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Realizing Potential: Overcoming Key Impeding Factors for German Companies in the German-Moroccan Green Hydrogen Market

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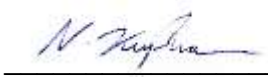
Declaration of authorship

I, Nora Kußmann, hereby affirm that I have written the following thesis “Realizing Potential: Overcoming key impeding factors for German companies in the German-Moroccan Green Hydrogen Market” in the master’s program Management Franco-Allemand M.A. under supervision of the thesis examiner Prof. Dr. Ulrich Schüle myself, and that I have cited all sources and tools used in the thesis in full.

Additionally, I affirm that I have documented all use of AI tools for the production of this thesis in the appendix of this thesis in tabular form by naming the tool and the purpose for which it was used. I am aware that any attempt at undocumented use of AI tools will be considered an attempt to cheat under the examination regulations. I confirm that I have not adopted content generated using AI tools without reflection and that, as the author, I am responsible for the information and statements in this thesis.

Ingelheim, 9 February 2025



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Abstract

English:

Green hydrogen is widely regarded as an important contributor to the energy transition, and hereby climate change mitigation. Germany and Morocco are both interested in green hydrogen to diversify their energy sources, with Germany also aiming to decarbonize emission-intensive industries. Morocco is seen as a potential low-cost exporter of green hydrogen, while Germany is expected to import a large amount of the needed green hydrogen. This thesis employs a Mixed Methods approach consisting of a survey and semi-structured interviews. The population of both survey and interviews are German companies who are active or interested in the Moroccan market for green hydrogen. The study analyzes the green hydrogen market between Germany and Morocco from a company-perspective, focusing on impeding factors for German companies, and how to mitigate them. Key found impeding factors are the influence of green hydrogen market development on a global scale, and in Morocco, political and regulatory challenges mainly in Germany and the EU, risk aversion by other market players, and a lack of resources. The thesis analyzes that political support by the German government, an adaptation of existing funding programs, an update of green hydrogen regulation in Germany and the EU, as well as information distribution of market knowledge could contribute to de-risking this market.

Deutsch:

Grüner Wasserstoff wird weithin als wichtiger Beitrag zur Energiewende und damit zur Eindämmung des Klimawandels angesehen. Sowohl Deutschland als auch Marokko sind an grünem Wasserstoff interessiert, um ihre Energiequellen zu diversifizieren, wobei Deutschland auch auf die Dekarbonisierung emissionsintensiver Industrien abzielt. Marokko gilt als potenzieller, kostengünstiger Exporteur von grünem Wasserstoff, während Deutschland voraussichtlich eine große Menge des benötigten grünen Wasserstoffs importieren wird. In dieser Arbeit wird ein Mixed-Methods-Ansatz verwendet, der aus einer Umfrage und semi-strukturierten Interviews besteht. Die Grundgesamtheit sowohl der Umfrage als auch der Interviews sind deutsche Unternehmen, die auf dem marokkanischen Markt für grünen Wasserstoff aktiv oder an diesem interessiert sind. Die Studie analysiert den Markt für grünen Wasserstoff zwischen Deutschland und Marokko aus der Unternehmensperspektive und konzentriert sich dabei auf Hindernisfaktoren für deutsche Unternehmen in diesem Markt und wie diese abgemildert werden können. Die wichtigsten Faktoren, die den Markteintritt erschweren, sind die Entwicklung des Marktes für grünen Wasserstoff auf globaler Ebene und in Marokko, politische und regulatorische Herausforderungen vor allem in Deutschland und der EU, die Risikoaversion anderer Marktteilnehmenden und unternehmensspezifische Faktoren wie die Unternehmensgröße. Die Arbeit analysiert, dass politische Unterstützung durch die deutsche

Regierung, eine Anpassung bestehender Förderprogramme, eine Aktualisierung der Regulierung von grünem Wasserstoff in Deutschland und der EU sowie die Verbreitung von Marktwissen dazu beitragen könnten, das Risiko dieses Marktes zu verringern.

Français:

L'hydrogène vert est largement considéré comme un contributeur important à la transition énergétique et, de ce fait, à l'atténuation du changement climatique. L'Allemagne et le Maroc s'intéressent toutes deux à l'hydrogène vert pour diversifier leurs sources d'énergie, l'Allemagne visant également à décarboner les industries à fortes émissions. Le Maroc est perçu comme un exportateur potentiel d'hydrogène vert à faible coût, tandis que l'Allemagne devrait importer une grande quantité de cet hydrogène vert nécessaire. Cette thèse adopte une approche de méthodes mixtes, composée d'une enquête et d'entretiens semi-structurés. La population de l'enquête et des entretiens est constituée d'entreprises allemandes actives ou intéressées par le marché marocain de l'hydrogène vert. L'étude analyse le marché de l'hydrogène vert entre l'Allemagne et le Maroc du point de vue des entreprises, en se concentrant sur les facteurs qui freinent les entreprises allemandes et comment les atténuer. Les principaux facteurs freinants identifiés sont l'influence du développement du marché de l'hydrogène vert à l'échelle mondiale, et au Maroc, les défis politiques et réglementaires, principalement en Allemagne et dans l'UE, l'aversion au risque des autres acteurs du marché, et le manque de ressources. La thèse analyse que le soutien politique du gouvernement allemand, une adaptation des programmes de financement existants, une mise à jour de la réglementation sur l'hydrogène vert en Allemagne et dans l'UE, ainsi qu'une meilleure diffusion des connaissances sur le marché pourraient contribuer à réduire les risques associés à ce marché.

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II List of abbreviations

AHK	German Chamber of Commerce = Deutsche Auslandshandels-kammer
BMWK	German Federal Ministry for Economic Affairs and Climate Action = Bundesministerium für Wirtschaft und Klimaschutz
KfW	Bank for Reconstruction = Kreditanstalt für Wiederaufbau
GIZ	International Cooperation Society = Gesellschaft für internationale Zusammenarbeit
IRESEN	Research Institute for Solar Energy and New Energies = Institut de Recherche en Energie Solaire et Energies Nouvelles
IRENA	International Renewable Energy Agency
MASEN	Moroccan Agency for Sustainable Energy
MENA	Middle East and North Africa
MT	Metric ton
PAREMA	Moroccan-German Energy Partnership
PV	Photovoltaic
PtX	Power-to-X
PPP	Public Private Partnership
R&D	Research and Development
RNFBO	Renewable Liquid and Gaseous Fuels of Non-Biological Origin
SME	Small and Medium Enterprise
WTO	World Trade Organization

1 Introduction

Climate change presents numerous challenges to humankind, and the planet as a whole. One of the key issues is the transformation towards a decarbonized energy system. In this context, green hydrogen is emerging as an important potential contributor to this energy transition.

Hydrogen is a chemical with diverse uses. It is mostly applied as a feedstock to produce green ammonia and green methanol, but also as a fuel in the metal, glassmaking and steel production, as well as the chemical industry and in oil refining (AbouSeada & Hatem, 2022, p. 3875; Weko et al., 2023, p. 8). Currently, the emission-intensive form of gray hydrogen is used for this, which contributes significantly to climate change (WTO & IRENA, 2023, p. 3). In contrast, green hydrogen is seen as a more sustainable alternative, as its production is expected to generate far fewer emissions. While the application of green hydrogen will not be able to solve the climate crisis single-handedly, it could behold a key part in this endeavor.

Green hydrogen's potential goes beyond substituting gray hydrogen. As an energy carrier, its applications are much broader. Through Power-to-X (PtX) technologies, synthetic fuels can be produced in a climate-friendly way using green hydrogen (Kittel et al., 2023, p. 564). Additionally, green hydrogen can act as a vector for energy storage, contributing to stabilizing electricity supply from variable renewable energy sources (Schrotenboer et al., 2022, p. 1; IRENA, 2020, p. 11). When purified and converted to gas via Power-to-Gas applications, it could reduce natural gas consumption (Lebrouhi et al., 2022, p. 7020). While there is ongoing debate whether green hydrogen is also economically and ecologically feasible for a widespread use in sectors such as transport and heating (Weko et al., 2023, p.8), there is a consensus that it will play an important role in future energy systems (IRENA 2024, p.9).

Besides its environmental importance, green hydrogen is also considered politically crucial. Geopolitical events, like the Russo-Ukrainian war, have highlighted the need for energy independence, and a diversification of energy sources. Unlike fossil fuels, which are concentrated in specific regions, green hydrogen can be produced in a broader range of locations, making it a key element in achieving these political goals (Patonia, 2025, p.3). The green hydrogen market is still evolving, but many countries are already making strides in it. Here, Germany and Morocco both stand out as key players on a global scale. Both nations are aiming to diversify their energy sources, with Germany particularly focused on using green hydrogen to help decarbonize its hard-to-abate industries (Blohm & Dettner, 2023, p. 3; Amouzai & Haddioui, 2023, p.4). The two countries are already collaborating on various fronts, as they both have an interest in the building and development of a German-Moroccan green hydrogen market. Morocco is focused on advancing green hydrogen production within its borders, aiming to foster job

creation and attract investment (Steinbacher, 2015, p.41). Germany sees this market as a way to secure affordable green hydrogen imports and expand its green hydrogen technology exports (Lindner, 2023, p.1045).

Companies are important actors in the development of the German-Moroccan market for green hydrogen, and enacting the strategic and economic visions of the political sphere. However, their perspective has so far not been a focus in research. Publications have mainly analyzed the macro-economic and political scope, as well as research efforts and knowledge exchange between Germany and Morocco. For that reason, this study examines the German-Moroccan market for green hydrogen from a company perspective, focusing on German companies.

The complexity of this emerging market, especially in its early stages, raises the question of how German companies experience this market. The research will therefore focus on the impeding factors German companies experience in the German-Moroccan market, and what is needed to overcome them.

This thesis commences by defining green hydrogen and distinguishing it from other forms of hydrogen. This is followed by a literature review summarizing scientific findings on green hydrogen, including its production, transportation, and the associated social and environmental impacts. The review also explores the challenges and opportunities within the green hydrogen market. Thereafter, the theoretical framework is given, along with an overview of the national strategies of Germany and Morocco in this market. The methodology section then outlines the research design employed in this study, which serves as the foundation for presenting the results. The thesis concludes with a presentation and discussion of the findings.

2 Conceptual framework

The following chapters will examine key terms and significant scientific literature on green hydrogen and the green hydrogen economy. The aim is to provide an understanding of the factors that drive company decisions in the green hydrogen market and the national policies shaping this market. Furthermore, market entry strategies are analyzed, to understand the complexities of international expansion within the green hydrogen sector.

2.1 Definition of green hydrogen

Hydrogen is a substance which is available abundantly in nature, particularly in a combination with oxygen in water (Lebrouhi et al., 2022, p. 7020). But while it does get produced in its pure gaseous state as a by-product in some chemical processes (Islam et al., 2024, p.463), it usually is part of combined stable forms in organic materials (Ratnakar et al., 2021, p.24151). However, for it to be used in industry, it needs to be available in its pure state. This is only possible by chemical processes through which the hydrogen is separated from other substances.

Hydrogen is commonly clustered in color codes. These color codes differ depending on the production method used and its environmental “cleanness” (Dawood et al., 2020, p. 3853). Nowadays, the most common form of hydrogen is gray hydrogen (Amouzai & Haddioui, 2023, p.4). For this, pure hydrogen is produced by steam reforming of methane or electrolysis (Morgen et al., 2022, p.4). This way of production is, as of now, the cheapest. However, due to the production of not only hydrogen but also high CO^2 emissions, it is also one of the production methods considered to be most harmful to the environment (Kittel et al., 2022, p.563).

A production method that is less emission-intensive is blue hydrogen (Kittel et al., 2022, p.563). Blue hydrogen is produced in a similar way to gray hydrogen. However, the main difference is that the CO^2 is not released into the atmosphere, but rather stored, and in some cases repurposed (Morgen et al., 2022, p.4). Blue hydrogen is often seen as a transition path to green hydrogen, as this production method is cheaper compared to green hydrogen (Scita et al., 2020, p.13) and has the most advanced technology (Islam et al., 2024, p.460).

There are many hydrogen production methods (Figure 1), which differ in technological and cost efficiency, and regarding their emission output.

