these countries are classified as low-income nations with limited energy development, making energy access a crucial factor in enhancing the well-being of their populations (VILAR (ED), 2012). Energy access remains a significant obstacle to economic and social development.

There are still few indicators in this 21st century to paint the picture of the West African energy situation region, where the energy sector is dramatically underdeveloped, while population growth and prospects for economic growth would require more energy (Hafner et al., 2018).

The electricity access rate in the region is experiencing a significant disparity ranging from less than 20% in countries such as Niger, and Burkina Faso to more than 50% in Cote d'Ivoire 69.7% (95% in urban areas only), Senegal (70.4%), Ghana (85,9 %) (74% in rural areas and 95% in urban areas). Nigeria, although the fact that it is the country with the largest population in Africa (over 223 million inhabitants), faces a considerable challenge, with an estimated 96 million people, or 55.4% of the population, who have no access to electricity (*World Bank*, 2023a).

According to the World Bank, the electrification rate in West Africa is among the lowest on the continent and the highest in sub-Saharan Africa in terms of electricity cost, leaving approximately 220 million people without electricity access (Sesay et al., 2023). This limited access to electricity in the region can be attributed to regulatory, social, economic, technical, and financial constraints. But also challenges such as inadequate electricity generation, high fuel prices, limited financing options, and power transmission losses (Dramé, 2014).

II.5. DRYHY Project

Regarding the impact of climate change, it is critical to reevaluate our practices in energy production and all other practices that contribute to carbon dioxide emissions. The Paris Agreement served as a wake-up call for the increase in global temperatures, emphasizing the need for adopting new practices and developing environmentally friendly technologies.

The DRYHY project (Water-conscious production of hydrogen and e-fuels in dry regions) represents an innovative initiative aligned with this goal. The project aims to make use of new technologies and processes for the production of green hydrogen and e-methanol in an environmentally friendly manner, promoting energy conservation, sustainability, and efficiency. Germany intends to share its technological expertise through an energy partnership with African nations, particularly those facing challenges with water access or scarcity. A team of experts, both from Germany and Africa, including specialists from Forschungszentrum Jülich GmbH (FZJ), RWTH Aachen University (RWTH), Volkswagen AG (VW), and FEV Europe GmbH (FEV), are collaborating to realize this project. The goal is to empower landlocked countries like Niger and Mali to reduce their reliance on external energy sources and achieve energy self-sufficiency, thereby ensuring equitable energy access across West Africa in an environmentally responsible manner (Thoms, 2023). It aims to present a decentralized, small-scale, green methanol production system and hydrogen production. This will be achieved through the combination of direct air capture technology and Solid Oxide Electrolyzer (SOE) for the production of green hydrogen using the abundant natural resources found in sub-Saharan Africa's arid regions (Brown, 2022).

II.5.1. Direct Air Capture Technology

Direct air carbon capture (DAC) involves removing carbon dioxide directly from the atmosphere and storing it underground or using it for other purposes. The DAC process mimics the natural process of photosynthesis performed by plants, which converts sunlight into energy through their leaves. The DAC process uses specialized materials to capture carbon dioxide from the air and convert it into usable forms. This innovative technology can be deployed in various locations, making it a versatile solution for capturing CO2 emissions. Moreover, the captured carbon dioxide can be stored or utilized in various industries, such as fuel production or manufacturing processes, contributing to a more sustainable and circular economy (Dent, 2021).

II.5.2. Methanol

Methanol is a versatile compound that can be used as a raw material in various industries, including automotive, electronics, and construction. It's high energy density and low emissions make it an attractive alternative to traditional fuels. Indeed, methanol is a transparent chemical liquid obtained through the combination of carbon dioxide and hydrogen. Thanks to its low cost and remarkable

volatility, it is used in a wide range of applications as a solvent, fuel, or antifreeze agent. Easily dissolved in water, its combustion is clean, and its decomposition is fast and environmentally friendly. However, its true value resides in its ability to generate various chemical and material derivatives essential to manufacture everyday products such as building materials, textiles, pharmaceuticals, and plastics. Moreover, using methanol as a fuel source can reduce dependence on fossil fuels and mitigate climate change impacts.

This versatility makes methanol a promising candidate for sustainable energy solutions and a key component in the transition toward a circular economy. Additionally, the production of methanol from renewable sources helps to address the issue of carbon emissions by effectively recycling carbon dioxide and reducing its release into the atmosphere (Klein, 2020).

III. LITERATURE REVIEW

To gain an overview of all relevant literature concerning institutional framework and green hydrogen project, we conducted a structured literature review. The first characteristic of a structured review is the research plan, which must be carefully designed to capture a wide range of relevant documents. Each right choice made during that process will add value and increase the replicability of the work. The first stage of the data-gathering process follows the grounded theory of literature review, which includes five stages: define, search, select, analyze, and present the findings (Wolfswinkel et al., 2013). During that step “define”, was a question to define all the keywords that were found important for a meaningful understanding of the topic. Starting in 1990, only articles published during and after that date were considered. Moreover, only accurate journals, official documents, and articles that are possible to rely on have been used. As the selected country is a francophone country, most articles were found in French, and then important information was translated into English. The search has not been limited only to the field of economic and business management, but as the topic involves social science, we tried to have a view of the topic according to different scientific disciplines that can add value to the study. The second step was the search for data. Some databases, like Google Scholar, Google, Scopus, JSOR, and IEEE Explore have been used to find relevant articles. For this study, the main terms are "institutional framework”, “institutions”, “institutions inhibitors and facilitators”, “institutions and economic growth” and “institutions and green hydrogen project implementation” which have been used as a common

denominator to find relevant articles. The articles were selected based on their topic, title, abstract, and relation to this research topic.

III.1. Corruption

Some institutional instability and long-lasting problems can be attributed to corruption (Ika, 2012). International transparency defines corruption as “the abuse of entrusted power for private gain” (Transparency International, 2023). It has been shown that corruption has an interrelationship with relevant factors for economic development such as foreign direct investment, income inequality, poverty levels, individual well-being, environmental policies, rates of inflation, public opinion on the political system, and the effectiveness of regulations. During expert or civil society interviews regarding the main challenges facing developing countries, corruption is often mentioned as one of the main problems. They perceived countries with higher levels of corruption as having mediocre infrastructure (Gillanders, 2014).

Not least, corruption in public administration services makes up gangrene for businesses. It fosters an unhealthy business environment that is highly damaging and leads to exorbitant transaction costs accompanied by risks related to transactions made in such an environment. Regulations that are circumvented by unofficial payments limit business activities and make the cost of obtaining the legal documents necessary for the proper functioning of the business excessively expensive (Enterprise Survey, 2017).

Corruption is one significant obstacle highlighted in the different articles that hamper project implementation. Corruption has always been one of the most challenging issues that the Ivorian government has to deal with. Despite the multiple signatures of the convention and commitment to tackle that issue, there are still " crime networks" among the officials, making people more and more skeptical (ISSAfrica.org, 2021). One document attributes this to the “temptation of personal gain”. *“60% of Ivorians consider the government's performance in the fight against corruption inadequate”* (UNDP, 2023). The government of the country is most often pointed out as the principal actor in corruption in both the public and private sectors (OCINDEX, 2021).

To tackle this issue, the government has put in place some strategies, such as digitizing his system, to improve transparency and accountability within his department. the reinforcement of national anti-corruption strategies through the adoption of new laws and regulatory frameworks. the establishment of an anti-corruption brigade and a special unit to work to improve transparency and

accountability in his ministries of economy and finance, interior, and security, respectively. To manage all these newly established strategies, the government has also created, in 2020, a new ministry for the promotion of governance and capacity building. This ministry is in charge of overseeing the implementation of these anti-corruption measures and ensuring coordination among the various departments involved (ISSAfrica.org, 2021).

However, these efforts have been met with mixed results, as corruption continues to persist in various sectors of the country. According to a survey done by Afrobarometer with over 1,200 participants, more than 50% consider the government and all Ivorian institutions' staff implicated in the corruption. The most corrupt, according to them, are the municipal councilors, judges and magistrates, and tax agents (Afrobarometer, 2022). This is verified by the study of the National Institute of Statistics with over 3082 participants, the majority have designated security agents, educational personnel, health agents, and justice personnel as the most corrupt institutions in the country (Tape et al., 2015). These findings highlight the widespread perception of corruption across various sectors of the Ivorian institutional framework, raising concerns about the integrity and accountability of public officials.

III.2. Political Climate and Risk Associated

It is imperative to recognize and take into account the complexities and the necessity of a good political climate, and the central role it plays in ensuring the smooth operation and sustainability of the project. Expropriation, political unrest, legislative changes, restrictions on foreign currency, war, and civil disturbance are other risks directly linked to an unstable and complex government administration that has exclusive control over national power (Clews, 2016). Although it’s difficult to forecast the likelihood of these risks it's important to take the appropriate measures to ensure stability (Clews, 2016). Since the acquisition of its independence in 1960, Cote d'Ivoire has always been considered a politically and economically stable country according to the African standard think of the one-party system of the Democratic Party of Ivory Coast (Parti démocratique de la Côte d'Ivoire, PDCI), established and led by the first president, Felix Houphouet Boigny. They established this system intending to eliminate any kind of opposition and this system was favorable for the maintenance of peace, security, and stability in the country. However, the imbalance of investment between the north and south parts and the massive immigration of neighboring countries, more precisely Burkina Faso, have created the precondition for the disruption of political

stability. This imbalance in the distribution of resources between the North and South is considered "ethnic discrimination". After the country's economic crisis in 1980, Boigny launched an economic reform based on the democratization starting point of a new political system based on the multi-party rule, which further led to the creation of political representation based on ethnic groups or religious confessions and the use of the term "ivoirité" to differentiate between immigrants and the genuine. This approach aimed to address economic disparities and foster inclusivity. However, it also fueled tensions and deepened divisions among different ethnic and religious communities, hindering the country's progress toward unity and stability (Ištok, 2010).

As in most West African countries, political stability remains a major challenge in the region. Attacks by jihadists, national insecurities, and civil, religious, and tribal wars are threats that the countries of this region must face, but the majority remain coups orchestrated by military leaders who are considered *"too ambitious"* (*Striving to Achieve Stability and Development*, 2023). Although Cote d'Ivoire is suffering from a socio-political crisis fueled by deep-rooted political divisions, economic inequality, and widespread corruption that affect the state of the country, it has also had to face a troubled political situation during the electoral period. During the electoral period, Cote d'Ivoire witnessed tensions and violence due to disputed election results and power struggles among political factions. The government's response to these challenges has been met since the actual president took office in 2011 with widespread criticism but now an atmosphere of peace and security hangs in the air accompanied by free and peaceful elections (*Striving to Achieve Stability and Development*, 2023).

III.2.1. Bureaucracy Red Tape

"It took so long for the two countries to realize their goal because of bureaucratic inefficiency that was influenced by the dysfunction in the Ivory Coast for a myriad of reasons" South African Ambassador to the Ivory Coast Zolani Mtshotshisa (Mahlakoana, 2021).

An idiomatic term coming from the colonial period of America and Great Britain, red tape has been used as a means for a long time to bundle and tie up official documents to differentiate them from other paperwork. In our case, it refers to all the procedures that are characterized as time-consuming. Red tape refers to extensive rules, also known as "bad rules, ", regulations, and procedures that persist without contributing to the intended objectives for which they were designed. Among the various evils that afflict bureaucratic systems, such as the ambiguity of

objectives and rigid structures, red tape stands out as the most pervasive and consequential. This phenomenon is partly rooted in the claim of critics that excessive bureaucratic procedures complicate the lives of civil servants and citizens, imposing a heavy toll on the effectiveness of public institutions. There is widespread literature about that issue coming from reputable organizations or research scholars to highlight the negative impact of red tape (Brewer & Walker, 2010). For instance, according to the Organization for Economic Co-operation and Development, "*outdated or poorly designed regulations hinder the progress of innovation and erect barriers to market entry, international trade, investment, and overall economic efficiency. Bureaucratic expenses associated with permit applications, forms, declarations, and government requirements can be burdensome for businesses, deterring potential entrepreneurs from starting new businesses. These adverse consequences become even more costly in global markets, as the competitiveness of companies can be directly influenced by the effectiveness of national regulatory frameworks and administrative processes... the solution lies in implementing rigorous programs that prioritize the quality of regulation, ensuring that regulations are developed in a manner that meets high standards of excellence*" (OECD, 2006). As in many countries, Cote d'Ivoire has also to face the issue of red tape due to bureaucratic inefficiencies and excessive regulations.

III.2.2. Infrastructures Gaps

"*No region in the world is in greater need of new investment and more efficient operation of its infrastructure than Sub-Saharan Africa. The almost universally poor quality of the region's infrastructure directly impacts the living standards of its people and constrains private investment in other activities. Nor could any region as a whole benefit more from enhanced flows of foreign direct investment development of local capital markets…to sound economic policies". (Kerf & Smith, 1996).* The importance and attractiveness of a country's infrastructure are undeniable, as they promote collaboration and investment opportunities. However, Côte d'Ivoire faces a significant challenge in terms of access to and the development of its infrastructure (Daniel & Sama, 2020a) even for the basic project implementation. Infrastructure, by definition, encompasses the essential capacities that enable the production, transport, and distribution of goods and services. Unfortunately, for green hydrogen production, Côte d'Ivoire lacks the infrastructure for efficient water electrolysis, storage, distribution, and transport. This lack of infrastructure and technology is a major obstacle to the advancement of green hydrogen production in the country. Without proper

infrastructure in place, building a reliable and efficient green hydrogen supply chain is becoming challenging, hampering the country's ability to fully exploit the potential of this sustainable energy source. As a result, it is becoming imperative for Côte d'Ivoire to bridge this infrastructure gap, enabling the full adoption and beneficial use of green hydrogen technology.

III.2.3. Investment Risk

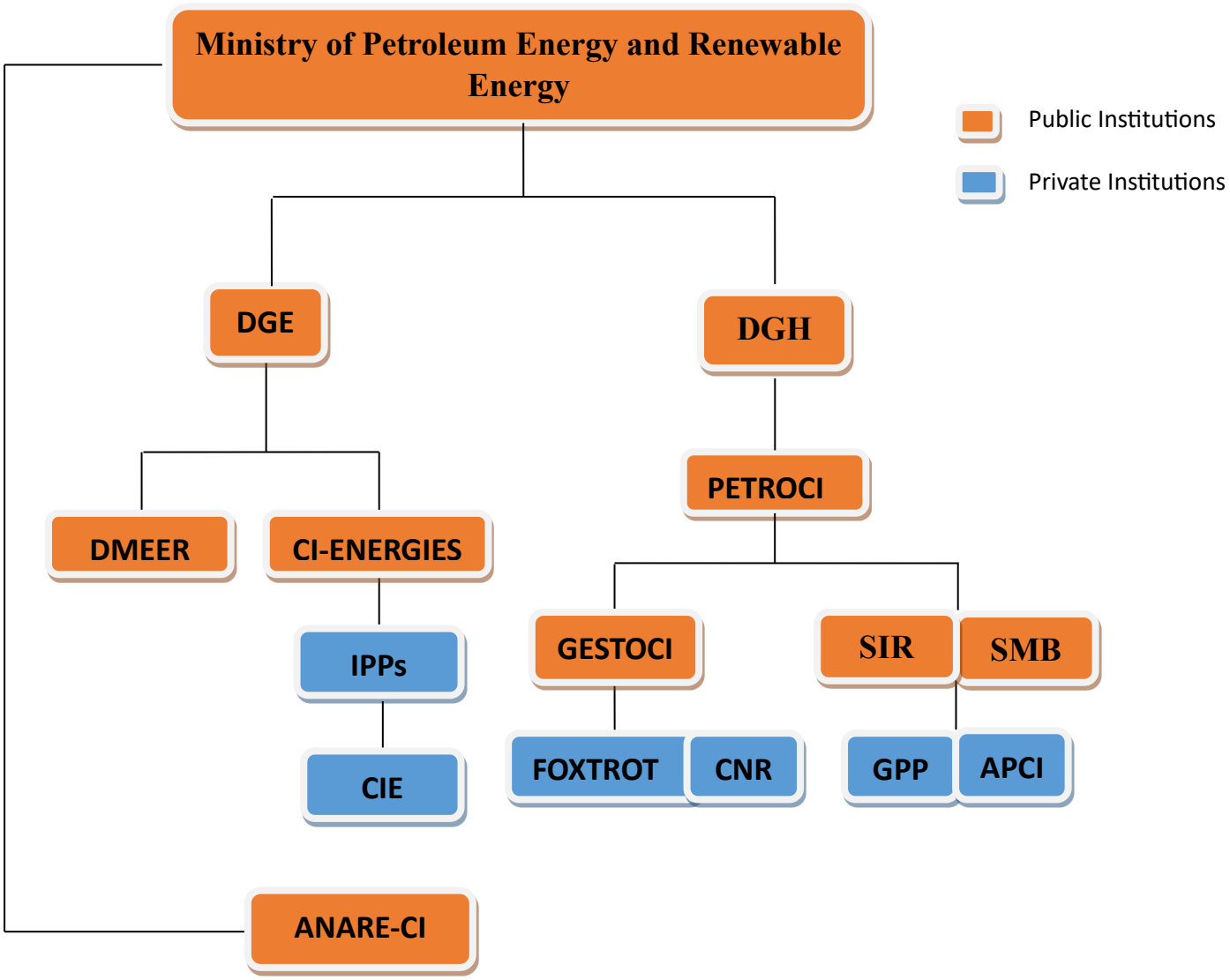
The foremost factor in any project's implementation is the investment risk. For an investor to consider investing in a project such as green hydrogen production, which is related to climate protection and sustainable development, the host country's ability to guarantee security and a return on investment defines it. Although there are many countries with enormous potential, including West African countries, implementing this kind of project remains, mostly, selective (Olawuyi, 2008). The conditions for eligibility are political stability, and access to the market, which is very important given the monopolistic character of most of the energy markets in the subregion, especially in the energy field, but even more important is the ability to find on-the-spot buyers, both industrial and normal consumers. The population and the actors in the energy sector should know the importance of the production of green hydrogen, its necessity for the energy transition, and how to fight against the climate change already present in our walls with all its consequences. According to an Afrobarometer study, less than half (44%) of Ivorians say they have heard about climate change, and over 70% expect much more action from the government or the outside (Koné & Silwé, 2022). This reflects the lack of knowledge and education on this subject. Despite its recognition of the Paris Agreement and the submission of its NDC, very few programs promote awareness or climate education. The population should be free to choose the energy that suits them; the legal environment should also be attractive; investors should have a workforce on the ground; and without forgetting macro-economic stability, which is a prerequisite for any investment, it implies the establishment of a global framework of institutions and budgetary and monetary policies. It also requires currency alignment with market levels, managing inflation, facilitating trade, establishing a national budget, generating revenue, and ensuring transparency. Given the fact that West African countries are defined by political instability and risk management, these issues need to be addressed (*Macroeconomic Stabilization*, n.d.).

III.3. The Institutional Framework in Côte d'Ivoire

In Cote d'Ivoire, the energy sector falls under the responsibility of the Ministry of Petroleum, Energy, and Renewable Energy. The ministry's role is to prepare and implement government policies related to the exploitation, production, and consumption of both renewable and hydrocarbon energies. This Ministry closely collaborates with the Ministry of Economy and Finance. There are two public institutions under the Ministry of Petroleum, Energy, and Renewable Energies: The General Directorate of Energy (la Direction Générale de L'Energie (DGE)), and the General Directorate of Hydrocarbons (la Direction Générale des Hydrocarbures (DGH)). Affiliated with the general directorate of energy, The Energy Management and Renewable Energy Department (La Direction de la Maîtrise de l'Energie et de l'Energie Renouvelable; DMEER) is the main body and pivot of this institution, responsible for various tasks which are:

- Contributing to the implementation and reassessment of the National Energy Plan to ensure the integration of renewable energies.
- Ensuring the monitoring of its execution, identifying and developing tax and customs incentives for the development of renewable energy.
- Developing a legislative and regulatory framework to promote renewable energy
- Defining standards and specifications for renewable energy.

Because of its incentive policy and regulatory framework that aims to promote the active participation of the private sector in electrical production, in particular, the Independent Power Producers (IPPs), Ivorian electrical production is not subject to any monopoly. However, the distribution and transmission are the monopolies of the private operator, Ivorian Electricity Company (CIE), whose assets are owned by CI-ENERGIES, the organization that presides over this entity. The regulation of the electricity sector is the responsibility of the independent administrative authority ANARE-CI, which has the role of regulating the energy market, ensuring and guaranteeing access to the public network with no discrimination (SIE-CI, 2020).



CI-ENERGIES

Project management and management of financial flows-in charge of the electricity production.

PETROCI

Search and exploration of hydrocarbon deposits.

GESTOCI

Storage of oil products.

SIR/SMB

Refineries and bitumen

FOXTROT/CNR

Oil & gas producers

GPP/APC

Oil and gas distributors.

Figure 4: Cote d'Ivoire Institutional Framework

III.3.1. Policy and Regulatory Framework for Renewable Energy and Green Hydrogen

In a review painting the legal and regulatory landscape of ECOWAS countries it has been shown that the legal framework and policy measures existing are not sufficient to influence the adoption of green hydrogen technologies (Ballo et al., 2022). Pletzman provided insight from his work for the political economy theories on the role of political institutions in the allocation of resources and formulation of policies this demonstrates that The allocation of resources and the formulation of policies for green hydrogen projects are influenced by the dynamics of political institutions and interest groups (Peltzman, 1980) and therefore need to be assessed to facilitate green hydrogen initiative. The government of Cote d'Ivoire has recognized the importance of diversifying its energy sources to reduce dependency on fossil fuels and promote sustainable development. The government has set an ambitious target for renewable energy in its energy mix, with a share of up to 42%. This visionary plan involves a complex mix of hydroelectricity, biomass, and solar energy at 26%, 10%, and 6%, respectively. As a result, the government has implemented various policies and incentives to attract private investments and encourage the adoption of renewable energy technologies among businesses and households. The table below summarizes all these policies.

Table 2: Renewable energy policies in Cote d'Ivoire

Name	**Launch**	**Description**
Decree No. 2016-862	03 November 2016	Grant tax and customs benefits on renewable energy equipment, and projects that contribute to the improvement of energy efficiency (Ballo et al., 2022)
Project to Improve Access to Electricity in Rural Areas (PAEMIR)	2018	Expand the grid to most rural areas for better quality, and reliability; use off-grid for 86 remote locations (IRENA, 2021).
Electricity code	2014	The Code promotes private sector development of small-scale solar PV and biomass projects, supporting grid electricity sales, and promoting distributed applications, aiming for sector liberalization

III.3.2. Conclusion

The literature review has helped us establish the relationship between the institutional framework and green hydrogen projects. Additionally, it has allowed us to pinpoint various inhibiting factors within the Ivorian institutional framework, including corruption, political instability, macroeconomic stability, infrastructure and technology limitations, as well as bureaucratic red tape. However, to validate the accuracy of these findings, further in-depth investigations were conducted through interviews, which will be discussed in the next section.

CHAPTER 2 : RESEARCH METHODOLOGY

IV. METHODS

The research methodology this study relies on is called qualitative research through the use of a case study approach. By definition, qualitative research is any type of research that produces findings without using any means of quantification. It is particularly useful when exploring complex social issues and understanding the subjective experiences of individuals. "Qualitative researchers attempt to describe and interpret some human phenomena, often in the words of selected individuals. These researchers try to be clear about their biases, prepositions, and interpretations so that others can decide what they think about it all"(Heath, 1997).

On the other side, the use of a case study approach will provide in-depth insights into the specific context, allowing for rich and detailed analysis, and are mostly applied to study complex phenomena that imply inquiry where the informant's declaration must be confirmed or disconfirmed through the use of both primary and secondary sources of evidence, which make up the so-called "data triangulation".