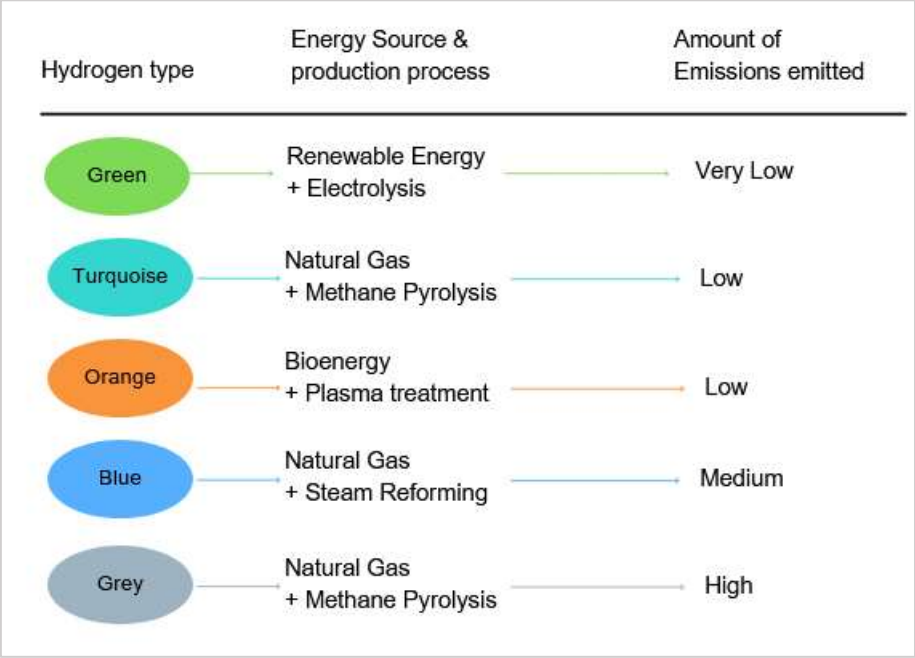

Figure 1: Selection of Production methods of Hydrogen (Own illustration according to Morgen et al., 2022, p.4; Kittel et al., 2023, p.563)

Of all the production methods, green hydrogen is considered to be the only climate-neutral one (Kittel et al., 2023, p.563). It is also the production method that offers the greatest energy independence, as it relies the least on other energy sources (Weko et al., 2023, p.8). Green hydrogen is often referred to as “Renewable hydrogen” (Dejonghe, 2023, p.1), as it can be

produced via electrolysis using electricity made from renewables. During the electrolysis process water is split into hydrogen and oxygen (Caillard et al., 2024. p.4). Since the only by-product is oxygen, no carbon emissions are produced during its production.

While many scholars associate green hydrogen with the production method of electrolysis, that a global definition unitary definition of green hydrogen does not exist yet. The Green Hydrogen Organisation (2023) has made an effort with its publication on “The Global Standard for Green Hydrogen and Green Hydrogen Derivatives”, in which it defines green hydrogen as “hydrogen produced through the electrolysis of water with 100% or near 100% renewable energy with close to zero greenhouse gas emissions” (p.5).

2.2 Green hydrogen economy

Although the idea of a green, or at least clean, hydrogen production dates back over a century (IRENA, 2024, p.9), it has never reached the proclaimed potential. One reason for this may be that sustainability and climate neutrality were not always prioritized, and the widespread availability of gray hydrogen reduced the perceived need to scale up green alternatives. However, even today, while these concerns drive the transition towards green hydrogen, numerous factors continue shaping the development of the green hydrogen economy.

The green hydrogen economy is a broad concept which refers to how green hydrogen could be integrated into the global energy system (Oliveira et al., 2021, p.2-3). To grasp this concept, an understanding of everything that entails green hydrogen and its market is essential. This chapter reviews literature on technological, economic, social and environmental factors influencing this economy. It also examines the green hydrogen market as a part of this economy, its opportunities and the challenges that impact it on a global scale.

2.2.1 Techno-economic assessments of green hydrogen production

In-depth techno-economic assessments of green hydrogen production are mainly recent (Superchi et al., 2023; Henry et al., 2023; Jang et al., 2022; Vives et al., 2023). This is due to the fact that in earlier publications the focus lay more on other, non-sustainable hydrogen production methods. While the term ‘green hydrogen’ gained mention in the 2010s, studies from that period, notably from Dincer (2012a, 2012b; Dincer & Canan, 2015), do not regard hydrogen made via solar-powered electrolysis an economically viable option. At the time, photovoltaic (PV) modules were considered inefficient and too costly (Hosseini et al., 2016). In the years since, the price of solar energy has gradually lowered, so that in recent studies by Jaradat et al. (2024*)* and Yong Ying Loh et al. (2024) solar energy has become an acclaimed option for green hydrogen production, given that this energy source is abundant in the location of production (Jaradat et al., 2024, p.9; Yong Yin Loh et al., 2024, p.16).

In addition to solar energy, scholars also proclaim wind energy and geothermal energy as potential sources for electrolysis (Ishag & Dincer, 2021; Jaradat et al., 2024). However, geothermal energy is only an economically feasible option in geothermally active regions. While there are other technological options such as biomass gasification, electrolysis is widely regarded to be the best option for green hydrogen production. This is due to its technological maturity (Jaradat et al., 2024, p.4) and scalability (Abdelsalam et al., 2024, p.13).

The electrolysis process can be conducted using various methods. The most well-established method is Alkaline Water Electrolysis. According to Sebbahi et al. (2024, p.594), this method is the least costly one, and possibly scalable for commercialization, an assessment which is supported by other researchers (Nami et al, 2022; Abdelrahman et al., 2024, p.601). However, as the method is not adjustable to fluctuating renewable energy inputs, and its reliability is therefore impacted, researchers are working on a new method, notably Emerging Anion Exchange Membrane. This technology is supposed to combine the advantages of Alkaline Water Electrolysis and Proton Exchange Membrane, an electrolyzer technology which is ideal for fluctuating renewable energy sources (Sebbahi et al., 2024, p.595; Abdelsalam et al., 2024, p.13). While substantial strives have been made in the technological department, there are still large energy losses occurring during the electrolysis process which negatively impact the production cost (IRENA, 2020, p.13).

Numerous studies have focused on determining the production cost of green hydrogen (Baral, 2024; Yong Ying Loh, 2024). While Yong Ying Loh (2024) considers both solar and biomass energies as fuel for electrolyzers the most cost-efficient option, Baral & Šebo (2024) analyze that a hybrid system combining PV and onshore wind turbines could lead to a minimum green hydrogen cost of 3.01 US$/kg. The average evaluated cost of green hydrogen differs largely depending on the source, but is believed to lay at 2.5 US$/kg to 7 US$/kg (AdbouSeada & Hatem, 2022, p.3886). These differences in the results are not surprising as the cost may vary depending on the electrolyzer efficiency, location of the production site, and electricity prices (Wolf et al., 2024, p.191). Since each study analyzes a different set of countries and does not always use the same definition of green hydrogen, results are not easily comparable.

For the green hydrogen production using solar and wind energy, the MENA-region and Sub-Saharan Africa are considered to be the regions with the highest technical potential. It is estimated that in these regions production cost below 1.5 US$/kg is feasible by 2050, by taking advantage of innovation and learning-curve effects (Leiblein et al., 2023, p.21). While a possible importing country of green hydrogen such as Germany could produce green hydrogen at 2.74€/kg to 4.28€/kg according to Wolf et al. (2024), cost of imported green hydrogen is considered to be considerably less despite the added cost of storage and transport. Import prices from Morocco to Germany are estimated to lie between 1.73€ to 3.28€/kg and for Algeria at

1.72€/kg to 3.23€/kg in 2050 (Wolf et al., 2024, p.190). For 2023, the average production cost of gray hydrogen in European was on average 3.76 €/kg, with green hydrogen cost evaluated at 6.61 €/kg (European Hydrogen Observatory, 2023). It is expected that until 2030 production of gray hydrogen will remain "the most cost-competitive option" (Scita et al. 2020, p.9), however green hydrogen is expected to slowly catch up, as the cost have already dropped considerably in the past two decades (Lebrouhi et al.,2022, p.7026).

While the techno-economic scope undeniably plays an important role in the market for green hydrogen, social and environmental are equally vital to consider. The following subchapter regards these two factors more in-depth.

2.2.2 Social and environmental aspects of the green hydrogen transition

The energy transition from fossil fuels towards renewable energy sources is often primarily treated as a technological and economical challenge. As a result, much of the research on green hydrogen has focused on these two dimensions, with only a few techno-economic studies taking social and environmental issues into account (Sajawal et al., 2023; Dincer & Acar, 2015; Mengdi & Jianlong, 2021). However, a number of scholars have criticized this state in research, as they believe that these aspects play an important role in ensuring that the green hydrogen economy, as opposed to the fossil fuels economy, is a just one and in line with sustainable development goals (Dejonghe, 2023, p.4; Leonard et al., p.1).

Although green hydrogen is regarded as more environmentally sustainable than other fuels, and the energy transition tied to it could significantly benefit countries engaging in it, there are some issues which lead scholars to worry. The first one is the resource of water, which is needed in a purified form during the electrolysis process (Cremonese et al., 2023, p.19430). According to Cremonese et al. (2023), countries considered to have the highest potential for green hydrogen production, due to considerable solar and wind power, are some of the regions facing the highest water scarcity worldwide. There is the threat that the development of the green hydrogen economy in such countries could lead to making this resource even more scarce. A possible solution could be desalination plants, especially in countries with access to seawater, such as Morocco. However, the current technology of these plants requires high amounts of energy which would also need to be provided by renewable energy sources in order for the green hydrogen to be truly 'green' (Cremonese et al., 2023, p.19427). According to Amouzai & Haddioui (2023) and Patonia (2025), there is the danger that these plants and the renewable energy sites will be primarily used for the benefit of green hydrogen production, while their negative impacts have to be borne by the local population and the environment.

Additionally, there are social and environmental issues related to land use. The development of renewable energy sources requires large patches of land which may lead to a competition

with agriculture, and negatively impact local communities (Cremonese et al., 2023, p.19426). Furthermore, areas that are highly effective in producing renewable energy at the lowest costs are often not free from “legal or cultural property claims” (Patonia, 2025, p.5), and communities affected by the building of projects on the soil they regard as their own are rarely involved in the decision-making process.

One issue which has been analyzed in depth in research is the threat of neo-colonial structures in this energy transition (Müller, 2024; Boretti, 2025; Kalt & Tunn, 2022; Gabor & Sylla, 2023). If one looks at the list of possible exporting and the possible importing countries, it becomes clear that importing countries are predominantly located in the Global North, while exporting countries are mainly situated in the Global South. Some scholars have voiced their concerns that patterns of dependencies and inequalities stemming from colonialism could continue in this green hydrogen transition (Claar, 2021; Amouzai & Haddioui, 2023). Currently, technology development for green hydrogen production is mainly concentrated in the Global North, and it is probable that countries aiming to export green hydrogen could mainly be importing high-value technology, while exporting less-valuable green hydrogen (Amouzai & Haddioui, 2023, p.10). This would reinforce structures where a few countries, mainly in the Global North, exploit the resources of many others for their own wealth, as has happened in the past. To counteract this, researchers stress the importance of long-term, mutually beneficial cooperation between all kinds of actors in the economy (Cremonese et al., 2023, p.19425; Lindner, 2023, p.1045; Claar, 2021, p.146). They also highlight the need for stakeholder inclusion at all decision-making levels and ensuring local populations have access to energy, so that the benefits of the transition are shared by more than just a few.

These social and environmental aspects also play a role in shaping and accelerating the development of the green hydrogen market, which is examined in the following subchapter.

2.2.3 Global green hydrogen market

The green hydrogen market is one still considered to be in the early stages of development (Bayssi et al., 2024, p.836). Currently, hydrogen plays a minor role in the energy sector. In 2018 worldwide consumption of hydrogen amounted to 120 MT (Leiblein et al., 2023, p.1), of which green hydrogen only holds a minimal portion (Brauer et al., 2022, 7). The World Trade Organization (WTO) and IRENA estimate that supply of clean hydrogen (blue and green) must increase more than five-fold by 2050, to more than 500 million tons annually, to effectively decarbonize industries and meet the targets outlined in the Paris Agreement (WTO & IRENA, 2023, p.3). This is also due to an expected continued rise of global energy demand. However, despite the widespread interest in the product, the green hydrogen market is slow to take up, and both supply and demand remain low.

In their “Guide to policymaking” for green hydrogen the International Renewable Energy Agency (IRENA) (2020) summarizes the main barriers in accelerating the green hydrogen market: “high production costs, a lack of infrastructure, (…) and missing value recognition of green hydrogen” (IRENA 2020, p.13). While the production cost is already assessed in Chapter 2.2.1, the remaining two issues are explored in the following sections.

As green hydrogen is a product largely dedicated for import and export, not only production plants and renewable energy sites are needed to build the market, but also ways to store and transport it. Storage is vital, not only to account for the intermittent character of renewable energy sources wind and solar, but also to balance supply with demand. Transport infrastructure is needed, as production sites are often located far from offtakers. Storage options for green hydrogen include tanks, caverns, or underground facilities (Olabi et al., 2021; Ratnakar et al., 2021), while transportation will happen through pipelines, ships, and trucks. While some infrastructure is already in place, and existing pipelines currently used for natural gas could be repurposed, the majority of infrastructure is missing (Merten & Scholz, 2021, p.34). In order to build this, significant investments are needed.