IV.1. Case Study

After reviewing documents relative to the topic, we have seen that there is a need for an in-depth analysis. The institutional framework, by his definition, brings together various factors that are all important to take into account for green hydrogen project implementation and need in-depth exploration. By doing this study, we aim to identify the key factors (inhibitors/ Facilitators) within the institutional framework for smooth project implementation in West Africa. As West Africa is a vast region comprising 15 countries, there is a need to narrow down our boundaries to get a holistic perspective of the institutional framework. For that, the more suitable approach is a case study. “A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context when the boundaries between phenomenon and context are not evident and multiple sources of evidence are used” (Yin, 2009).

IV.1.1. Case Study Justification

Located in the northern hemisphere between the tropic of Cancer and the equator, Côte d'Ivoire is one of the 15 countries in West Africa. The transitional zone between the humid equatorial climate and the dry tropical climate, Côte d'Ivoire is divided into two climatic zones in the north and south, which influence its ecosystem, agriculture, and economic activities. As the world's largest producer of cocoa and cashew nuts, Côte d'Ivoire's economy is mainly based on agriculture and is the third largest energy system in West Africa. Its sustained economic growth rate, which is considered to be the fastest in West Africa, gives the country an essential position as an economic hub in the UEMOA ("it represents 36% of the GDP of the UEMOA franc zone") (*Côte d'Ivoire*, 2019) (World Bank, 2023b). Although it contributes to 0.1% of global greenhouse gas emissions, it has set a target of 30.41% by 2030 without support and 98.95% with support from the international community (UNDP, 2023). In its NDC, Côte d'Ivoire is committed to a just transition focused on creating green employment based on gender and using clean energy. As a result, it intends to overhaul its institutional framework to increase its capacities for better climate resilience (SIE-CI, 2020). However, Côte d'Ivoire faces a significant vulnerability to the impacts of climate change. This vulnerability is explained by its geographical situation, its economic structure, and its inability to cope with the negative effects of climate change. With an economic development focusing on the agricultural sector, which is also one of the country's major sources of emissions, the intermittency of temperatures and changes in climate seasons affect its agricultural productivity and thus its food security. Coastal erosion and sea-level rise are also major threats facing the country and threatening populations living on the coast. According to the ND-GAIN, "Côte d'Ivoire is placed in the upper-left quadrant of the matrix.

Côte d'Ivoire is the 52nd most vulnerable country and the 148th most ready country. This high vulnerability score and low readiness score cause both a great need for investment and innovations to improve readiness and a great urgency for action. " (*CDN-CI*, 2022).

IV.2. Data Sources

The primary method of data collection employed in this study involved conducting interviews between June 1st and the end of July 2023. To gather responses, we reached out to various organizations, experts, and project managers, utilizing platforms like social media, specifically LinkedIn, and email. Our initial search focused on Ivorian companies engaged in the energy sector, a field that lacks a monopoly structure. Independent Power Producers (IPPs) notably contribute over 50% of the national electricity production, making the private sector our chosen area of investigation. This selection was facilitated by the private sector's accessibility in comparison to the more complex processes involved with engaging the public sector. Our approach included building contacts with potential participants, comprising project managers, directors, and experts. Selection criteria included their titles within organizations and ease of accessibility. Out of a total of nine people contacted, seven participants responded positively to partake in the study. We aimed to ensure gender balance by initially involving two women, even though this balance was not fully achieved. Despite not receiving responses from these women, the study continued with the remaining participants, focusing on gathering valuable and diverse insights. Interviews were conducted through online platforms such as Zoom, Google Meet, or Microsoft Teams, based on participants' preferences. This approach facilitated participation from different geographic locations, enhancing the study's inclusivity. The structured and open-ended interview format was chosen to maintain consistency in data collection, enabling easy comparison of responses across participants (see appendix). We developed two versions of the questionnaires. The first set of questionnaires was crafted by drawing inspiration from various examples found in studies related to institutional topics. We adapted these initial questionnaires to our specific case, incorporating insights from the literature. It was this second version of the questionnaires that we used during the interviews and distributed to the participants. However, upon closer examination and after an initial meeting with the participants, we determined that a readaptation of the questionnaires was necessary. This adjustment aimed to facilitate a more straightforward comparison with the findings in the literature. We also included questions related to their assessment of the level of corruption in

the country. To ensure thorough comprehension of the study's objectives, participants were provided with clear instructions and information about the study's authorship, affiliations, and institutions for data analysis. Although the initial plan was to follow a structured interview format with predetermined questions, participants' engagement led to a more flexible approach. Their interest and importance attributed to the topic spurred them to contribute further, offering advice on study methodologies, suggesting articles, and sharing documents that enriched the research process. The collaborative nature of this study extended beyond the participants' active involvement. Their insights not only bolstered the credibility of findings but also fostered a sense of shared ownership and pride in the research outcomes. This symbiotic collaboration between participants and authors underscores the value of diverse perspectives in academic investigations, ultimately enhancing the comprehensiveness and impact of the results. The subsequent section presents the detailed results of our study.

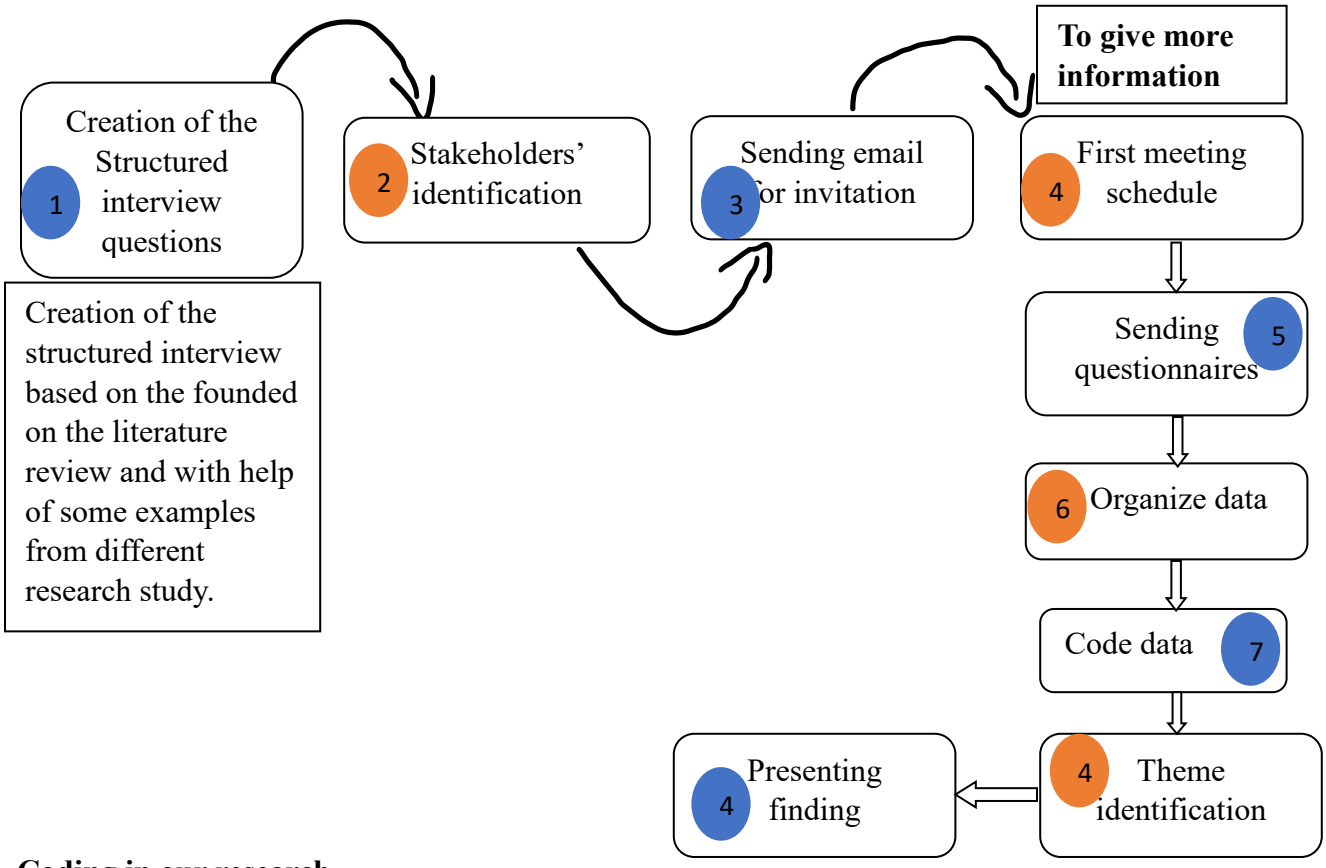
Table 3: Summary of Information on the 7 Participants

Participants Id Number	Function in the Organization	Organization Type	Nationality	Level Of Organization
1	Project Manager, Renewable Energy	Fuel distribution	Ivorian	International
2	General director of Energies	Renewable energy services	Ivorian	Regional
3	Sales Manager	Energy Power & Renewable Energy	Senegalese	Regional
4	Fonder	Green hydrogen promotion	French	National
5	Expert	Renewable energy and energy efficiency	Ivorian	International
6	Project manager	Solar power and photovoltaic technology	Ivorian	International
7	Project component manager	Renewable energy	Ivorian	International

IV.3. Data Collection and Analysis

In our review of the existing literature, we encountered various qualitative data analysis methods, including thematic analysis, narrative analysis, and others. To determine the most appropriate approach for our analysis, we thoroughly examined each method. Ultimately, we chose to employ content analysis due to its widespread use and compatibility with open-ended questions that lack specific constraints.

- **Process**



<u>Coding in our research</u>

Coding involves thoroughly reviewing the obtained responses to identify pertinent themes that hold significance for our research. Subsequently, specific codes to these themes, serve as markers to easily locate and reference the corresponding sections of text at a later stage.

Coding type	Definitions	
Deductive	A top-down approach is where you start with a set of predetermined codes and then find excerpts that fit those codes.	
Inductive	A bottom-up approach is where you start with no codes and develop codes as you analyze the dataset (*Delve*, 2021).	
Hybrid	Deductively start with a set of codes, and then inductively come up with new codes.	✕

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Hybrid coding method

In the hybrid coding phase, we will employ a method known as In vivo coding. This specific approach consists of using the exact words or phrases of the participants as codes to capture their experiences and points of view; in brief, it is a textual representation of the language of the participants, while preserving the authenticity and richness of their expressions.

As we progress, we will make use of descriptive coding, a method designed to condense the extracts already obtained from the initial in vivo coding. this second step involves using a single word or name that sums up the general idea of the data. In general, these words offer a snapshot of the data collected and give a quick idea of its content.

Coding structure

	Code	Description
1	Respondent	Participants of the interview (R1, R2...)
2	Questions	Questions that need to be answered (Q1, Q2…)
3	In vivo coding	Corruption, investment, monitoring…
4	Descriptive coding	Weaknesses, strengths, inhibitors, facilitators...
5	Answer from respondent	Exact text translates

Tools used

For data analysis, we opted to utilize Microsoft Word and Excel for various reasons. Firstly, these tools are readily accessible to us, and we possess a comprehensive understanding of their functionalities due to frequent usage. We chose to undertake a manual analysis using these tools,

primarily due to the limited number of respondents we ultimately received. This approach allowed us to thoroughly review and analyze all the content provided by the participants.

Upon closely reviewing their responses, we recognized the value of each contribution, reinforcing the need to integrate them into our work. The systematic manual analysis enabled us to diligently assign codes to all content and subsequently extract key themes from this coding process. These themes have been transformed into the main sections of our analysis. Given the time constraints, we decided against learning new software for this purpose. Instead, we referred to webinars offered by the American University Professional Studies on YouTube to effectively utilize these tools for coding (AU Professional Studies, 2023).

Coding process

The data was first structured according to the specific questions and under each question, the responses from the participants were arranged in a Word document.

Q9 : Comment voyez-vous le potentiel de la Côte d'Ivoire pour la production d'hydrogène vert et de méthanol électronique ?

R1 : La Côte d'Ivoire a le potentiel de devenir un acteur clé dans la production d'hydrogène vert et d'e-méthanol en raison de plusieurs facteurs favorables tel que ces Ressources renouvelables abondantes : La Côte d'Ivoire bénéficie d'un ensoleillement généreux et de vents constants, ce qui offre un potentiel important pour la production d'énergie renouvelable, telle que l'énergie solaire et éolienne. Ces sources d'énergie renouvelable sont essentielles pour produire de l'hydrogène vert et de l'électricité nécessaire à la production d'e-méthanol. Et son Engagement envers la durabilité par son plan national d'action pour les energies renouvelables.

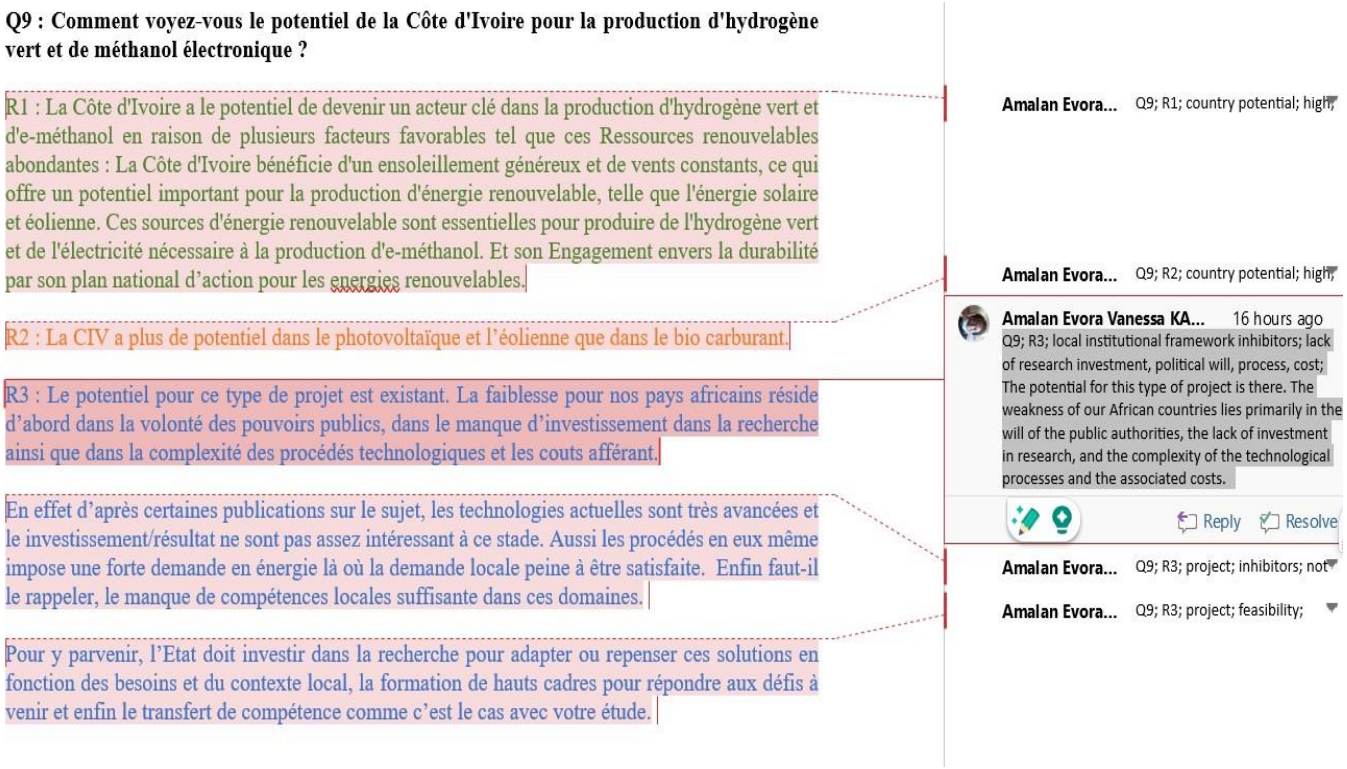
R2 : La CIV a plus de potentiel dans le photovoltaïque et l'éolienne que dans le bio carburant.

R3 : Le potentiel pour ce type de projet est existant. La faiblesse pour nos pays africains réside d'abord dans la volonté des pouvoirs publics, dans le manque d'investissement dans la recherche ainsi que dans la complexité des procédés technologiques et les couts afférant.

En effet d'après certaines publications sur le sujet, les technologies actuelles sont très avancées et le investissement/résultat ne sont pas assez intéressant à ce stade. Aussi les procédés en eux même impose une forte demande en énergie là où la demande locale peine à être satisfaite. Enfin faut-il le rappeler, le manque de compétences locales suffisante dans ces domaines.

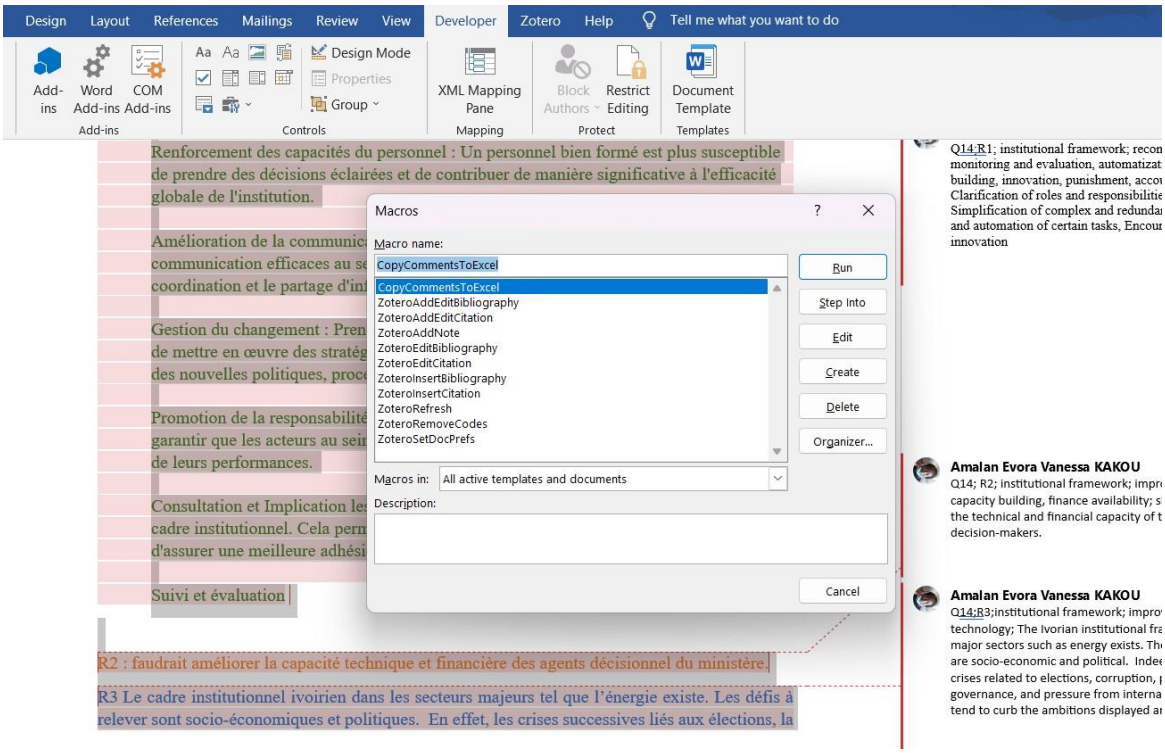
Pour y parvenir, l'Etat doit investir dans la recherche pour adapter ou repenser ces solutions en fonction des besoins et du contexte local, la formation de hauts cadres pour répondre aux défis à venir et enfin le transfert de compétence comme c'est le cas avec votre étude.

For the coding process, we began by carefully reading through the data. Some responses were quite lengthy, so our approach involved summarizing them to capture the essential points. We then left comments applying the defined code structure, with each code being separated by a semicolon (;). Since all the responses were in French, we undertook the task of translating each of them. In cases where the responses were particularly lengthy, we opted to summarize them for the sake of brevity and clarity. Below an example

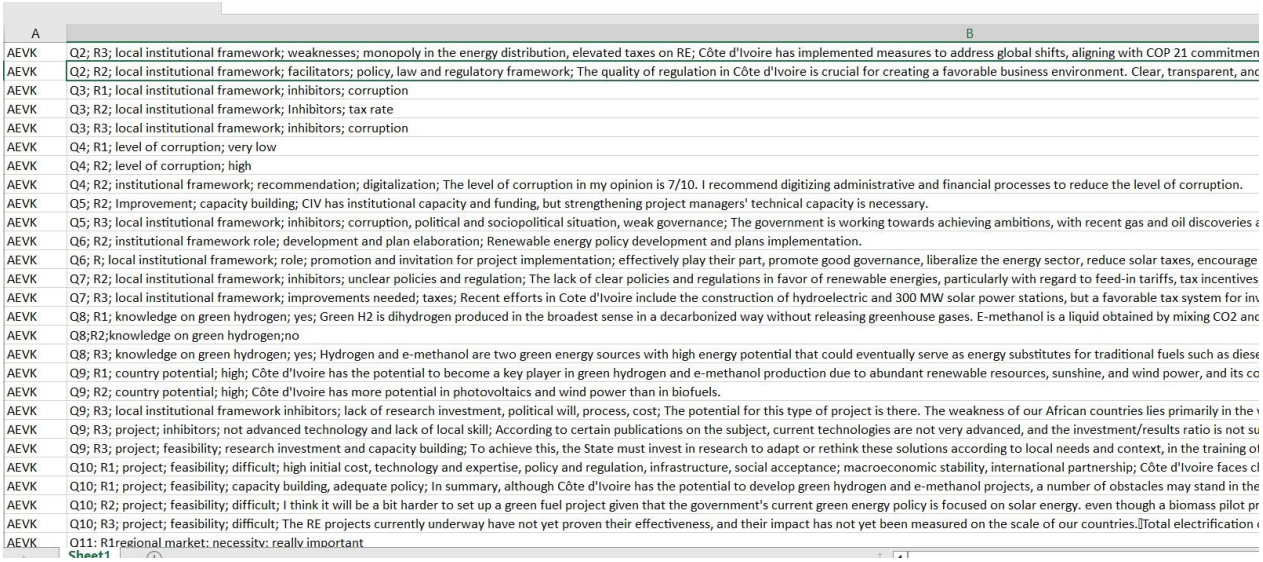


Analysis on excel

After incorporating comments based on the established code structure, we proceeded to transfer all of them into an Excel document. However, to facilitate the seamless transfer to Excel, we followed a specific procedure. We revisited a YouTube video that guided this process, where we acquired a code that needed to be applied before extracting the comments (Paul Martin, 2021). Below, we outline the steps followed for this process (for a more detailed description, you can refer to the YouTube video)



After running we got all our comments in the Excel file like the one presented below