Apart from insufficiently developed infrastructure, the market is missing another key component: an international standard of green hydrogen. While there is a generally referred-to definition of green hydrogen (see Chapter 2.1), the color-coding model does not specify how much greenhouse gases are allowed ’to be emitted, in order for the hydrogen to still be considered green (Dawood et al., 2020, p.3853). There are no internationally recognized ways to differentiate green hydrogen from more carbon-intensive forms of hydrogen, which leads to a lack of value recognition (IRENA, 2020, p.13). An international standardization of green hydrogen could minimize the risk of unfair competition (Scita et al., 2020, p.15), help simplify negotiations for offtake agreements between suppliers and potential customers (Green Hydrogen Organisation, 2024), and contribute to harmonizing the global green hydrogen market (Islam et al., 2024, p.459).

Understanding general challenges in the market for green hydrogen is important for comprehending the behavior of market players. Strategies of both economic and political players in this market are examined in the following chapters.

2.3 Green hydrogen market strategies

Building on the understanding of how the green hydrogen market works, it is now essential to explore how companies as actors in this market can enter it. This chapter sheds a light on market entry strategy. The second part of the chapter explores the approaches taken by Germany and Morocco in this sector. This is of interest, as national policies and frameworks play

a role in shaping the market environment, and influencing the activities of companies operating within it.

2.3.1 Market entry strategies

Market entry strategy comprises all of the decisions with which a company's entry markets are selected, and the chosen market is entered (Fritz & von der Oelsnitz, 2007, p.73). Market entry strategy is often at the heart of the internationalization strategy of a company (Zentes, 2012, p.25), as market entry not only includes the entry in a domestic market, but also a foreign market. There are different reasons for a company to enter a new or adjoining market (Markan 2019, 1241). It could be to grow sales, diversify the geographical presence of the company or develop capabilities (Markman et al., 2019, p.1242). As market entry is a complex process that, depending on the chosen entry mode, demands substantial resources (Markman et al., 2019, p.1242), choosing the right strategy is seen as crucial in deciding whether a company will be successful in a new market (Zentes, 2012, p.26; Schellenberg et al., 2018, p.2). This choice could also contribute to minimizing market entry barriers and risks in the chosen market on a long-term basis.

Arguably, the most important part in implementing a market entry strategy is choosing the right entry market mode (Anderson & Gatignon, 1986, p.2; Shen et al., 2017, p.429). The entry mode "refers to the way that a firm wants to carry out its business activities in a market" (Shen et al., 2017, p.429). There are a large amount of entry modes, however this study will look at the most established non-equity and equity-based modes (Glowik, 2020, p. 68), which could be relevant for companies engaging in the green hydrogen market.

One of the non-equity-based entry modes which is often used due to it being less risky and faster than others (Glowik, 2020, p.68) is direct and indirect export. Export is the provision of goods and/ or services across borders, while the value-creation activities remain based in the domestic market (Zentes 2012; 27). Export can be divided into indirect export, which means a company moves its goods into a different market through an intermediary, and direct export, in which the company itself is in contact with the importing customers abroad (Glowik, 2020, p.69). Licensing is especially important regarding knowledge transfer. When doing licensing, contractual transaction of knowledge rights, for instance in the form of a patent, take place (Glowik, 2020, p.72; Zentes ,2012, p.27). Turnkey contracts are another non-equity mode. In turnkey contracting, the contractor designs, plans, and builds a product or facility, transferring ownership to the client upon completion. This is typically used for large-scale projects like plant construction (Chakraborty 2023; Glowik, 2020, p.75).

As opposed to non-equity-based entry modes, equity-based modes require a larger investment of the expanding company, both in capital and in time. A common mode is here the

establishment of a subsidiary, which is partly or fully owned by the company entering the market. Setting up a subsidiary can be done either by greenfield investment or by acquiring another company (Zentes, 2012, p.26). This mode has the advantage of allowing the company a high level of influence in the market activities, but bears high risks regarding capital (Zentes, 2012, p.27). While in establishing a subsidiary, a company typically acts independently, a Joint Venture is a form of a partnership between two companies. The two companies pool assets in a legally independent organization of which they share joint ownership. (Tang & Liu, 2012, p.50; Glowik, 2020, p.76). Another such "cooperative mode of market entry" according to Glowik (2020), is the strategic alliance. The goal of this rather long-term partnership is usually to strengthen the companies' position in their respective markets. This mode is not necessarily equity-based, and the participating companies remain "legally fully responsible to their business" (Glowik, 2020, p.76). Depending on a company's strategy these modes may be combined and interconnected.

For developing a successful market entry strategy, a company needs to assess factors such as stakeholders in the market, company-specific factors such as resources and organizational structure, barriers to entry, cultural distance between the home and the target market in case of a foreign market entry, and the timing of entry (Zentes, 2012, p.33; Markman et al., 2019, p.1241-1245; Buckley & Casson, 1998, p.543). Timing of entry is a critical factor in the strategy, since being an early entrant in a new market can mean higher market shares, but also greater risks and higher uncertainties (Murray et al., 2012, p. 51-52).

Since the political environment also plays a role in the market entry strategy, the following chapter will shed light on the green hydrogen strategies of Morocco and Germany, and cooperation between the two countries.

2.3.2 German and Moroccan strategies

Morocco and Germany are among over fifty countries that have published strategic documents outlining their plans to accelerate the hydrogen sector both domestically and internationally (IRENA, 2024, p.15). Their strategies have a different focus. Germany mainly sees itself as an importer of green hydrogen due to limited land availability for domestic production. It is expected, that Germany will need to import about 85% of the required hydrogen for its industries (Merten & Scholz, 2021, p.33). In contrast, Morocco aims to position itself as a key producer and exporter of hydrogen, particularly to Europe (Amouzai & Haddioui, 2023, p.4). This is ascribable to its geographical proximity to the continent, a high capacity of solar and wind power, and the highest installed capacity of renewable energy in Africa (Ersoy, 2022, p.24). While both countries are predominantly focusing on green hydrogen, Germany leaves the option of importing blue, turquoise, and orange hydrogen open, should the green hydrogen market fail to develop as expected (Kittel et al., 2023, p.566).

The German “Nationale Wasserstoffstrategie” expects that hydrogen will be transported as hydrogen derivatives such as ammonia via sea route (Kittel et al., 2023, p.566). The strategy’s primary focus is on establishing hydrogen applications, developing infrastructure in both domestic and foreign markets, and creating favorable regulatory conditions (Lebrouhi et al., 2022, p.7036). Furthermore, the strategy paper stresses the importance of the global hydrogen market for domestic technology producers specialized in electrolyzer technologies, hydrogen fuel cells, and storage solutions. In order to strengthen the competitiveness of German companies in this, the strategy paper prioritizes research and development (R&D) in the field of hydrogen technologies (Kittel et al., 2023, p.566).The implementation of the strategy is mainly driven by the German Federal Ministry for Economic Affairs and Climate Action (BMWK), with initiatives and pilot projects implemented in collaboration with national actors such as the German Bank for Reconstruction (KfW), the German International Cooperation Society (GIZ), and research institutes like the Fraunhofer Gesellschaft. The strategy is considered to be unique due to its international scope which goes beyond partnerships with European countries (Quitzow et al., 2023). One such partnership is with Morocco.

The Moroccan-German Energy Partnership (PAREMA), established in 2012, initially focused on promoting energy transition and supporting Morocco’s renewable energy sector. The NOOR solar plant in Morocco was largely financed by KfW (Daum, 2020, p.71). In 2020, the two countries expanded their partnership to the PtX-sector (PAREMA, n.d). However, the partnership was paused in 2021, due to political tensions between the two countries (Dejonghe, 2023, p.9). These arose as Germany made its critical stance on Morocco’s sovereignty claim over the Western Sahara clear. The Western Sahara region is a contested territory in North-Western Africa. Formerly colonized by Spain, the region is now largely controlled by Morocco. While Morocco regards the land as belonging to its kingdom, the official status of it is disputed, as the local Saharawi people claim the region for themselves. (Weko et al., 2023, p.3-10)

The partnership between Germany and Morocco resumed in 2022, with players from both countries now cooperating on the construction of Morocco’s first reference plant for green hydrogen production in Morocco (KfW, 2024), and collaborating in R&D efforts (Ersoy et al., 2022, p.17-18).

In its Green Hydrogen Roadmap, Morocco outlines its goal to become a leading R&D hub in the green hydrogen sector (Weko et al., 2023, p.16), and position itself as a “gateway to Africa” (Weko et al., 2023, p.3). Additionally, the country’s strategy outlines the aim to decarbonize its phosphate sector, a main export sector of Morocco, by using green hydrogen to produce green ammonia. The Moroccan national strategy for green hydrogen is divided into three phases which focus on reducing the cost of green hydrogen products, implementing pilot projects, supporting R&D in the sector, developing a legal framework, and expanding the use of green

hydrogen beyond the phosphate industry in Morocco. Key actors driving this strategy include the Research Institute for Solar Energy and New Energies (IRESEN), the Moroccan Agency for Sustainable Energy (MASEN), universities, and state-linked companies such as OCP and Nareva Holding. Like Germany, Morocco strides to foster cooperation on an international level, actively advancing this goal by hosting events like the PtX summit, global conference on the hydrogen market.

The Moroccan king, Mohamed VI, has been vital in advancing the green hydrogen transition. In 2022, the monarch launched the 'Offre Maroc'. The initiative's aim is to support investor projects by creating a regulatory and institutional framework for green hydrogen, and developing necessary infrastructure. It includes investment incentives and a project tender, to which both domestic and foreign investors can apply, therefore providing a possible entry option for foreign companies. (El Youssoufi Attou & Nadir, 2024, p.513 – 516).

Both the market entry strategies and the German and Moroccan strategies provide the framework for this thesis to examine company-level challenges in this environment.

3 Methodology

As Morocco has been identified as a suitable exporting country for Germany's green hydrogen demand by the Fraunhofer ISI (2024), there exists a large body of literature on German-Moroccan cooperation, national policies, and the green hydrogen strategies of both countries. While some studies such as those by Jesse et al. (2024) or Schmidt et al. (2024), have explored the company-perspective, no research has been conducted on the microeconomic viewpoint of the German-Moroccan market. This thesis seeks to close this research gap by analyzing this developing market from the perspective of German companies. The following subchapters outline the research design of this study and the methods used to obtain and analyze the results.

3.1 Research Design

Entering a new market involves navigating various risks and limiting factors, which influence a company's decision to enter the market and shape its development. The research objective of this study is to identify these limiting factors in the Moroccan green hydrogen market for German companies. In a second step, the thesis aims to analyze ways to limit these factors, thereby de-risking the German-Moroccan green hydrogen market. The following research question will be answered:

What are the key limiting factors for an involvement of German companies in the establishment of a German-Moroccan market for green hydrogen, and how can they be overcome?

To this end, the research design combines both quantitative and qualitative approaches in a Mixed Methods approach with a focus on qualitative methods. The Mixed Methods approach consists of a survey and semi-structured interviews. The chosen population sample are German companies that are active in the green hydrogen market and have an interest or are already active in this sector in Morocco. This study defines all companies having their headquarters in Germany as 'German companies'. As the green hydrogen sector is a multi-faceted one, in which players from different sectors come together, all companies, independent of their sector or size, were included in the sample. The sample was selected via a non-probability sampling for both the survey and the interviews. This is important to mention, as it increases the research bias of the conducted study. The Chapters 3.2.1 and 3.2.2 will look into detail on how the sampling was conducted.

The basis for the survey was a literature research. This research mainly focused on recent literature (2015-2025) to see which factors might influence this market. The results of this research are summarized in the Conceptual Framework of this thesis. For the literature research the following key words in combination with '*green hydrogen*' have been used in data bases such as Ebsco, Google Scholar and Science Direct: '*Morocco'*, '*Germany'*, '*market'*, '*economy'*, '*challenges and opportunities'*, '*production'*, '*transport'*, '*storage'*, '*techno-economic'*, '*socio-economic'*, 'environmental', and '*strategies'*. The found literature encompasses different disciplines such as economics, political science, social science, and engineering. It was mainly literature in English examined, as this makes up the largest portion, but also German and some French publications. The majority of literature was either published in the form of research papers or review papers due to the actuality of the topic.

Due to the limited literature available on a microeconomic view of the market, additional primary research was conducted through data collection. This data collection was carried out using a Mixed Methods approach, which is detailed in the following subchapters.