A	B
AEVK	Q2; R3; local institutional framework; weaknesses; monopoly in the energy distribution, elevated taxes on RE; Côte d'Ivoire has implemented measures to address global shifts, aligning with COP 21 commitmen
AEVK	Q2; R2; local institutional framework; facilitators; policy, law and regulatory framework; The quality of regulation in Côte d'Ivoire is crucial for creating a favorable business environment. Clear, transparent, and
AEVK	Q3; R1; local institutional framework; inhibitors; corruption
AEVK	Q3; R2; local institutional framework; Inhibitors; tax rate
AEVK	Q3; R3; local institutional framework; inhibitors; corruption
AEVK	Q4; R1; level of corruption; very low
AEVK	Q4; R2; level of corruption; high
AEVK	Q4; R2; institutional framework; recommendation; digitalization; The level of corruption in my opinion is 7/10. I recommend digitizing administrative and financial processes to reduce the level of corruption.
AEVK	Q5; R2; Improvement; capacity building; CIV has institutional capacity and funding, but strengthening project managers' technical capacity is necessary.
AEVK	Q5; R3; local institutional framework; inhibitors; corruption, political and sociopolitical situation, weak governance; The government is working towards achieving ambitions, with recent gas and oil discoveries a
AEVK	Q6; R2; institutional framework role; development and plan elaboration; Renewable energy policy development and plans implementation.
AEVK	Q6; R; local institutional framework; role; promotion and invitation for project implementation; effectively play their part, promote good governance, liberalize the energy sector, reduce solar taxes, encourage
AEVK	Q7; R2; local institutional framework; inhibitors; unclear policies and regulation; The lack of clear policies and regulations in favor of renewable energies, particularly with regard to feed-in tariffs, tax incentives
AEVK	Q7; R3; local institutional framework; improvements needed; taxes; Recent efforts in Cote d'Ivoire include the construction of hydroelectric and 300 MW solar power stations, but a favorable tax system for inv
AEVK	Q8; R1; knowledge on green hydrogen; yes; Green H2 is dihydrogen produced in the broadest sense in a decarbonized way without releasing greenhouse gases. E-methanol is a liquid obtained by mixing CO2 and
AEVK	Q8;R2;knowledge on green hydrogen;no
AEVK	Q8; R3; knowledge on green hydrogen; yes; Hydrogen and e-methanol are two green energy sources with high energy potential that could eventually serve as energy substitutes for traditional fuels such as diese
AEVK	Q9; R1; country potential; high; Côte d'Ivoire has the potential to become a key player in green hydrogen and e-methanol production due to abundant renewable resources, sunshine, and wind power, and its co
AEVK	Q9; R2; country potential; high; Côte d'Ivoire has more potential in photovoltaics and wind power than in biofuels.
AEVK	Q9; R3; local institutional framework inhibitors; lack of research investment, political will, process, cost; The potential for this type of project is there. The weakness of our African countries lies primarily in the
AEVK	Q9; R3; project; inhibitors; not advanced technology and lack of local skill; According to certain publications on the subject, current technologies are not very advanced, and the investment/results ratio is not su
AEVK	Q9; R3; project; feasibility; research investment and capacity building; To achieve this, the State must invest in research to adapt or rethink these solutions according to local needs and context, in the training of
AEVK	Q10; R1; project; feasibility; difficult; high initial cost, technology and expertise, policy and regulation, infrastructure, social acceptance; macroeconomic stability, international partnership; Côte d'Ivoire faces ch
AEVK	Q10; R1; project; feasibility; capacity building, adequate policy; In summary, although Côte d'Ivoire has the potential to develop green hydrogen and e-methanol projects, a number of obstacles may stand in the
AEVK	Q10; R2; project; feasibility; difficult; I think it will be a bit harder to set up a green fuel project given that the government's current green energy policy is focused on solar energy. even though a biomass pilot pr
AEVK	Q10; R3; project; feasibility; difficult; The RE projects currently underway have not yet proven their effectiveness, and their impact has not yet been measured on the scale of our countries.Total electrification
AEVK	Q11; R1regional market; necessity; really important

We continued by organizing the Excel file; the use of semicolons to separate different codes greatly facilitated this phase, enabling us to easily delineate the content and permit us to have the result presented below.

QUESTIONS	RESPONDENTS	THEME	DESCRIPTION	INVIVO CODING	exact text translate
Q1	R2	local institutional framework	weaknesses	corruption and weak governance	Côte d'Ivoire's institutional framework boasts several weaknesses, including corrup
Q1	R2	local institutional framework	strengths	political stability, administrative efficiency improvement	Côte d'Ivoire's institutional framework boasts several strengths, including political s
Q2	R3	local institutional framework	strengths	political willingness for RE, subsidies for LPG	Côte d'Ivoire has implemented measures to address global shifts, aligning with COP
Q2	R3	local institutional framework	weaknesses	monopoly in the energy distribution, elevated taxes on RE	Côte d'Ivoire has implemented measures to address global shifts, aligning with COP
Q2	R2	local institutional framework	facilitators	policy, law and regulatory framework	The quality of regulation in Côte d'Ivoire is crucial for creating a favorable business
Q3	R1	local institutional framework	inhibitors	corruption	
Q3	R2	local institutional framework	Inhibitors	tax rate	
Q3	R3	local institutional framework	inhibitors	corruption	
Q5	R3	local institutional framework	inhibitors	corruption, political and sociopolitical situation, weak governance	The government is working towards achieving ambitions, with recent gas and oil dis
Q6	R2	institutional framework role	improvement needed	Renewable energy policy development and plans implementation.	
Q6	R3	local institutional framework	role	promotion and invitation for project implementation	effectively play their part, promote good governance, liberalize the energy sector, r
Q7	R2	local institutional framework	inhibitors	unclear policies and regulation	The lack of clear policies and regulations in favor of renewable energies, particularl
Q7	R3	local institutional framework	improvements needed	macroeconomic stability, international partnership,Taxes	Recent efforts in Cote d'Ivoire include the construction of hydroelectric and 300 MV
Q5	R2	local institutional framework	Improvement needed	capacity building	CIV has institutional capacity and funding, but strengthening project managers' tech

IV.4. Limitation

We acknowledge that there are some limitations to our work mainly the interview. Indeed, we were able to collect a few responses to the questionnaires than we expected, partly due to distance and the limited time available. Opting for a survey with multiple-choice questions, which are simpler and quicker to answer, would have been a more prudent choice. Additionally, our decision to prioritize the participation of business directors and project managers made data collection relatively challenging and demanded a significant time investment. While most of those contacted (7 out of 9) responded positively, obtaining their responses after sending the questionnaire took some time. However, the utilization of structured interviews with prepared questionnaires greatly facilitated the process.

Furthermore, the absence of inclusion of civil society and individuals from various sectors of activities has restricted our ability to analyze the diverse factors identified from varying perspectives. A more diversified approach would have enhanced the coherence of our work. Nevertheless, the structured literature review enabled us to address certain gaps by consulting documents that have already conducted surveys and interviews in this field in Côte d'Ivoire. Documents such as the Afrobarometer, the study of the “Institut National des Statistiques en Cote d’Ivoire (INS)” and the World Bank Enterprise Survey served as references and provided support for our work. Afrobarometer allowed us to obtain a wider range of opinions from civil society concerning their perception of the identified inhibitors and facilitators. The World Bank survey furnished us with an overview of how companies perceived the business environment in Côte d'Ivoire, along with their viewpoints on the identified factors such as corruption and political instability and their impact on business operations. Even if we mainly focused on business leaders and project managers, this approach allowed us to obtain sincere and authentic answers regarding the Ivorian institutional framework, the challenges they face, and their perception of green hydrogen.

CHAPTER 3 : RESULTS AND DISCUSSION

V. RESULTS

V.1.1. Green Hydrogen and Country Potential

Before starting the questioning process, it's crucial to ensure that all participants possess a foundational understanding of the subject matter. A majority of them were already familiar with green hydrogen or had experience in the field. One respondent defines "*green hydrogen as dihydrogen produced in the broadest sense in a decarbonized way without releasing greenhouse gases and considered E-methanol as a liquid derivate by mixing CO2 and H2. For another, Hydrogen and e-methanol are two green energy sources with high energy potential that could eventually serve as energy substitutes for traditional fuels such as diesel and gasoline. Although the technology and processes still need to be fine-tuned, the initial results augur well for the future"*.
In general, all participants possess a clear comprehension of the research subject and maintain an objective perspective regarding Côte d'Ivoire's potential for their production. While the country's policy may currently prioritize biomass and hydropower as primary renewable energy sources, the participants believe the country "*has more potential in photovoltaics and wind power than in biofuels"* and are optimistic about the fact that *"Côte d'Ivoire has the potential to become a key player in green hydrogen and e-methanol production due to abundant renewable resources, sunshine, and wind power, and its commitment to sustainability through its National Renewable Energy Action Plan"*.
However, before reaching these conclusions, it's important to acknowledge that there are challenges within the institutional framework that need to be addressed.

V.1.2. General View on the Institutional Framework Challenges

The institutional framework in a country encompasses all the rules, norms, and regulations necessary to guide the decision-making process it also has the role of ***"****promoting and inviting for project implementation"*. It includes various directives that are subject to challenges that need to be addressed. According to the respondents, there are numerous challenges encompassed in general in the institutional framework. However, "*the main institutional challenges to the development of a green hydrogen and e-methanol sector are the Policies and regulations, political stability,*

political willingness, and the lack of investment and financing". However, there is still ample room for improvement, particularly through "*digitalization, the development of renewable energy policies, and the effective implementation of national renewable energy plans".*

In the case of Côte d'Ivoire, numerous challenges have been highlighted, with one of the most prominent being the issue of corruption, one participant rated, the level of corruption at 7 out of 10, indicating a significant concern. However, corruption is not the only challenge, the institutional framework is marked by various weaknesses. *"Côte d'Ivoire's institutional framework boasts several weaknesses, including corruption, inadequate governance, administrative sluggishness, regional disparities, and social instability. Despite the positive trend of enhancing political stability, the possibility of social tensions remains a need to be considered"*. Also, although the fact that the *"government is working towards achieving its ambitions, with recent gas and oil discoveries, institutional arrangements and external factors like socio-political situation, governance, and corruption remain unresolved".* Furthermore, despite ongoing efforts to *"implement measures to address global shifts, aligning with COP 21 commitments, these include incorporating new energy facets into the Ministry of Energy and Petroleum, the encouragement for renewable energies through engineering institutions, and initiating multiple renewable energy projects"* there is still *"weaknesses"* mainly in the *"energy distribution"* due to the *"Monopoly"* in effect there *"and the significant tax pressure on solar products. Also, the lack of clear policies and regulations in favor of renewable energies, particularly about feed-in tariffs, tax incentives, production targets, and support mechanisms for renewable energy projects"* are part of the challenges. Nevertheless, *"Côte d'Ivoire's institutional framework boasts several strengths, including political stability, enhanced administrative efficiency, and significant economic potential".*

V.1.3. Improvement Needed

To ensure the successful and streamlined implementation of a green hydrogen project, several challenges must be addressed and improvements made. First, the government needs to *"promote good governance, liberalize the energy sector, reduce solar taxes, and encourage entrepreneurial initiatives, and new companies' installation".* While significant strides have been taken in the country, such as *"the construction of numerous hydroelectric dams and the ongoing development of a 300 MW solar power plant, there remains a need for a favorable tax system"* that encourages

investment in these sectors. *"Clear, transparent, and predictable regulations"* will *"facilitate business operations and reduce bureaucratic"* red tape. secondly, clarity of laws, stability of rules, and protection of property rights for permit issuance need to be considered. *"Côte d'Ivoire has the institutional capacity and funding"* necessary, *"but strengthening project managers' technical capacity is required. Regarding the situation of corruption, all participants recommend digitizing administrative and financial processes"* to limit interaction between individuals and officials and reduce bribery**.** *"To improve the technical and financial capacity of the ministry's decision-makers"*, they emphasize the fact that *"Leaders must give the example. This means making ethical and responsible decisions, being open to learning, and being ready to adapt to changes. Strengthening values and corporate culture. Encouraging good behaviors promotes accountability, transparency, and collaboration".*

There is also a need "*for capacity building on conflict management, emotional intelligence, intercultural communication, and many other relevant topics to strengthen employee skills. Implement Regular monitoring and evaluation, to identify weak areas, through the use of key performance indicators example the monitoring dashboards can help monitor progress and take corrective action promptly. Involve government stakeholders, employees, customers, suppliers, and local communities, in decision-making. Make use of Flexibility and agility in adaptation to rapid changes in the market".* Proceed to the *"Clarification of roles and responsibilities. Simplify complex and redundant processes and, Encourage innovation".*

The government must also "improve the technical and financial capacity of the ministry's decision-makers, promote energy sovereignty, and create more local wealth to reduce the influence of international donors.

Combining the efforts of countries facing the same energy challenges through the creation of a regional market." To accomplish the aforementioned objectives government must demonstrate a Strong political will.

V.1.4. Importance of the regional market

All the participants acknowledge the importance of a regional market to increase the electricity rate access of the different countries and foster economic growth and *"energy stability".* The implementation of a regional energy market holds substantial potential for both Côte d'Ivoire and neighboring nations. *"Most countries in the sub-region allocate a significant proportion of their*

budgets to solving energy-related problems (domestic electrification). Some industries are struggling to set up because of a lack of electrical power to run their equipment. Other countries are forced to subsidize fuel to contain social pressure. All these problems can be addressed if regional efforts lead to viable solutions and a more open market. The creation of a regional and sub-regional market is a necessity because all the West African countries are facing the same socio-economic and energy challenges, even if some seem to be better structured and more advanced. The diversity of natural resources available, the sharing of skills, and the possibility of mobilizing financial resources are all assets that can be exploited at the regional level. A regional energy market could attract investment, create jobs, and stimulate innovation".