3.2 Mixed Methods approach

The Mixed Methods approach is "an approach to a research problem that leverages the advantages of both qualitative and quantitative research methods" (Harper, 2022). While qualitative research has the advantage of a higher flexibility, and a focus on individual viewpoints, quantitative research allows the analysis of large sample population, as well as a better comparison of data (Roch, 2017, p.95). Combining the two allows for deeper insights into the research problem (Creswell, 2014, p.188).

In this study a sequentially exploratory Mixed Methods approach is used. This means that the research methods are employed one after another. Initially, quantitative research in the form of a survey is conducted, followed by the qualitative research via semi-structured interviews.

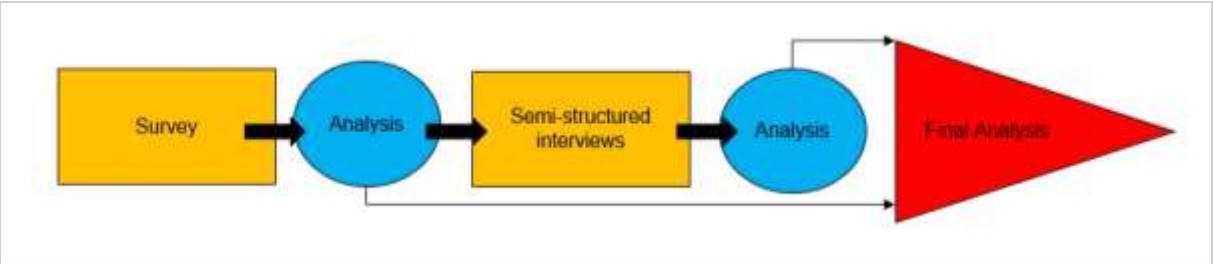

Figure 2: Visualized Mixed Methods Approach – Own illustration according to Creswell (2014, p.194)

This design has the advantage that one research phase may inform the other, as the survey data is collected and analyzed before conducting the interviews. This specific order was chosen as the green hydrogen economy is complex, and limiting factors in the market are various. By first conducting a survey, its results can be used in order to formulate more specific interview questions, and further analyze issues which were found in the survey. The qualitative results can then be used to explain and interpret the quantitative results, which is done in a Final Analysis combining the findings of the two methods. (Creswell, 2014, p.191-194; Gray, 2014, p.223)

3.2.1 Survey

The survey is a standardized questionnaire through which a large number of respondents can be reached (Gray, 2014, p.379). Its aim is to collect reliable and valid information from the respondents (Ekinci, 2015, p.3). To achieve this, a survey should be formulated in an objective way, simply structured, and not taking more than thirty minutes to complete (Ekinci, 2015, p.16).

The basis for the survey of this study consists predominantly of knowledge found by the literature research about the green hydrogen market, as it was assumed that, according to findings in Lauther et al. (2023), challenges inherent to the market have a large influence on the companies. The aim of the survey is to get a general idea about what limiting factors and risk play a role for German companies in the Moroccan market for green hydrogen. Since the population size for the study, meaning the total number of German companies interested in the green hydrogen market in Morocco, is not known, the difficulty was finding an appropriate sample size, and keeping researcher bias in the selection of the sample minimal (Ekinci, 2015, p.28).

In the end, the survey was sent to 150 German companies active in the green hydrogen market. They were part of various sectors: renewable energies, steel industry, consulting, chemical sector, project development, building, and finance. The companies were found by using the network of the German Chamber of Commerce in Morocco (AHK), and by an extensive online research. For this LinkedIn and search engines were consulted to find companies in the green

hydrogen sector in Germany. Additionally, the Atlas of the hydrogen network in Germany by NOW GmbH was used to find networks in the sector and research their members (NOW GmbH, 2022). The identified companies were contacted via email mid-September 2024. The email consisted of a short explanation of the research project and a link to the survey, which was closed by the end of the month. The survey was made using the tool SurveyMonkey. As only German companies were contacted, both the email and survey were written in German.

The survey includes one open-response, and seven closed-response questions. The questions were formulated deductively, based on the findings of the literature review. The survey commences with three mandatory questions covering the sector of the company, company size and whether they are already active in the Moroccan market for green hydrogen. For the following three questions, the participants are divided into two groups. Group A consists of companies that indicated that they are active in the Moroccan market for green hydrogen. Companies in Group B are not yet active in this market. Questions for Group A focus on (1) the reason for becoming active in this market, (2) in which way they are participating in the market, and (3) what problems they are facing. Respondents in Group B are asked (1) why they are interested in becoming active in this market, (2) the reasons for not having done so yet, and (3) what resources they are missing for doing so. The first of these questions was a multiple-choice question for both groups, with the possibility to choose more than one answer. The second one was posed in the form of an open-response question, and the third a multiple-choice, limiting the responses to two. The last question was posed to the whole survey population and asked what risks their company (possibly) faces on this market. The respondents were given sixteen possible response options, with a limit of five to choose. Although research does not recommend using more than nine response options (Franzen, 2022, p.1119), such a high number was still provided. This was done due to the importance of the question and the extensive research findings. At the end of the survey, participants are asked, whether they would be interested in further supporting the research by participating in an interview. Seven participants consented to this, and left their email address as a measure of contact.

Responding to the survey took the participants no more than five minutes. They were informed both in the email and the preface of the survey that their data would be treated confidentially, and that it would not be possible to draw conclusions about their person or the company in the final study. Of the 150 companies contacted, twenty-six replied to the survey, of which four only replied to the first three mandatory questions. These four were treated as non-replies, and deleted from the data set. The survey sample size is therefore twenty-two, marking a survey response rate of 14,67%. In addition to the twenty-six companies that partly filled out the survey, thirty-four companies stated via mail that they are not interested in the Moroccan market, and will therefore not reply to the survey. Response rate to the study was therefore 40%, since

in total sixty companies replied to the email. Even if no response was received from ninenty companies, it can be assumed that the majority of them are not interested in the Moroccan market. Furthermore, with the twenty-two companies that responded to the survey, the decisive companies have presumably mostly been covered, as the market is still new, and Morocco is not the only market option.

Responses to the survey were analyzed using Excel. For multiple choice questions, frequency of responses was counted, and the percentages calculated. Open-response questions were analyzed by thematic analysis. For this, responses were organized, and counted towards a supra-category. To gain deeper insights from the data, two cross-tabulations were performed, examining the size of the company in regards to the highest possible risk on the market, and company size in relation to the resources that are missing. It is important to note that because of the small survey sample size, findings cannot be generalized. However, the results may still give a first idea of what companies think. Appendix 2 gives an overview of the survey results that are analyzed in Chapter 4. Due to limitations connected to quantitative data, semi-structured interviews were conducted to gain more in-depth insights. The following subchapter covers the methodology behind these interviews.

3.2.2 Semi-structured interviews

In the field of management research, interviews are a popular method for data collection, as they allow to gain data on individual opinions and perspectives (Cassell, 2015, p.2). A semi-structured interview was chosen as the interviewer has the opportunity to ask follow-up questions (Gray, 2014, p.378), and unreliability as well as the interviewer effect are minimized (Cassel, 2015, p.2). This happens as the interviewer uses a pre-formulated list of questions to guide through the interview. Since this method is non-standardized, not all of questions in the interview guide will necessarily be asked, and additional ones may be added by the interviewer depending on the course of the interview (Gray, 2014, p.381-384).

The interviews took place online, in a synchronous manner on the platform Microsoft Teams, with one being held via WhatsApp. All interviews were recorded with the consent of the participants. Between October and December 2024, twelve interviews were conducted. The population sample was conveniently selected. First, the respondents in the survey which consented to participating in an interview were contacted via email. Of these seven respondents, six replied and participated in an interview. The other six interview participants were found via the network of the AHK. This was done to gain deeper insights into the perspectives of companies that are already active in the market, as all six of these companies have either entered the market or are in the process of exploring it. All interviewees are employees in departments of companies that deal directly or indirectly with hydrogen, and have at least basic knowledge

of the strategic decisions in their company. Any personal data, or information which could reveal the name of the company was anonymized according to Cassell (2015, p.37-40).

The interviews took in average half an hour with the shortest lasting fifteen minutes. One interviewee provided additional written information, as they felt to not have imparted all information due to time constraints. This information is included in the analysis. Apart from two interviews held in English, all others were conducted in German.

After the recording, the interviews were transcribed using the transcribe software of Microsoft Teams and the AI-software Restream. The transcripts were then manually corrected, and converted into easy transcription, therefore accents and colloquial language were translated into Standard German and English. As translation may lead to interpretation issues (Cassell, 2015, p. 48), sections from the interviews cited in this text are always written in the language the interview was held in, and translated into English where necessary.

The basis of the interviews were two questionnaires. One for companies already active in the Moroccan market for green hydrogen, and another for companies not yet active in this market. The interview questions in each of the guides can be found in the Appendix (Appendix 3). An overview of the questions was sent to the interviewee prior to the participation. The questions were formed deductively, using the results of the survey. Both guides cover the market activities of the company in the green hydrogen sector, and their risk and problem assessment of an activity in this sector in Morocco. The guide for companies in the market focuses on their activities in Morocco, while the guide for companies yet to enter the market explores the reason behind their decision. Furthermore, the questions cover the second part of the research question, collecting data on how these problems and risk could be mitigated, and where the companies need support. Both guides conclude with questions regarding the future of the German-Moroccan market on green hydrogen.

The interview transcripts were analyzed using a qualitative content analysis according to Mayring (2000). For this, codes were formed deductive-inductively, relying on the results of the survey, and the questionnaire. The coding guide which was formed for the analysis can be found in Appendix 5. In order to facilitate the coding, the software MAXQDA was used. The results were analyzed in accordance with the research questions, referring to limiting factors for German companies in the market, and possible solutions identified by the interviewees.

4 Results and Discussion

Several reasons contribute to the interest of German companies in the green hydrogen market in Morocco. For one, the geographical location of the country and, due to this, its potential for renewable energy and green hydrogen production plays a decisive role in their interest.

However, the main reasons, according to findings from the survey, are the opportunities for building partnerships, and gaining access to a new market (Appendix 2).

Despite this general interest, the final analysis reveals several factors which hinder the companies' involvement in the market. The results are based on data collected from the survey and the interviews, analyzing the perspectives of twenty-eight companies. Figure 3 gives an overview of the final analysis sample by providing a visualization of the companies' sectors, their size, and how many have already entered the Moroccan market.

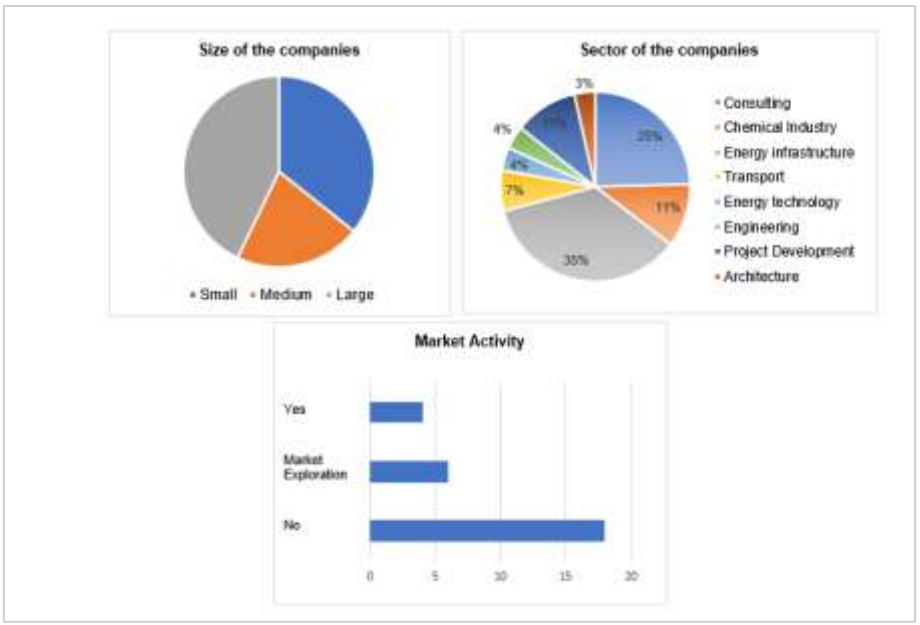

Figure 3: Population sample in the final analysis made up of the sample of both survey and interviews

The following subchapters will present and discuss the impeding factors of German companies in the German-Moroccan market for green hydrogen, as well as analyze measures identified by the companies to mitigate those.

4.1 Impeding Factors for German companies

As the green hydrogen market is a broad concept, several of these impeding factors are interconnected, and have cause-effect relationships which are also partly regarded in the chapter. The analysis of the impeding factors is followed by a presentation and discussion of the measures identified by the companies to mitigate those.

4.1.1 Market development

In international business, market development typically refers to strategies, on how a company can expand into new domestic and foreign markets (Lubis, 2024, p.1). However, this chapter adopts a macroeconomic view of market development, in line with what the results of the final

analysis indicate. In the context of the green hydrogen market, this entails the energy market transition, infrastructure development, and market conditions at both global and national levels.

In the survey and interviews, companies refer only to development in the global and the Moroccan green hydrogen markets, not the German one. One-third of survey respondents consider the development of the global green hydrogen market a risk, making it the second-most frequently mentioned one (Appendix 2). This concern is expressed by five small companies, three large companies, and no medium-sized company. All companies already active in the Moroccan green hydrogen market indicate that risk. The interviews further support this finding, with all but one company mentioning challenges related to global market development. Both the survey and interviews suggest that the global market development is an impediment, and considered a major risk. Additionally, the survey also hints that medium-sized companies are not affected by this, while large companies, and especially small companies are. This is only partly supported by findings in the interviews. For instance, while small companies do refer to the challenges in the global market development in the interviews, they seem to not play a major role in their business activities (Interview 11, Interview 12). Market development factors are more often named by large-sized companies (Interview 2, Interview 5, Interview 7, Interview 10), but except for two interviewees (Interview 7, Interview 10), none of them refer to challenges which could directly impact their business. Of the medium-sized companies none refer to the market development challenges.

In the interviews, companies mainly acknowledged the uncertainty in the global green hydrogen market. As one interviewee remarks:

> „Der alte Markt, der eigentlich den neuen finanzieren soll, der bricht zusammen, […], und das neue ist noch nicht da. […]. Der eine läuft noch nicht und der andere läuft nicht mehr.“ (Interview 7) - *The old market, which is supposed to finance the new one, is collapsing [...], and the new one is not yet here. [...]. One is not yet running and the other is no longer running.*

The fossil fuels market is collapsing, while the hydrogen market is underdeveloped (Interview 7), which creates uncertainty. Another company emphasizes that market maturity represents the largest risk they face (Interview 10), and one company in the survey states the not yet sufficiently developed market as the reason to why they have not yet entered the Moroccan market (Appendix 2). A recurring element in the interviews is the insecurity surrounding the cost, pricing, and long-term viability of the green hydrogen market. One interviewee describes entering the green hydrogen market as a “financial disadvantage” (Interview 7). That green hydrogen is not cost-competitive to gray and blue hydrogen is common knowledge among the companies (Interview 4; Interview 7; Interview 10). However, two interviewees state that in the projects getting implemented now, cost and price seem to be even higher than estimated

before, and that this is a reason for the slow-down in market development (Interview 2; Interview 9).

The interviewees only refer to the global market development in general terms, however it is clear that they are affected by these market-related factors, as also concluded in another study from Lauther et al. (2023). Results from the survey and the interviews suggest that medium-sized companies are less affected by this. However, due to an underrepresentation of medium-sized companies in the sample, these results cannot be generalized, and would need to be evaluated in a quantitative study with a larger sample. The results show that especially cost and price uncertainty seem to have an effect on the companies. Currently, since only a small number of projects has been implemented so far (Odenweller & Ueckerdt, 2025), there is a lack of real-world data, and all price evaluation is based on theoretical calculation. This in turn influences investment decisions (Schmidt et al., 2024, p.20). According to research, rising production cost and higher-than-estimated prices could influence the market entry mode chosen by German companies. According to Scita et al. (2020) and Islam et al. (2024) these cost developments will impede the acceleration of this market. If a market is growing, companies are more inclined to choose higher risk entry modes (Šarapovas et al., 2016, p.48). Therefore, if the market does not continue to grow, the companies might be inclined to choose non-equity entry modes.

In terms of market development in Morocco, two elements are indicated as potential impeding factors for an involvement of the companies. One of these is infrastructure development. In the survey, six of the twenty-two companies identified “Lack of infrastructure” as a risk in the Moroccan market, with four of these being large companies. In the interviews, however, the lack of infrastructure in Morocco is generally not viewed as a major impeding factor. Interviewees note that Morocco's infrastructure development plan looks promising, and the country’s strategic location and existing energy infrastructure offer a solid foundation for green hydrogen production and export (Interview 7; Interview 11). Nevertheless, one interviewee expresses doubt about whether Morocco will follow through with its plans and meet its stated targets:

> *“*Die Infrastruktur ist sehr generalstabsmäßig geplant, wenn es denn dann auch alles so umgesetzt wird. Planung heißt ja noch nicht, dass es gemacht wird*.“ (*Interview 7*) - The infrastructure is planned very strategically, if it is actually implemented as planned. Planning doesn’t necessarily mean it will be carried out.*

Another sees infrastructure development in Morocco as “not trivial”, and aims to reduce infrastructure dependency by focusing on green methanol production (Interview 5). While production of methanol with the use of hydrogen is technologically complex, it is easier to transport than green hydrogen (Schorn et al., 2021, p.4). A third interviewee plans to reduce

infrastructure dependency by implementing small-scale projects for which they could build necessary transport infrastructure themselves (Interview 11).

The second identified element, which could serve as an impeding factor, is the delay of projects. Market development and project implementation are tied, as projects contribute to market growth. Morocco has already demonstrated its capability to deliver large-scale project, with the NOOR solar plant being a prominent example. However, one interviewee notes than in the past, several other announced projects had either been delayed or never materialized (Interview 8). Another of the interviewed companies has themselves experienced delays in the implementation of their projects in Morocco (Interview 10). Although green hydrogen projects in other countries have also been announced and not implemented (Oddenweller & Ueckerdt, 2025), if such issues persist and become more common in the Moroccan market, it could lead to a perception of increased risk in the country (Interview 8).

Results show that market development in the Moroccan does not seem to be a big impeding factor for the companies. For instance, the mentioned project delays in the Moroccan market are a common project management risk (Tavares 1999; Interview 10). Still, if these delays become recurrent and public, this could affect the decision of Germany companies to enter the Moroccan market. They may opt to invest in countries with more predictable project timelines and fewer implementation risks. Additionally, while the issue of infrastructure development could become a market-specific problem, it is generally a problem inherent to the global market, as mentioned in Chapter 2.2.3. Morocco is not only in the interviews evaluated to have a good base for the infrastructure development, but also in research (Caillard et al., 2024; Ersoy et al., 2022). Still, scholars (Caillard et al., 2024; Weko et al., 2023) share the apprehension that Morocco might not meet its targets. Caillard et al. (2024, p.21) state that the targets laid out in the Moroccan strategy are not yet in line with existing energy infrastructure in Morocco, and according to Weko et al. (2023) the timeline of these projects is still uncertain (p.21).

In summary, especially market development on a global scale is an impeding factor that the companies are wary of. Here, predominantly cost and price uncertainties play a role. While the market development specifically in Morocco does not appear to be an obstacle for most companies, the delays in project execution and infrastructure implementation have the potential to become a future impeding factor. Political and regulatory environment are also part of market development; however, they will be analyzed in the following subchapter in order to present the results in a more precise way.

4.1.2 Political and regulatory challenges

In the survey question on the biggest risk in the Moroccan market, the risk of changes in the regulatory environment is mentioned by over a third of the companies (Appendix 2). In the

interviews, four of the twelve companies refer to regulatory challenges (Interview 5, Interview 7, Interview 8, Interview 9). Notably, EU regulations which apply directly to Germany, are mentioned several times. For instance, the RNFBO (Renewable Liquid and Gaseous Fuels of Non-Biological Origin) regulations are indicated as a step in the right direction, but not well-adapted to the market by one company. The same interviewee regards the swift implementation timeline as unrealistic, stating:

> *"What they have forgotten to do, is to allow the market to get adjusted to it. They say, it is going to be implemented and enforced from, say, 11/25, that is way too quick." (Interview 9)*

Another company criticizes exactly the opposite, saying that the implementation of EU regulations takes too long (Interview 5). The same interviewee also sees the complexity and bureaucracy that accompany these regulations as an impediment. They argue that once they are implemented, they serve as market barriers due to these reasons (Interview 5). This is supported by two other companies (Interview 7), with one of them adding that the rules made by the EU are "suffocating a lot of players" (Interview 9).

Researchers see the EU regulatory framework as a step in the right direction, as it gives market players more certainty (Hassan et al., 2024, 325). However, some other studies (Brandt et al., 2024; Schmidt et al., 2024) also refer to criticism surrounding these regulations. According to industry experts, the EU regulations will further increase production cost, and therefore the price of green hydrogen (Brandt et al., 2024, p.703).

In contrast to this, regulatory challenges in Morocco are only cited by one company:

> "[…] [Es gibt] für ganz viele Sachen noch gar keine Gesetze, die gehandhabt werden sollen. Mittlerweile gibt es in Marokko ein paar geschriebene Dinge, aber zwischen einem Circulaire und einem Gesetz gibt es noch Unterschiede." (Interview 9) - *[…] there are still no laws for many things that are supposed to be applied. There are now a few written things in Morocco, but there are still differences between a Circulaire and a law.)*

According to them the incomplete regulatory framework is especially in project development an impeding factor. They also voice that for them it is not transparent when this legal framework will be implemented, and find that the process "goes in the right direction, but goes very slowly" (Interview 8). As the majority of companies in the sample has not yet entered the market, it is likely that the missing regulatory framework does not yet pose an obstacle.

In contrast to the regulatory challenges, political challenges are less frequently identified in the survey. Here, four companies regard political insecurities as a risk, two of which are already active in the Moroccan market. However, the survey gives no insights into whether these political insecurities are related to Germany, Morocco, or both. In the interviews, among the companies already active in the Moroccan market, four mention that they view Morocco as

politically stable (Interview 1; Interview 3; Interview 6; Interview 10). For some this was a defining reason for the market entry (Appendix 2). Political impeding factors in relation to Morocco are only mentioned in connection to the Western Sahara dispute. At the height of the political tension between Morocco and Germany, not only diplomatic relations, but also economic relations were temporarily suspended (Dejonghe, 2023, p.9). Though relations have since improved, the Western Sahara dispute continues to influence business activities, as one company remarks:

> „Man hat das auch bei dem Meeting gesehen […], dass die wirklich die Sahelzone ausgelassen haben, weil eben Deutschland das nicht anerkennt. […]. Das ist Politik. Und egal, welche Entscheidung die treffen, das beeinflusst auch die erfolgreiche Umsetzung von Unternehmern." (Interview 1) - *You also saw that at the meeting […] that they really left out the Sahel region because Germany doesn't recognize it. [...]. That is politics. And no matter what decision they make, it also influences the successful implementation of entrepreneurs.*

Another company adds that this situation does not help to keep business relations stable (Interview 7). According to Weko (2023, p.3), the dispute directly influences the business activities of the companies in Morocco. As Germany doesn't recognize Morocco's sovereignty claim over the Western Sahara, they will not provide public funding to hydrogen projects in these parts. Therefore, German companies which are reliant on these government subsidies cannot do business in this territory, or they would be unable to receive the funding. The political sensitivity surrounding the region also limits the ability of German companies to participate in some business activities. The Western Sahara is considered to be a promising region for green hydrogen production (Daum, 2020, p.50), and the Moroccan government is planning to release large patches of land in that territory for projects in "Offre Maroc" (Weko et al., 2023, p.3). Of all the interviewed companies, only one says that they are planning to implement a project in that region. This company stresses that they are only able to do so, as they are not dependent on any public funding from Germany, and do not emphasize their German roots in Morocco (Interview 1).

Despite this political situation, German companies seem to have a good reputation in Morocco (Interview 8; Interview 10; Interview 11). According to the AHK Marokko this is partly due to the "Energiewende" in Germany, which is seen as a successful example in Morocco (DIHK, 2024, p.9). However, one interviewee mentions, that a lack of political support gives this reputation a "zynischen Beigeschmack [cynical aftertaste]" (Interview 11). This lack of political support in Germany is mentioned in three interviews in contrast to the political backing that French companies receive (Interview 6; Interview 11; Interview 12).

In October 2024, the French president Emmanuel Macron visited Morocco along with a high political and business delegation, with a focus on hydrogen. During this visit, Emmanuel

Macron accepted the sovereignty claim of Morocco over the Western Sahara territory (Le Monde Afrique, 2024). Three out of four companies mentioning this political visit criticize that, in comparison to France, Germany is lacking such a clear signal towards the promotion of hydrogen in Morocco. While Germany has a number of energy cooperations with different countries, one interviewee estimates that these are not kicking off (Interview 2). Without political support, the companies have to enable a lot by themselves, which means carrying higher risks, and more resource investment (Interview 5; Interview 11). One interviewee suggests that this lack of political support could, to some extent, stem from the current political situation in Germany, where the country is awaiting re-elections (Interview 12).