However, to facilitate the implementation and smooth operation of a regional energy market, several types of institutions need to be created to ensure proper functioning and supervision. For example, a regional energy agency, a research and development institute, a collaboration platform, and the implementation of a common policy framework. Given the urgent need for energy access in the region, the creation of a new agency can be costly and time-consuming so, *"it would be simpler to build on existing regional structures and set up dedicated research and project units with the necessary resources".*

V.1.5. Participants' opinions on the project.

From the perspective of our participants, it will be difficult to implement such a project due to the readiness of the technology. for one of our participants, "According to certain publications on the subject, current technologies are not very advanced, and the investment/results ratio is not sufficiently attractive at this stage. In addition, the processes themselves impose a high energy demand at a time when local demand is struggling to be met". *And the* "lack of local skills in these areas. For another, The Renewable Energy projects currently underway have not yet proven their effectiveness, and their impact has not yet been measured on the scale of our countries. The total electrification of Côte d'Ivoire has not yet been achieved. The social and economic challenges facing our countries are not conducive to investment in these areas". *Some are even more pessimistic about the project and think that "it would be difficult at this stage to see projects such as hydrogen, e-methanol, or even terminals for electric cars.*

There are, however, some promising local initiatives, such as the production of biogas and biofuel from agricultural residues, cassava, and rubber seeds".

"In summary, although Côte d'Ivoire has the potential to develop green hydrogen and e-methanol projects, several obstacles may stand in the way of their implementation. To succeed, the country will need to address these challenges by creating a favorable investment environment, developing local skills, establishing appropriate regulations, and promoting social and environmental acceptance. The government must invest in research to adapt or rethink these solutions according to the local needs and context and ensure the transfer of skills, as is the case with the West African Science Service Center on Climate Change and Adapted Land Use (WASCAL) scholarship".

VI. DISCUSSION

VI.1.1. The Views of Participants Compared with The Literature

Conducting the interviews was of great importance as the results obtained confirmed the validity of several aspects such as the level of corruption in the country, the prevailing political instability, and the current stability brought about by recent government reforms. In addition, the interviews shed light on the lack of infrastructure and provided valuable insights into the challenges and potential solutions for implementing green hydrogen projects. However, opinions on the feasibility of the project are more controversial. Côte d'Ivoire is rich in renewable energy potential, both solar and wind. These resources could be used to produce both electricity and, in the specific case of our project, hydrogen for the production of e-methanol, a potential candidate to replace existing fuels. However, Côte d'Ivoire faces several challenges within its institutional framework that need to be overcome to create a favorable environment for the implementation of green hydrogen projects.

VI.1.1.1. The case of corruption

The persistent nature of corruption in Côte d'Ivoire, which even seems to be an incurable disease, is defined by the proportion of illegal transactions that take place between officials and individuals or companies. Although corruption is unquantifiable, its prevalence is more or less equivalent to the direct and indirect costs it imposes on businesses. However, if it were better structured by the government and considered a fixed tax, it would become less negative and more understandable for companies. Although this practice would increase the prevalence of corruption, it would allow companies to legitimately anticipate certain government regulations in exchange for bribes and continue to operate with greater confidence. As we have seen with the Ivorian customs services,

most people and companies are aware of additional payments in addition to the guarantee of authorization to obtain certain objects or products (*Extent of Public Corruption in Ivory Coast*, 2022). However, in most cases, as in the case of Côte d'Ivoire, corruption appears in another form, called arbitrary, because officials, in search of profit, act independently and unpredictably, creating a chaotic network of corruption, regardless of the consequences of their actions on businesses. There is therefore a feeling of insecurity at the level of companies, which are seeking services in a corrupt environment and do not know whom to bribe, how much to pay, or whether their payments will result in the promised goods or services. Some imposters or scammers pose as direct contacts in the government office and demand bribes for services they cannot provide. They are most common in the preparation of legal documents, permits, licenses, and the sale of land in Côte d'Ivoire. In such an environment, the amount and frequency of bribes required for licenses or permits remain uncertain and, even when paid, do not always guarantee the desired results. The pervasiveness of corruption poses significant challenges, but the arbitrary nature of corruption undermines a company's ability to accurately estimate the costs and impact of corruption on its operations. In this case, most firms choose to avoid such corrupt markets, incurring opportunity costs by not entering them (Doh et al., 2003). We attempted to measure the level of corruption in Côte d'Ivoire based on its arbitrariness and pervasiveness. To do so, we evaluated the World Bank's 2017 Business Environment Survey for Côte d'Ivoire (*Explore Economies*, 2023). This survey focuses on the general business environment of 361 firms in the country, as well as the global obstacles faced by firms through interviews with business owners and top managers. It shows that 266 (73.6%) firms identified corruption as a major obstacle, 129 firms expected to give gifts to win government contracts and 91 firms (25.3%) had already experienced bribery. If we assume that the companies that had already experienced it were those that had expected it for contracts, this means that more than 70% of this group had already experienced it. From this, we can conclude that corruption is widespread in Côte d'Ivoire, that most companies are aware of it and expect it, and that it is also arbitrary.

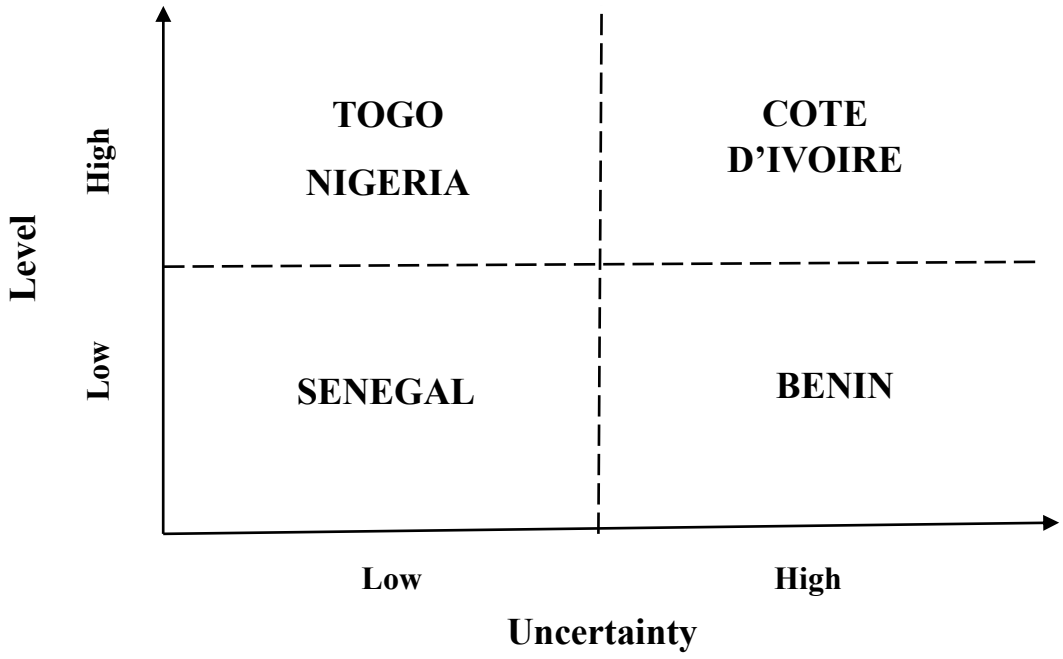


Figure 5: Dimensions of corruption matrix in some west African countries

Note: The countries added are based on the same assumption and are all parts of West Africa it was just to have a view on the corruption state and level of the case study.

These two factors can lead to market avoidance. Some key strategies have been highlighted to help address the issue of corruption in Côte d'Ivoire.

The results presented in the following table below are derived from the document titled Coping with corruption in foreign markets (Doh et al., 2003).

Table 4: Keys Strategies to Address Corruption Issue

Strategies	Targeted entity/people	The goal of the strategy
1. Promote public awareness and youth education corruption	Population and youth	Demonstrate through sensitization to the population the negative character of corruption and create a young generation more aware of their rights and responsibilities in the fight against corruption.
2. Fostering a culture of integrity and ethic	Firms and government employee	Make them avoid any practice of corruption
3. Stricter regulation and penalties for bribery	Firms	Discourage them toward any engagement of such practice.
4. Ethics and anti-corruption training	Government and institutional officials	Open their eyes to the negative consequences of corruption and the benefits of having a transparent and accountable environment.
5. Implementing a strict and transparent audit process	Government offices and firms	Reduce the opportunity for corruption Promotion of transparency and accountability
6. Create an independent agency anti-corruption with legislative power.	From government officials to population	Make sure that all the strategies adopted are respected and applied.
7. Implement and enforce strict anti-corruption legislation	From government officials to population	Ensuring the punishment of all forms of corrupt behavior. ensure the greatest transparency, accessibility, and universality of these laws, applicable to all individuals, especially those in public office.

Strategies	Targeted entity/people	The goal of the strategy
8. Encourage anonymous whistleblowing in exchange for a bonus and with the penalty of firing the employee guilty of corruption.	Government officials/ and institutions officials	guarantee a safe environment where everyone would become an agent in the fight against corruption.
9. Fostering partnership	Civil society organizations, government agencies, and international bodies	Learn from others, and share resources, expertise, and best practices.
10. Digitalise all system	Public institutional office	Minimizing human interaction in certain transactions ensures and reduces corruption opportunities.
11. Recovery of illegal asset	Public institutional office	Ensure the traceability of any documents obtained illegally by special code or numbering
Given the existence of an anti-corruption agency in Côte d'Ivoire, it is imperative to recognize that, unfortunately, its effectiveness has not been recognized. This sad reality can be attributed to the lack of knowledge and resources available to the agency. To address this, it would be prudent to strengthen the agency's capacity through extensive training, financial support, and strong and credible legal authority. Leaders should set strong examples of ethics and integrity and ensure that anti-corruption initiatives are at the forefront of their agendas.		

VI.1.2. Regional Integration and Public-Private Partnerships

Despite the real importance of infrastructure and its role in promoting cooperation and investment opportunities, it remains a challenge in Côte d'Ivoire (Daniel & Sama, 2020b). One solution to this problem can be found through regional integration. The development of regional infrastructure is an opportunity for market creation and greater economic opportunities. It ensures the development of essential infrastructure to promote and support economic development not only regionally but also nationally for all member countries. It promotes trade and investment and contributes to the eradication of poverty and the improvement of social conditions. ECOWAS has made great strides in developing regional infrastructure, both in terms of regional transport and communication systems, which are essential for cooperation in the region, and in terms of energy and water supply. However, challenges remain, including those related to the institutional framework, corruption, and political instability (Ibok & Atayero, 2022). Corruption leads to misallocation of resources through misappropriation of funds for infrastructure projects and fraud (Daniel & Sama, 2020b). Notably, in an interview conducted by VOA Africa with Professor Léonce Ndikumana, an expert on illicit capital flows at the African Development Bank, he stated that "those who divert money are the very ones responsible for managing it". He went on to say that, according to their analysis, "between 40 and 60 cents of every loan granted to African countries is lost to corruption and financial mismanagement". This leakage is deeply rooted in the institutional framework, as those who benefit from capital flight simultaneously undermine the government's ability to oversee trade and fiscal transactions (Guensburg & Manirakiza, 2022). In conjunction with addressing the lack of adequate infrastructure, the establishment of public-private partnerships (PPPs) emerges as a potential solution. Public-private partnerships (PPPs) are, by definition, cooperative arrangements that bring together government agencies and private sector companies, usually, multinational corporations (MNCs), to jointly deliver public services, in our case infrastructure projects. They can be a means of overcoming operational inefficiencies and strengthening institutional frameworks. By leveraging expertise and resources on both sides, challenges such as capital flight and electoral fraud can be addressed. Through this collaborative approach, governments can leverage private sector innovation and investment to drive economic growth and development. While this element is truly important, certain barriers need to be removed to fully realize the potential of such a partnership (Dykes & Jones, 2016).