Regarding political challenges the companies mention the Western Sahara dispute. In studies on the risks of the German-Moroccan cooperation, the Western Sahara dispute is seen as the only major potential political risk (Dejonghe, 2023; Weko et al., 2023). However, the interviewees do not evaluate the potential of this dispute escalating again as high. Another political challenge is the lack of political support from Germany for companies in Morocco. This is interesting, as researchers mainly emphasize Germany's "hydrogen diplomacy" (Dejonghe, 2023, p.1), and its global influence and presence in the sector (Weko et al., 2023, p.3). This difference in results could lie in the different perspectives on the issue. On a macro level, Germany seems to be perceived as very engaged due to the numerous energy partnerships. Companies at the micro level, however, evaluate these partnerships and the actual political impact behind them as less influential, as they see no concrete actions behind them.

The results of this chapter illustrate how regulatory and political factors are influencing companies. It is interesting that political and regulatory challenges seem to be primarily tied to the German and European environment for the companies. This could be due to the fact that their companies are based in Germany, and domestic politics have a substantial influence on their activities. Accordingly, it could be that they are more aware of German politics, especially since the majority of them have not yet entered the market. That German companies see the long-term country risk in Morocco as rather low, even lower than regulatory and political challenges in European countries, in the results of this study is debatable, and needs to be further researched in a study with a larger population.

The following subchapter will look at another impeding factor for German companies in the market: risk aversion.

4.1.3 Risk Aversion

In research, risk aversion refers to an individual that is reluctant to follow through with actions that could signify a risk of loss, or of which the benefits are not assured (Kimball, 1993, p.1; O'Donoghue & Somerville, 2018, p.91). In business research, risk-aversion especially plays a

role in entrepreneurship and investment decisions (O'Donoghue & Somerville, 2018, p.91; Kan, 2006, p.465).

Risk aversion emerged as an impeding factor during the interview analysis, as it is frequently mentioned by the interviewees. Statements in relation to risk aversion are mentioned by six companies (Interview 5; Interview 6; Interview 7; Interview 9; Interview 10; Interview 12). The majority of them refers to risk aversion by investors, while three also mention risk aversion by the German state or initiatives on behalf of the state (Interview 9, Interview 11, Interview 5). According to the interviewees, risk in the green hydrogen market seems to be evaluated as high by both investors and politicians, while the companies themselves regard the risks as manageable.

This risk aversion is also seen directly in initiatives, such as H2Global, H2Uppp and the PtX Development Fund. All three of these initiatives offer companies financial support for their projects in hydrogen. While both H2Global and H2Uppp are projects of the BMWK, the PtX Development Fund is a fund of the KfW. These initiatives and investors are criticized for only supporting low-risk and mainly small-scale projects (Interview 5; Interview 6; Interview 7). Regarding H2Global, one company describes:

> „[Da] ist man […] das geringstmögliche Risiko eingegangen, indem man eine bestehende Ammoniakanlage subventioniert, die jetzt nur noch grün gemacht wird durch eine grüne Stromerzeugung." (Interview 6) - *[They] have really taken the lowest possible risk by subsidizing an existing ammonia plant, which is now only being made green by generating green electricity.*

Risk Aversion can pose a problem to the companies, as the needed financial resources are not invested, and projects which are needed to lower the general risk in the market are not being implemented.

The interview results show that risk aversion plays a role, but they also give indications to where this could originate from. One reason could be the First Mover Disadvantage mentioned by one interviewee (Interview 7), which is related to the infant stage of the market. According to IRENA (2024), technology in green hydrogen will evolve quickly with market development. Due to this innovation, investments of first movers could become less cost-competitive and simply not technologically-feasible anymore. As investment in green hydrogen projects is a long-term venture (Deutsche Energie-Agentur, 2024, p.8), such a development could lead to high losses for the investors (IRENA, 2024, p.81). Therefore, players might be reluctant to invest into this market. Apart from the First Mover Disadvantage, the political situation contributes to why investors do not see a Safety of Investment. According to two interviewees (Interview 6; Interview 7), the current political situation in Germany and Europe raises doubts

about the long-term stability of the region. Investors in that region do not see their investments secured in the long term.

Apart from this, a lack of knowledge among investors likely adds to risk aversion. As one interviewee says, no one knows anything about the “complex issues” (Interview 5) connected to green hydrogen projects. This poses a problem to investors, as estimation of the success of their investment is unclear. This lack of knowledge also seems to be linked to the technology. As opposed to the majority of the interviewed companies, which evaluate the technology as well-established, investors regard the technology as new (Interview 2; Interview 5), and therefore bearing a higher risk.

Interestingly, two companies link this risk aversion especially to German market players. According to them risk aversion is embedded in the German culture (Interview 9; Interview 10):

> *“The Germans are, I would say, conservative to put it in that way. They are very hesitant when there is a risk involved.” (Interview 9)*

Additionally, all the funding initiatives mentioned above are German ones. Following these results, it could be likely that risk aversion is higher among German market players. In the public eye, German culture is believed to be more risk-averse than others (Bartke & Schwarze, 2008, p.3). However, this statement is not fully supported by research. According to the applied Hofstede cultural difference model by Al-Alawi & Alkhodari (2016), Morocco and Germany have similar attitudes towards uncertainty avoidance. According to them Morocco is a country with a “preference for avoiding uncertainty” (p.40861) and Germany an “uncertainty avoidant country” (p.40861). In order, to reach definite conclusions on this, a comparison of investor decisions in different countries would have to be made.

In conclusion, risk aversion among investors and state initiatives, especially on the German side, can be an impeding factor for the companies and the development of both the global and the German-Moroccan market for green hydrogen. This risk aversion is compounded by a First Mover Disadvantage, insecurity in the German and European political landscape, a lack of market and technology knowledge, and possibly cultural factors. The following subchapter will look at company-level factors which are impeding the involvement of German companies in the market.

4.1.4 Lack of resources

Factors which are inherent to the companies specifically, and not necessarily all German companies, can also act as an impeding factor in this market. One of these factors is a lack of resources. According to research, resource possession is decisive in deciding whether a company pulls through with a market entry (Shen, 2017, p.437; Calheiros-Lobo, 2024, p.2).

Generally, companies only possess a limited amount of resources, and according to one interviewee, there exists a fight for resources (Interview 8). This not only concerns financial resources, but also market capital, such as manpower, and social capital, like attention. While all the companies in the survey and interviews are interested in the Moroccan market, some refer to a prioritization of European and other markets, which is present in their company at the moment (Interview 2; Interview 4; Appendix 2). This seems to be influenced by company-intern decisions, the economic and political insecurity in Germany, as well as on a global level, and the geographical and cultural closeness of countries such as Spain (Interview 2; Interview 2; Interview 4). North African countries are perceived as more insecure location for business activities than European countries by some interviewees (Interview 4; Interview 7). Furthermore, some other foreign markets seem to be more present among German companies due to their size and promotion in Germany (Interview 6; Interview 2).

A resource missing by over half of the respondents are partners and a network. A lack of partners is seen as the biggest risk on the Moroccan market for green hydrogen by over 63% of the companies in the survey, and a key reason for why companies have not yet entered this market (Appendix 2). The majority of companies facing a lack of partners are of small and medium size. According to one interviewee, actors in Morocco seem to focus more on large market players who already have a proven reputation, which makes it harder for small companies to find partners (Interview 1). This is especially difficult for startups, as they lack reference projects with which they could prove their credibility and expertise to investors (Interview 1). A lack of partners can be decisive in the market entry strategy, especially in a collectivist society like Morocco. Strong relationships and values play an important role in business relations (Al-Alawi, 40860-40861). One interviewee notes that this social structure makes it hard for someone new to enter the market:

> „[…] in einem Land wie in Marokko, mit einer sehr starken sozialen Struktur, ist es für ein Unternehmen, was da neu reinkommt, ohne eine lokale Geschichte zu haben […] immer sehr schwierig einschätzen zu können, mit wem man zusammenarbeitet, […] Also diese ganzen lokalen Strukturen zu durchschauen ist nicht einfach.“ (Interview 8) - *“[...] in a country like Morocco, with a very strong social structure, it is always very difficult for a new company that comes in without a local history [...] to be able to assess who you are working with [...] So it is not easy to see through all these local structures.*

For companies active in another market segment in Morocco, finding partners, and entry in the green hydrogen market can be easier, as they already have relations in the country (Interview 3; Interview 7; Interview 10). The cost of services offered by German companies could be another factor influencing the ease of finding partners in the Moroccan market. Services of German companies are often significantly more expensive than that of competition from

African and Asian countries. Due to this finding the right partners for projects is not easy according to one company (Interview 10).

The lack of a network and an understanding of market players are two of the biggest obstacles for German companies in this market. However, two interviewees evaluate that, in some cases, building relations in Morocco can be easier than in the German market. According to them this depends on the kind of partners and contacts one is looking for. They evaluate that especially high-ranking players are more easily accessible in Morocco than in Germany (Interview 11; Interview 12).

Additionally, a third of the survey respondents lack information and market knowledge as a resource. This lack of knowledge is also considered a big risk in the Moroccan market by a third of all companies analyzed, and half of the large companies. In the interviews, one company mentioned that for them the language barrier is a decisive factor (Interview 2). French is the main business language in Morocco, and especially in the public sector (DIHK, 2024, p.9), however according to the interviewee, they lack a substantial understanding of this language. Apart from this, the absence of skilled workers, and inadequate financial resources are also critical missing resources for some respondents. Five companies, three of which are large ones, indicate in the survey that they miss no resources. (Appendix 2)

The data can give no specific insights as to a correlation between the size of a company and the lack of resources. However, research suggests that company size influences the amount of resources a company possesses, which is also seen in some cases mentioned in the interviews (Chetty, 2024, p.4-5). According to one interviewee the funding landscape is already harder to navigate for small-sized companies, especially startups (Interview 5). However, funding programs in Germany seem to additionally favor large companies (Interview 12). This could contribute to a lack of financial resources for small and medium-sized companies (SMEs). This preferencing of large companies also happens in political decisions, as they possess more influence than SMEs:

> „Man merkt schon, dass die großen Player gemeinsam in der Politik […] sehr bestimmend sind. Und das sieht man dann auch in Ausschüssen, […] wo Vorgaben auch für die Politik erarbeitet werden, dass dann die Key Player dort auch sehr stark vertreten sind und auch überproportional viele Stimmrechte haben.“ (Interview 6) - *You can already see that the big players together are very influential in politics. And you can also see that in committees, […] where guidelines are also drawn up for politicians, that the key players are also very strongly represented there, and also have a disproportionately high number of voting rights.*

Company size also seems to impact market barriers experienced by the company. Small companies seem to experience higher market entry barriers than larger ones in Morocco (Interview 1; Interview 6; Interview 12). This in turn has an effect on market entry decision made by SMEs.

In summary, a lack of resources, especially a lack of partners, is the major company-specific impeding factor for German companies when entering the green hydrogen market in Morocco. Regarding their access to resources, the size of the companies seems to be an influential factor. Larger companies seem to benefit from better resources and political connections, while smaller companies face difficulty in accessing public funding, and gaining visibility among players in Morocco.

The following chapter will now look at ways to de-risk the identified impeding factors.

4.2 De-risking the German-Moroccan green hydrogen market

The solutions to minimize the above-mentioned impeding factors span political involvement, regulation, financial instruments, market knowledge, cultural understanding, and collaboration. In total, seven companies see solutions in relation to actions from the "government", the "state", or "politics" as important in de-risking the market (Interview 2; Interview 4; Interview 5 ; Interview 6; Interview 10; Interview 11; Interview 12). All of them refer to the German government. They believe that political intervention could help de-risk this market, and hereby foster investment (Interview 4; Interview 5; Interview 12). According to one interviewee, de-risking is hard to do for companies on their own, especially in large-scale and more complex projects (Interview 5).

Political support is especially needed in the early stages of the market development, in order to animate other investors in Germany (Interview 11; Interview 12). Some companies argue that this could be achieved by a proactive promotion of the German-Moroccan green hydrogen market on a political level, and a long-term political backing for the companies (Interview 1; Interview 6; Interview 10). One way to 'support a company is a "written commitment from the political side" (Interview 6). This could for instance, be in the form of a Letter of Comfort. A Letter of Comfort is typically issued by a parent company, but can also be given by a government (Faul, 1990, p.73). While such a document is not legally-binding, it can increase trust in the company receiving it, and hereby improve the company's reputation in the foreign market. The Letter of Comfort could therefore provide a competitive advantage, and lead to distortion of competition by the political side in a free market. The interviewee mentioning this option identifies this as the main reason for why German government officials have not yet handed such letters out (Interview 6).