VI.1.2.1. Social Acceptance

It's a big issue that needs to be highlighted, and it's at the heart of the political instability in the region, according to the participants and the literature. For decades, West African countries were under European colonial rule. Throughout this period, Europeans systematically exploited their territories, siphoned off the region's natural resources, engaged in ineffective trade with their colonies, and built infrastructure primarily to serve their interests. This exploitation fostered an enduring sense of resentment among the population, a sentiment that persists to this day. Post-independence, West African countries have maintained economic and political ties with Europe, mainly in the form of trade in commodities such as oil, cocoa, gold, and minerals. European nations are the main investors in these countries, exerting influence in sectors ranging from energy to agriculture. Unfortunately, the contracts signed in the trade often do not fairly reflect the value of the goods sold. This perpetual cycle of injustice perpetuates dependency and keeps populations in poverty. All of these realities have contributed to a profound lack of trust among the local population toward these entities, making potential partnerships difficult. This lack of trust is a major factor fueling political instability, coups, and post-election crises. Individuals seek leaders who can protect their interests and secure more favorable terms in their dealings with Europe. To meet these challenges, there is an urgent need for greater transparency within partnerships. This can be achieved by disseminating project information and demonstrating their tangible contribution to improving the lives of the population. The use of media platforms and, even more effectively, social networks would be beneficial, as a significant proportion of the West African population is young and digitally connected (UNFPA, 2018). Furthermore, it is imperative to involve local people in decision-making processes to ensure that projects truly meet their needs. Providing training and involving the community in project implementation can empower them to play an active role. Diversifying partnerships is also essential. Building trust is crucial to fostering any partnership.

VI.1.2.2. Policies

During the interview, one of the participants, a project manager in a local company, shared an important insight. He mentioned the key role of his company in the realization of a large project, commonly referred to as a 'big project'. The implementation of this project required specific laws that did not exist in the country. These laws were introduced to meet the needs of the project but

were dropped once implementation was complete. Investigations revealed that these laws had been copied from another African country without adaptation or modification. Although the desire to diversify the energy mix and promote renewables is affirmed in Côte d'Ivoire, the current laws for their use are weak and inconsistent. A major challenge for partnerships is often the inconsistency and variability of existing rules and regulations. Inadequate skills and the fragility of the legal system are also obstacles. It is undoubtedly wise to draw on best practices and regulations from other countries, especially when it comes to emerging energy sources such as green hydrogen, which is still little known in the subregion. However, it is all the more important to adapt them to the specific needs of the country to ensure their long-term effectiveness and strengthen their credibility in the international community. In this way, we can mitigate the risks of public-private partnerships in our region and ensure the proper development of our infrastructure. By creating robust regulations, we are setting the stage for sustainable and successful projects.

VI.1.2.3. Political Will and Technological Barriers

The second major factor highlighted by the study and by the participants is the lack of political will. This is primarily due to the complexity of this type of market, which requires a thorough understanding of all the contractual terms and conditions before a project can be implemented. Lack of experience in this area among managers and fear of opposition, often from trade unions or opposing political parties that foster political instability, also contribute to this phenomenon. There is also an insistence on maintaining state monopolies in certain sectors, such as energy, out of mistrust and to maintain state control, as seen in West Africa. Even when these partnerships are approved, they are often driven by short-term political interests, especially in the run-up to elections, to gain more votes and ensure that they remain in power. In terms of technology, forms the basis of project establishment. Technology is used to communicate, plan, and design projects through programming, project management, and evaluation software. However, it requires skills that are often lacking among the people directly involved in these projects and from the region. These partnerships also require an initial investment on both sides, which countries often choose not to make due to limited resources and accumulated debt.

VI.2. Critical analysis

Although climate change is a widespread issue and a reality accepted by most people, it is still unknown to most West Africans. The adoption and creation of green hydrogen, and the development of projects leading to its production, are primarily motivated by climate concerns rather than economic concerns, although behind the economic and political concerns, there is a primary need to stimulate public interest in this issue. It is necessary to inform the population, to present them with the different options available to them, and to allow them to choose freely which alternative suits them. One of the main findings of this study is the crucial role played by institutions in the development of projects. The case of Côte d'Ivoire is an excellent example of the complex and multifaceted nature of these institutions. While commendable efforts have been made to introduce and integrate renewable energy sources, it is clear that the institutional landscape is not without its shortcomings. Bureaucratic obstacles, regulatory uncertainties, and administrative inefficiencies appear to be significant barriers that can hinder the implementation of green hydrogen initiatives. These challenges highlight the urgent need for comprehensive institutional reforms that streamline processes, strengthen accountability, and create an enabling environment for increased private sector participation. In addition, there is a wide gap between intention and action (IRENA, 2022), particularly when it comes to implementing projects such as green hydrogen, although policy documents and frameworks can demonstrate a national commitment to achieving a sustainable energy transition. However, translating these aspirations into concrete initiatives requires careful coordination between the various actors in the private sector and the public sector. Differences in policy objectives and implementation methods can hinder the realization of the immense opportunities offered by green hydrogen projects. The study found that corruption and political stability have a significant impact on project implementation. Corruption, in particular, poses a significant threat to the transparency of decision-making and public confidence. To facilitate the smooth implementation of such a project, "public procurement rules should focus more on the prevention of corruption". Prioritizing the eradication of corruption and maintaining democracy and a stable political environment that gives investors the confidence to commit to long-term green hydrogen projects is therefore essential not only for the realization of specific projects but also for the region's overall goals of advancing energy access and transformation.

VI.3. Future Work

The main focus of this thesis has been to explore and identify inhibitors and facilitators within the institutional framework that can either contribute to or hinder the smooth implementation of green hydrogen projects. To ensure the true success of the implementation and development processes of such projects in West Africa, further research is required with increased sample size and an extension of the world for comparison purposes and identification of additional factors that may have been missing. Similarly, this work provides only a limited overview of the benefits associated with the development of green hydrogen projects. One of the major challenges in West Africa remains political instability and the establishment of regional markets, given the unequal distribution of natural resources between some countries in the sub-region. A more comprehensive assessment of this issue is needed to ensure the success of such projects in the region.

Future research should focus on how to effectively implement the solutions discussed, demonstrate their importance in increasing investor confidence, and promote transparency. This paper has already begun to suggest certain practices that could facilitate change, including capacity building, digitization, the establishment of standardized policies and regulations, the dissemination of information through social networks and the media, the involvement of civil society in decision-making, and the training of public personnel in ethics. It also emphasizes the role of leaders in leading by example, being receptive to public concerns, and being open to international partnerships. In addition, it's important to consider that existing compliance requirements, such as regulatory frameworks and policies already were primarily focused on conventional development processes, may need to be adapted to accommodate renewable energy projects. To promote an energy mix and facilitate the implementation of green hydrogen projects, these frameworks will need to be adapted. Finally, this study did not compare the potential barriers to determine their relative influence. Although the literature has identified corruption and political stability as significant factors, a more in-depth study at this level would have been beneficial.

VII. CONCLUSION

The main objective of this study on the institutional framework for green hydrogen projects in West Africa was to identify inhibitors that could act as barriers to the implementation of such projects, using Côte d'Ivoire as a case study to limit the boundaries. It also aimed to discover facilitating elements that could promote easy and effective implementation. These objectives allowed the formulation of three research questions, the first of which is:

1. What is the importance of an institutional framework for the implementation of green hydrogen projects in Côte d'Ivoire?

To answer this question, we started by identifying and defining the various key concepts that make up our research subject: "institutional framework" and "green hydrogen". We carried out this process through an empirical bibliographic review. This helped us to gain a comprehensive understanding and to establish the significant role played by the institutional framework. It turns out that an institutional framework is a set of established formal and informal constraints that aim to resist change and chaos while providing the essential structures and mechanisms for project implementation and operation. It provides crucial guidance to investors on various elements, such as taxes and prevailing standards, thereby facilitating decision-making. Institutions reflect a country's image, and their effective functioning enhances investment attractiveness. But what are the key elements that attract investors? Although each country has its standards, laws, and institutions, they are not all at the same level of development, particularly in the context of green hydrogen. Several documents highlight West Africa as an attractive region, but what are the factors limiting investment in this area? We sought to answer this through the second research question:

2. How does the institutional framework accelerate and/or inhibit the market for hydrogen technology in Côte d'Ivoire?

The literature review identified several barriers. These include corruption, political instability, red tape, lack of infrastructure, and investment-related risks such as macroeconomic stability. To authenticate the findings from the literature, interviews were conducted with key participants in the private energy sector in Côte d'Ivoire (directors and project managers). These interviews aimed to gather their opinions and insights on the existing institutional framework in Côte d'Ivoire, the level of corruption, their perceptions of political stability, as well as their views on the country's

renewable energy potential, energy mix policies and the potential implementation of the DRYHY project.

This research served to validate the elements collected from the literature on corruption and political instability, as they were found to be important as inhibitors. They also identified potential solutions for improvement and the establishment of a more robust institutional framework from an investor perspective. While opinions on the feasibility of the DRYHY project in Côte d'Ivoire varied due to the challenges to be overcome, certain measures and recommendations were identified.

This brings us to our final research question:

3. To what extent can these institutional frameworks be improved to facilitate the smooth implementation of the DRYHY project in Côte d'Ivoire?

One of the potential solutions identified is the creation of regional markets. This approach involves the establishment of cross-border energy markets that can improve cooperation between West African countries, promote efficient energy use, and stimulate economic development. The development of regional markets is an opportunity for market creation and greater economic opportunities. It ensures the development of essential infrastructure to promote and support economic development not only regionally but also nationally for all member countries.

Public-private partnership can also be a means to achieve infrastructure capacity, improvement, and development, but we need to overcome issues such as

- Social acceptance

For these collaborations to flourish, it is essential that all stakeholders, including local communities, understand the benefits and implications of these partnerships. Addressing concerns, ensuring transparency, and actively involving the public in decision-making processes are critical steps in fostering social acceptance.

- Lack of Political Will

Public-private partnerships require government support, commitment, and alignment with national development goals. Without strong political will, these collaborations can face obstacles in terms of regulatory support, resource allocation, sustained commitment, and technological barriers, not to mention legal barriers.

- Technological barriers

Green hydrogen projects often use advanced technologies that may require specialized knowledge and resources. Overcoming technological barriers requires investment in research and development, knowledge sharing, and capacity-building initiatives.

- Legal barriers

Clarity of the legal framework, transparency of procurement procedures, and dispute resolution mechanisms are key to building confidence in private partners.

The literature review identified a significant lack of studies directly related to our topic. As a result, our study is significant given the current energy situation and the emphasis on energy transition. This research contributes to a better understanding of the complex relationship between the institutional framework and the implementation of green hydrogen projects in both West Africa and Côte d'Ivoire. It also highlights the various institutional shortcomings that need to be reassessed and improved to promote more effective development.

The conclusions drawn from this study are informed by the findings of documents and articles dealing with various aspects of our subject. The main contributions of this study can be summarized in three key areas:

1. Policy-making

This study stands out as one of the few that looks at the institutional framework and implementation of projects related to green hydrogen production. It not only identifies weaknesses but also proposes practical solutions to address them. This research could serve as a valuable resource for policymakers seeking to implement incentive policies that are aligned with the needs of the country and the well-being of its people.

2. Practical Insight

We present a comprehensive overview of the Ivorian institutional framework, highlighting both positive and negative aspects that may be of interest to potential investors. This information can serve as a guide for potential investors, providing them with insight into potential risks associated with investment decisions and enabling them to make informed choices.

3. Decision-makers: This study provides a strong basis for regional and international partnerships to promote better development.

Several findings are derived from this study, with the most relevant being as follows:

The development or implementation of green hydrogen projects in West Africa should not solely focus on national profit but rather should promote the implementation of improved policies and a regulatory framework.

This study has demonstrated that despite the strong intention of the Ivorian government to achieve an energy mix, the current policies in place do not reflect this intention and are not up to the standards necessary to expedite the implementation of green hydrogen projects. Studies have also revealed that infrastructure and technology pose additional obstacles. Nevertheless, Public-Private Partnerships (PPPs) and regional markets can serve as avenues to contribute to infrastructure enhancement and encourage comprehensive regional energy access. Implementing green hydrogen projects necessitates the establishment of a local market, which hinges on community receptiveness and the participation of businesses; this entails raising awareness, disseminating information, and ensuring transparency. Corruption also poses a challenge, which can be mitigated through the digitization of specific processes, such as permit payments, alongside the need for better ethical education and capacity building among teams. Furthermore, the laws designed for everyone should be applied to any individual involved in corrupt practices. However, existing anti-corruption regulatory bodies should be granted greater independence, both financially and legally, to swiftly and autonomously address incidents.