In addition to political backing, financial support of the German state is seen as an important way to de-risk the market. One company is of the opinion that the German government needs to directly invest in the market:

> "[…] das geht nur als Equity. Es nützt nichts, wenn ich sage, ich gebe euch 10% Zuschuss. Wer will die anderen Prozent dann bezahlen, wenn es niemanden gibt. Dann helfen auch

> Förderungen nicht. […] Deswegen ist es Hochrisiko-Invest. Aber das muss es halt sein, ansonsten kommen wir nicht weiter." (Interview 6) *[...] that only works as equity. It's no use saying I'll give you a 10% subsidy. Who wants to pay the other percent if there is no one. Then subsidies won't help either. [...] That's why it's a high-risk investment. But it has to be, otherwise we won't get anywhere.*

Other companies see funding programs of government actors and banks in Germany and the EU as a good option to develop this market. However, they call for adaptation of these funding programs to ensure they are accessible to all companies, rather than, as mentioned in Chapter 4.1.4, primarily benefiting large companies (Interview 6; Interview 12). Such an adaptation would entail making the processes more transparent, providing feedback to applicants, and reducing bureaucracy. The interviewees also add that it would be helpful to introduce smaller funding options to support small-scale projects (Interview 6; Interview 12).

Additionally, the interviewees propose solutions to generally de-risk the green hydrogen market. These include a good monitoring of regulation implementation in the EU and Germany to prevent counterfeits negatively affecting the green hydrogen price (Interview 5). Additionally, state guarantees are named as viable option to minimize investment risk (Interview 4; Interview 11; Interview 12). Hedging instruments such as contracts for difference and long-term off-take agreements are seen as ways to tackle the cost-competitiveness of green hydrogen (Interview 7; Interview 11; Interview 12). However, while these are viable options, they are seen as more beneficial at a later stage in market development. Additionally, a rise of the carbon dioxide tax is named as an instrument to improve the economic attractiveness of green hydrogen in comparison to gray hydrogen. However, while they see it as a viable option, the interviewee also calls this an “unpopular measure” (Interview 9), which is due to questions about its effectiveness and social distribution effects (Venjakob et al., 2023, 11; Frondel et al., 2022).

In the current early stage, a price mechanism compensating the high price of green hydrogen would be helpful according to two companies (Interview 4; Interview 11). Such a mechanism could be implemented either by the EU or its member states, and positively influence both the German-Moroccan market, and the global green hydrogen market (Green Hydrogen Organisation, 2024, p.10). The European Energy Exchange already launched a first green hydrogen price index in 2023, however so far this index is regionally limited (Green Hydrogen Organisation, 2024, p.11).

There is no consent as to how far political support in the market should go. One interviewee voices the opinion that a market should regulate itself through offer and demand (Interview 6), while another states that “if you think that a market is going to act completely by itself, you’re living in a fantasy” (Interview 9). While especially financial support could help accelerate the market, these come with high investment. The European Commission estimates that €90 to

€115 billion are required in order for green hydrogen to become cost-effective (Spasowska, 2023, p.2). It is important to note that due to the high financial investments needed and the economic and political dependencies, which may come with it, there are scholars who warn against such political interference (Scholvin, 2025, p.1).

Beyond political, financial and regulatory support mechanisms, understanding the market dynamics in Morocco could facilitate the market entry for German companies. This involves gaining insight into key market players in the green hydrogen sector, how they are connected, their roles in the market, and the existing business and research infrastructure (Interview 7; Interview 8). German organizations based in Morocco like the AHK and the GIZ are already providing such information through initiatives such as the H2 Business Link or the Green Hydrogen Alliance. One interviewee suggests that such organizations could further support market entry by organizing business meetings in Germany and Morocco that are tailored to the specific needs of individual companies (Interview 10).

Additionally, the importance of long-term cooperation in the market, not only between German and Moroccan players, but also among German companies is underlined in the interviews and in research (Interview 3; Interview 12; Schmidt 2024, 8). Companies entering the Moroccan market should not only focus on engaging in the market via export and import, but on being physically there (Interview 9), for example by employing an equity-based entry mode. Furthermore, German companies should be conscious of building equal partnerships, and not exploiting Morocco's resources of land, sun and wind (Interview 9; Interview 12). Options to achieve this, are for instance Public Private Partnerships (PPP) (Interview 1; Interview 10) or investments in the education of the Moroccan youth (Interview 3).

In summary, while German organizations in Morocco can play a part in de-risking the market by providing information and coordination cooperation between German companies, especially political involvement on the German side could help mitigating several of the impeding factors mentioned in Chapter 4.1. In the current early stage of the market an improvement of funding programs, and a clear political backing of the German companies in the Moroccan market would be helpful. Later on, an adaption of the regulatory frameworks, and the development of a price mechanism for green hydrogen would play a bigger role. By employing long-term cooperation with both Moroccan and German players in the market, companies can contribute to de-risking the market.

5 Conclusion

This thesis demonstrates that many German companies are facing impeding factors in the German-Moroccan market environment. Market development challenges specific to Morocco are minimal so far, with German companies generally viewing the market environment in

Morocco as promising for a market entry. The majority of hindering factors in this market is linked to the situation in Germany and the global development of the green hydrogen market, which have both a significant influence on whether and how companies engage with German-Moroccan green hydrogen market.

Despite cooperation efforts at both the political and economic levels, companies perceive a lack of political presence of Germany in Morocco's green hydrogen market and inadequate political support for German businesses. Additionally, political challenges, such as the domestic political situation in Germany and the Western Sahara dispute between Germany and Morocco, are influencing the business activities of German companies in Morocco. While EU regulations are seen as a market barrier because of high requirements, the regulatory framework in Morocco is still at an early stage, and therefore hard to evaluate. Furthermore, risk aversion, particularly among German investors, and German-led funding initiatives, negatively impacts project development and the acceleration of the market. Some impeding factors, such as a lack of resources, may vary depending on factors like company size. The analysis also found that company size can play a role in how easily German companies can access the Moroccan green hydrogen market. Small and medium-sized companies, in particular, seem to be at a disadvantage compared to large companies. The main resource that is crucial for a market entry in Morocco, but missing or hard to access for most companies, is a network and partners.

In a second part, this study examines ways to mitigate these hindering factors faced by German companies in this market. Here, the study shows that the companies mainly see the German state as responsible for providing support, be it via Letter of Comfort, financial investments, or a better promotion of the Moroccan market. But also, organizations like the AHK and GIZ are seen as possible sources of support for the companies, especially in providing information and helping the companies build networks. According to the companies, equitable partnerships at all levels between Germany and Morocco, as well as intercultural exchange, could positively influence the future of this market.

German companies from various stages of market entry and of different sizes contributed to the data set through a survey and semi-structured interviews. The sample includes small, medium, and large-sized companies, some of which are interested in the market, others in the exploration phase, and some that have already entered the market. This thesis fills a research gap by offering a microeconomic perspective on the Moroccan-German green hydrogen market. It also contributes to existing literature by emphasizing the influence of global market development and the importance of political involvement. The results largely align with previous research on the green hydrogen market but provide more specific insights from the perspective of German companies.

However, there exist several limitations to this study. One is the availability of data. Given that the market is still young and companies are still negotiating deals, some data was confidential and could not be included in the analysis. Additionally, there is a potential sampling bias. Survey respondents and interview participants were partly selected through the AHK Morocco network and through the author's personal connections, which may have influenced in particular the interview results. Furthermore, the sample size is small, and not representative of the general population. Therefore, the findings of this study should not be seen as general conclusions, but rather as preliminary insights. Conclusions regarding the relationship between company size and involvement in the market are particularly limited, as the sample includes only a small number of companies from each size category. Due to sampling bias, it is also unclear how much weight each impeding factor carries. To obtain statistically reliable results, a much larger sample would be necessary.

Nevertheless, this thesis offers a foundation for future research. Future studies could explore in detail how the size of the company influences a market entry into the Moroccan green hydrogen market. Additionally, conducting a similar study using the same research design at a later time could show how this market has developed, and how challenges and opportunities for German companies evolved. As most companies in this thesis' sample have not yet entered the green hydrogen market, such a later study could evaluate the market entry strategies employed by companies. This study has not included the views of Moroccan market players, therefore research on the perspective of Moroccan companies in this market could contribute to better understanding the German-Moroccan green hydrogen market as a whole.

Ultimately, the German-Moroccan green hydrogen market holds great potential, and there are German companies already becoming active in it. Market development could be accelerated more effectively with de-risking strategies for the green hydrogen sector in general, but also specific measures in regards to the German-Moroccan market. To ensure a mutually beneficial cooperation and avoid neo-colonial structures, it is essential to foster balanced partnerships at all levels, including between Moroccan and German companies. With these efforts, the market could have a sustainable, positive long-term impact on both countries.

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IV Appendix

Appendix 1: Survey structure

Frage 1: In welcher Branche ist Ihr Unternehmen hauptsächlich tätig?

- Beratung
- Chemische Industrie
- Energieinfrastruktur
- Finanzwirtschaft
- Forschung
- Stahlindustrie
- Transport
- Andere (bitte angeben)

Frage 2: Wie groß ist Ihr Unternehmen?

- Bis zu 50 Mitarbeitende
- 51-250 Mitarbeitende
- Mehr als 250 Mitarbeitende

Frage 3: Ist Ihr Unternehmen bereits auf dem marokkanischen Markt für grünen Wasserstoff aktiv?

- Ja
- Nein

Bei Antwort „Ja" auf Frage 3:

Frage 4a: Weshalb ist Ihr Unternehmen in den marokkanischen Markt für grünen Wasserstoff eingetreten? *(Mehrfachnennung möglich)*

- Aufbau von Partnerschaften und Kooperationen
- Kostenvorteile
- Politische Lage und Rahmenbedingungen in Marokko
- Rechtliche Rahmenbedingungen
- Subventionen und andere finanzielle Unterstützung
- Technologische Expertise in Marokko
- Zugang zu einem neuen Markt

- Anderes (bitte angeben)

Frage 4b: In welcher Form ist Ihr Unternehmen bereits auf dem marokkanischen Markt für grünen Wasserstoff aktiv? *Bitte beschreiben Sie die Geschäftstätigkeit genauer.*

Frage 4c: Welche Herausforderungen haben den Markteintritt besonders erschwert? Nennen Sie bitte die zwei wichtigsten Herausforderungen. *(Mehrfachnennung möglich)*

- Finanzielle Herausforderungen
- Kulturelle Herausforderungen
- Politische Herausforderungen
- Rechtliche Herausforderungen
- Technologische Herausforderungen
- Es gab keine Herausforderungen.
- Andere (bitte angeben)

BEI ANTWORT „Nein" auf Frage 3:

Frage 4a: Weshalb sind Sie mit Ihrem Unternehmen an einem Eintritt in den marokkanischen Markt für grünen Wasserstoff interessiert? *(Mehrfachnennung möglich)*

- Aufbau von Partnerschaften und Kooperationen
- Kostenvorteile
- Politische Lage und Rahmenbedingungen in Marokko
- Rechtliche Rahmenbedingungen
- Subventionen und andere finanzielle Unterstützung
- Technologische Expertise in Marokko
- Zugang zu einem neuen Markt

Frage 4b: Aus welchem Grund/ welchen Gründen ist Ihr Unternehmen noch nicht auf dem marokkanischen Markt für grünen Wasserstoff aktiv? *Bitte erläutern Sie kurz.*

Frage 4c: Welche Ressourcen fehlen Ihnen, um mit Ihrem Unternehmen in den marokkanischen Markt für grünen Wasserstoff Markt einzutreten? *(Mehrfachnennung möglich)*

- Expertise
- Fachkräfte
- Finanzielle Mittel
- Informationen
- Partner/ Netzwerk
- Keine

Frage 5: Was sind für Ihr Unternehmen die größten Risiken auf dem marokkanischen Markt für grünen Wasserstoff? *(Mehrfachnennung möglich)*

- Arbeitsmarktrisiken (z.B. fehlende Fachkräfte)
- Änderungen im regulatorischen Umfeld
- Entwicklung des globalen Marktes für grünen Wasserstoff
- Fehlende Infrastruktur in Marokko
- Fehlende Partnerschaften
- Fehlende technologische Expertise in Marokko
- Hohe Investitionskosten
- Hohe Umsetzungskosten
- Korruption
- Kulturelle Unterschiede
- Lieferkettenrisiko
- Makroökonomische Lage
- Mangelnde Marktkenntnis
- Politische Unsicherheit
- Sprachunterschiede
- Wettbewerbssituation

Frage 6: Um die Forschungsergebnisse zu vertiefen, möchte ich nach dieser Umfrage mit einigen Umfrageteilnehmenden ein Interview führen, das weiter in die Tiefe geht als dieser Fragebogen. Wären Sie bereit an einem solchen Interview teilzunehmen?