Green hydrogen projects require a transparent institutional framework and adherence to international standards.

The success of green hydrogen projects depends on fostering a conducive environment for international partnerships and a genuine political commitment from our leaders.

Opinions on the technology used to produce green hydrogen varied widely.

All respondents were generally positive about the use of renewable energy, given the risks associated with climate change, particularly in Côte d'Ivoire, where rising sea levels are causing coastal erosion. However, when it comes to production technologies, opinions diverge, as these technologies are new and their impact has not yet been fully demonstrated. Moreover, the cost of developing these technologies is prohibitive for a population already struggling to access minimal energy at subsidized prices. One of our participants believes that, according to some publications on the subject, the current technologies are not very advanced and the ratio of investment to results is not sufficiently attractive at this stage. In addition, the processes themselves are energy-intensive

at a time when local demand is difficult to meet. Finally, there is a lack of local skills in these areas. Ongoing RE projects have not yet proven their effectiveness and their impact has not yet been measured on the scale of our countries. Total electrification of Côte d'Ivoire has not yet been achieved. The social and economic challenges facing our countries are not conducive to investment in these areas. It is therefore difficult at this stage to envisage projects such as hydrogen, e-methanol, or even terminals for electric cars, although there are some promising local initiatives such as the production of biogas and biofuel from agricultural residues, cassava, and rubber seeds. All these relevant issues need to be taken into account in the implementation of any green hydrogen project.

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APPENDICES

INVITATION TO PARTICIPATE IN A MASTER RESEARCH PROJECT

My name is KAKOU Amalan Evora Vanessa, I am a WASCAL scholar pursuing an international master's degree in energy and green hydrogen. I am currently specializing in economic policies and infrastructure for green hydrogen technology at the University Cheikh Anta Diop of Dakar, Senegal in the faculty of economic sciences and Management.

I am writing to invite you to participate in an interview for my master's thesis research on the topic of: "**Institutional framework for green hydrogen project in West Africa: a case study of Cote d'Ivoire"** at the Chair of Management at RWTH Aachen University, where I'm currently working with Prof. Peter Letmathe, Marcel Kottrup, and Dr. Fama GUEYE as supervisors and co-supervisor respectively.

I did some research on the role of the company (brief description)

Your participation in my research will add value to my data gathering because you are actively involved in nearly everything related to energy production and distribution in Cote d'Ivoire.

Your participation in this study is entirely optional. Therefore, if you consented to participate, the interview will be conducted by an online meeting and, you will be asked to answer a certain number of questions. The interview will take approximately 30-45min. The interview will take place over Zoom, a virtual meeting platform.

You may read more about Zoom on their website: https://zoom.us/trust.

Alternatively, I could forward the questionnaires to you by email.

If it has been decided to interview an online meeting, you will be asked for permission to audio record the interview to ensure accuracy. If you agree to be audio recorded, you will have the chance to validate your interview transcript to ensure accuracy after the recordings have been transcribed. A copy of the transcript will be emailed to you for review.

Just for clarification purposes: **You can withdraw from participation at any point in time if you deem it necessary**. Your participation in this study will be completely anonymous.

I would be pleased to offer any further information on this project. You may reach me at evorakakou@gmail.com for project-related inquiries, or Prof. Letmathe Peter, my supervisor, at letmathe@controlling.rwth-aachen.de, kottrup@controlling.rwth-aachen.de, or gueyefama21@gmail.com.

I sincerely hope to hear from you and will appreciate your contribution to my study project.

Yours Sincerely,
Amalan Evora vanessa KAKOU
WASCAL scholar, IMP-EGH

CONSENT FORM

By signing this permission form, you are not relinquishing your legal rights or absolving the researcher(s) or participating institution(s) of their legal and ethical obligations.

I hereby acknowledge that I have received a copy of the Invitation to Participate in the research project entitled: INSTITUTIONAL FRAMEWORK FOR GREEN HYDROGEN PROJECT IN WEST AFRICA: A CASE STUDY OF COTE D'IVOIRE, carried out by Ms. Amalan Evora Vanessa KAKOU WASCAL scholar at the University Cheick Anta Diop of Dakar doing an internship at RWTH Aachen, Faculty of Economics and Business in Germany.

I had an opportunity to read the information provided and any questions that I may have had have been answered.

I agree to participate in this research project, understanding that I am doing so voluntarily, that confidentiality will be maintained, that I may choose not to answer any of the questions, and that I have the right to withdraw from the study using the means outlined above.

You can contact KAKOU Amalan Evora Vanessa with any more inquiries.
Email: evorakakou@gmail.com.

I am willing to take part in this study, fully aware of all that has been said so far.
I consent to have my interview recorded on audio in case of a Zoom session.
I consent to the use of anonymous quotes in any thesis or publication resulting from this study.
Circle one:
I agree to participate in this study: Yes No
I agree to be audio-recorded: Yes No

Name of participant: _____

Signature of Participant: _____

QUESTIONNAIRES D'ENTREVUE (French version)

CADRE INSTITUTIONNEL POUR LE PROJET D'HYDROGÈNE VERT EN AFRIQUE DE L'OUEST : ÉTUDE DE CAS CÔTE D'IVOIRE

Rôle du participant dans l'organisation :
Nombre d'années d'expérience :
Le domaine de travail précédent :

1. Comment définissez-vous votre structure ? Je veux dire une description claire de la structure de vos valeurs, de votre mission, de vos objectifs et de vos aspects opérationnels.

2. Dans cette étude de cas du cadre institutionnel ivoirien, quelles sont, selon vous, les forces et les faiblesses des institutions locales en termes de temps et de rentabilité ?

3. Une bonne gouvernance économique dans des domaines tels que la réglementation, les licences commerciales et la fiscalité est un pilier fondamental d'un environnement commercial favorable. Comment évaluez-vous la qualité de la réglementation, de la délivrance des permis et de la gouvernance fiscale ivoiriennes en termes de création d'un environnement commercial favorable ?

4. Quel est le plus grand obstacle à une entreprise selon vous ? Encerclez le plus important pour vous.

- Instabilité politique
- Taux d'imposition
- Main-d'œuvre insuffisamment instruite
- Électricité
- Crime, vol et désordre
- Administration fiscale
- Corruption
- Réglementations douanières et commerciales

5. La corruption des agents publics peut représenter un fardeau administratif et financier majeur pour les entreprises. La corruption crée un environnement commercial défavorable en sapant l'efficacité opérationnelle et en augmentant les coûts et les risques associés à la gestion d'une entreprise privée. Avez-vous été victime de corruption, lors des taxes payées ou pour l'obtention de permis, de licences ou de tout autre raccordement aux services publics ? Comment pouvez-vous évaluer le niveau de corruption ivoirien supérieur à 10? Avez-vous des recommandations pour résoudre le problème de la corruption ?

6. Le gouvernement ivoirien vise à atteindre 100% d'électrification d'ici 2025 et une part d'énergie renouvelable de 42% d'ici 2030[1] Les institutions locales actuelles peuvent-elles assurer la réalisation des objectifs de résilience, d'adaptation au changement climatique et d'accès à l'énergie ?

7. Quel est selon vous le rôle que le cadre institutionnel devrait jouer dans la mise en œuvre des énergies renouvelables ?

8. Comment évaluez-vous le cadre institutionnel global, en particulier en Côte d'Ivoire en termes de production d'énergie renouvelable ?

9. Que savez-vous de l'hydrogène vert et du méthanol électronique ?

10. Comment voyez-vous le potentiel de la Côte d'Ivoire pour la production d'hydrogène vert et de méthanol électronique ?

11. Est-il facile de mettre en œuvre des projets d'hydrogène vert et de méthanol électronique en Côte d'Ivoire ? Si ce n'est pas le cas, quelles peuvent en être les causes ?

12. Pensez-vous que la création d'un marché régional de l'énergie soit nécessaire ? Dans l'affirmative, quels types d'institutions faudrait-il créer pour faciliter sa mise en œuvre et son bon fonctionnement ? Comment un tel marché peut-il contribuer au développement économique ?

13. Selon vous, quels sont les principaux défis institutionnels pour le développement d'une filière verte de l'hydrogène et du méthanol électronique ?

14. Comment ces défis institutionnels peuvent-ils être gérés ou atténués efficacement ?
15. Avez-vous des recommandations pour résoudre les problèmes liés au cadre institutionnel ou améliorer son efficacité ?

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[1] (*Cote_divoire_country_brief_0.Pdf*, n.d.)

INTERVIEW QUESTIONNAIRES

INSTITUTIONAL FRAMEWORK FOR GREEN HYDROGEN PROJECTS IN WEST AFRICA: CASE STUDY CÔTE D'IVOIRE

Role of the participant in the organization:
Number of years of experience:
The previous area of work:

1. How do you define your structure? I mean a clear description of your values structure, mission, objectives, and operational aspects.

2. In this case study of the Ivorian institutional framework, what do you think are the strengths and weaknesses of local institutions in terms of time and profitability?

3. Good economic governance in areas such as regulation, business licensing, and taxation is a fundamental pillar of an enabling business environment. How do you assess the quality of Ivorian regulation, permitting, and tax governance in terms of creating a favorable business environment?

4. What do you think is the biggest obstacle to a business? Circle the most important thing for you, please.

- Political instability
- Tax rates
- Under-educated workforce
- Electricity
- Crime, theft, and disorder
- Tax Administration
- Corruption
- Customs and trade regulations

5. Bribery of public officials can be a major administrative and financial burden for businesses. Bribery creates an unfavorable business environment by undermining

operational efficiency and increasing the costs and risks associated with running a private business. Have you been a victim of corruption, in taxes paid or in obtaining permits, licenses, or any other connection to public services? How can you assess the level of Ivorian corruption above 10? Do you have any recommendations to solve the problem of corruption?

6. The Ivorian government aims to achieve 100% electrification by 2025 and a 42% share of renewable energy by 2030[2] Can existing local institutions ensure the achievement of the goals of resilience, climate change adaptation, and access to energy?

7. What role do you think the institutional framework should play in the implementation of renewable energy?

8. How do you assess the overall institutional framework, particularly in Côte d'Ivoire in terms of renewable energy production?

9. What do you know about green hydrogen and e-methanol?

10. How do you see Côte d'Ivoire's potential for the production of green hydrogen and e-methanol?

11. Do you think it will be easy to implement green hydrogen and e-methanol projects in Côte d'Ivoire? If not, what can be the causes?

12. Do you think the creation of a regional energy market is necessary? If so, what types of institutions should be created to facilitate its implementation and proper functioning? How can such a market contribute to economic development?

13. In your opinion, what are the main institutional challenges for the development of a green hydrogen and e-methanol sector?

14. How can these institutional challenges be effectively managed or mitigated?

15. Do you have any recommendations to solve problems related to the institutional framework or improve its effectiveness?

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[2] "Cote_divoire_country_brief_0.PDF," accessed May 13, 2023, https://www.gogla.org/sites/default/files/resource_docs/cote_divoire_country_brief_0.pdf.

DECLARATION OF AUTHORSHIP

I, AMALAN EVORA VANESSA KAKOU declare that this thesis and the work presented in it are my own and have been generated by me as the result of my original research.

I do solemnly swear that:

1. Where I have consulted the published work of others or myself, this is always clearly attributed;

2. Where I have quoted from the work of others or myself, the source is always given. This thesis is entirely my own work, except for such quotations;

3. I have acknowledged all major sources of assistance;

4. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;

5. None of this work has been published before submission;

6. During the preparation of this work, I used ChatGPT, GRAMMARLY, QUILLBOT, REVERSO, and DEEPL to edit the writing of the thesis. After using this tool/service, I reviewed and edited the content as needed and took full responsibility for the content.

Date: 24/08/2023 Signature: _____