- Ja
- Nein

Bei Antwort „Ja“ auf Frage 6:

Danke für Ihre Bereitschaft, mich bei dieser weiterführenden Forschung zu unterstützen. Bitte geben Sie hier eine E-Mail-Adresse an, unter der ich Sie für ein Interview kontaktieren darf:

Appendix 2: Survey results

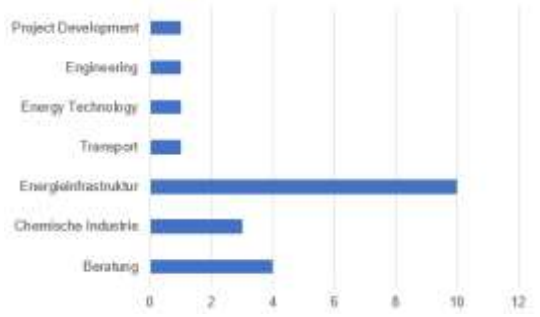
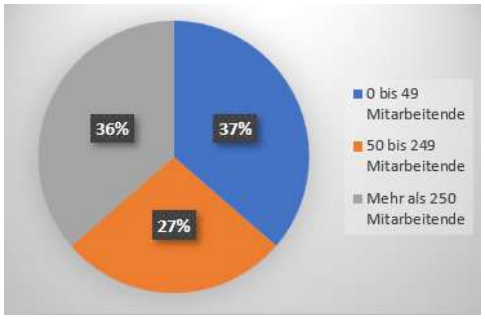
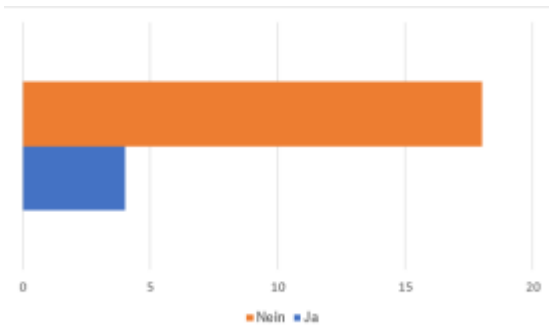
General results:

Total contacted German companies: 150

Sample size: 22

Not interested in Moroccan market: 34

Non-responses: 90

Question 1: Sector of the company*	***Question 2: Size of the company****
	
Responses: 22	Responses: 22
Question 3: Market entry in Morocco*	***Question 4a: Reason for market entry (JA)***
	
Responses: 22	Responses: 4 (out of 4)

Question 4c: Challenges for market entry (JA)

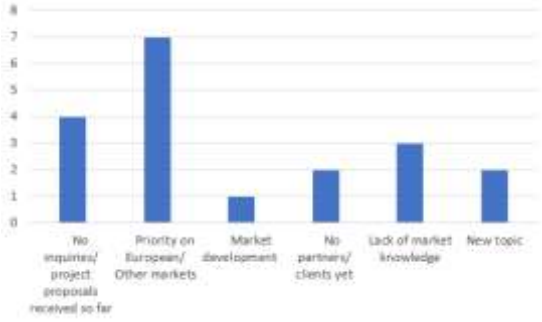
Company 1	Finanzielle Herausforderungen
Company 2	Kulturelle Herausforderungen Politische Herausforderungen
Company 3	Politische Herausforderungen
Company 4	Es gab keine Herausforderungen.

Responses: 4 (out of 4)

Question 4a: Reason for market entry (NEIN)

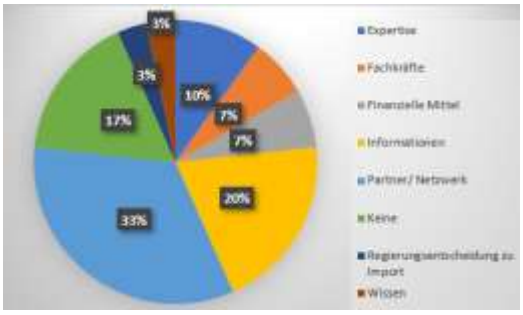
Responses: 17 (out of 18)

Question 4b: Why not in Morocco (NEIN)



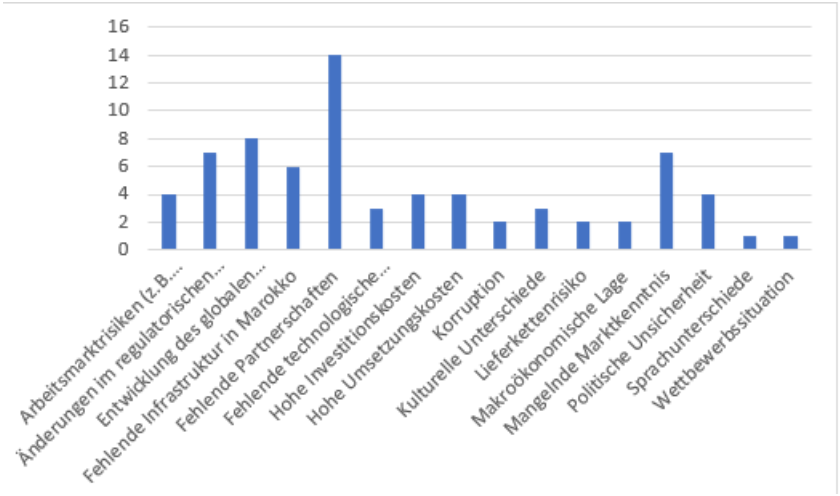
Responses: 18 (out of 18)

Question 4c: Missing ressources



Responses: 18 (out of 18)

Question 5: Biggest risks



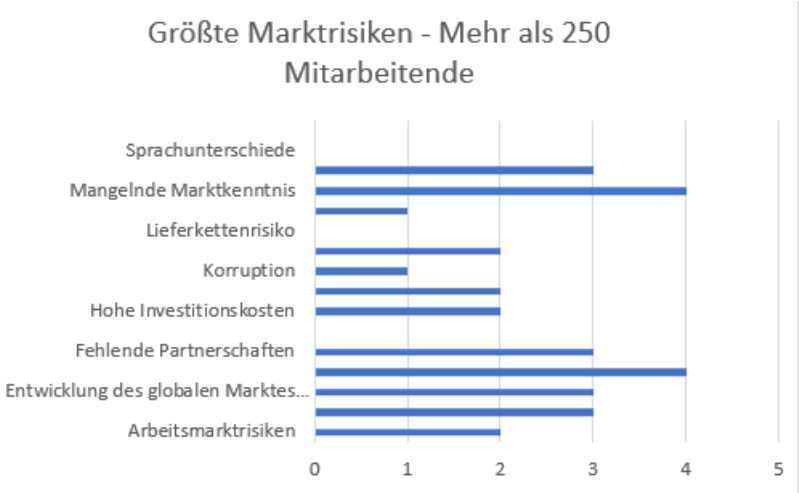
Responses: 22 (out of 22)

Results in relation to company size:

Number of small companies (0 to 49 employees): 8

Number of medium-sized companies (50 to 249 employees): 6

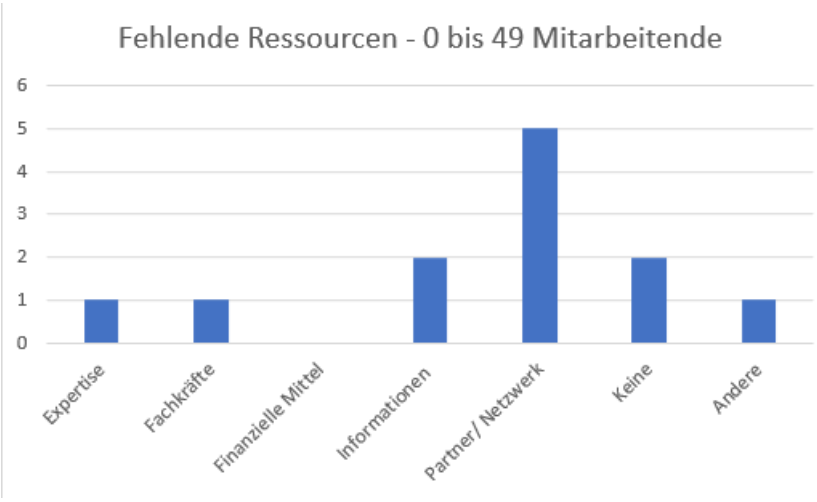
Number of large companies (more than 250 employees): 8

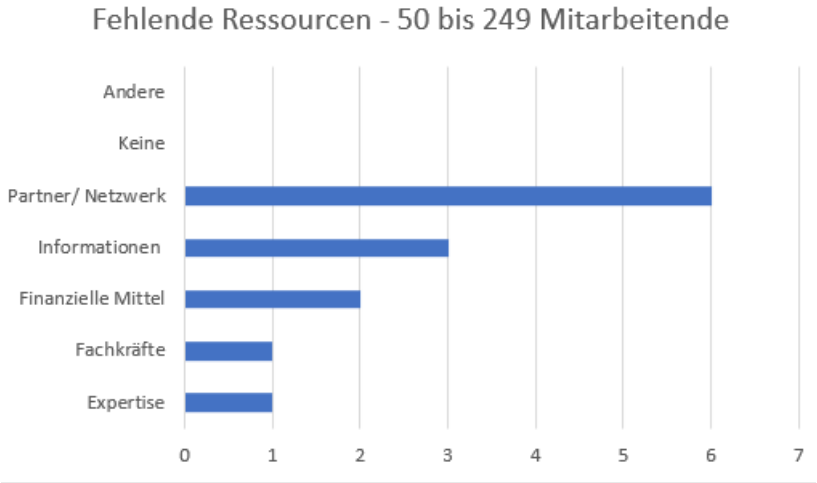


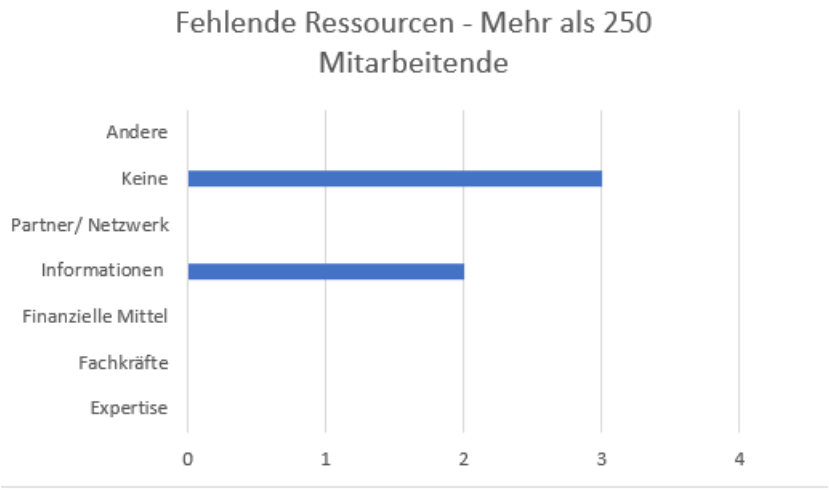
Number of small companies (0 to 49 employees): 7

Number of medium-sized companies (50 to 249 employees): 6

Number of large companies (more than 250 employees): 5







Appendix 3: Interview questionnaires

Questionnaire for companies already in the market:

Beschreibung der Aktivität im Markt
1. In welcher Form ist Ihr Unternehmen im Markt für grünen Wasserstoff aktiv? / Welche Rolle spielt grüner Wasserstoff in der langfristigen Strategie Ihres Unternehmens?
2. Inwiefern sind Sie im marokkanischen Markt für Grünen Wasserstoff tätig und weshalb sind Sie hier tätig geworden?
Problem- und Risikenbeschreibung
3. Mit welchen Risiken haben Sie vor Markteintritt gerechnet und welche sind tatsächlich eingetreten?
4. Welche spezifischen Probleme sind bei Ihrem Markteintritt im Bereich Grüner Wasserstoff in Marokko aufgekommen?
5. Wie haben diese Probleme Ihre Tätigkeit in diesem Markt in Marokko beeinflusst?
Ursprungsfindung
6. Weshalb wurden Sie mit diesen Problemen konfrontiert? Inwiefern sind diese Probleme spezifisch für den marokkanischen Markt?)
Lösungsfindung
7. Wie könnten die Ihnen begegneten Risiken und Problemen Ihrer Meinung nach minimiert werden?

8. Wo brauchen Unternehmen wie Sie mehr Unterstützung bei einem Markteintritt und Projektaufbau im Markt für grünen Wasserstoff in Marokko? Von welchen Akteur*innen würden Sie sich mehr Unterstützung wünschen?
Aufbau deutsch-marokkanischer Markt
9. Was braucht es, damit mehr deutsche Unternehmen im marokkanischen Markt aktiv werden?
10. Wie schätzen Sie die Zukunft des deutsch-marokkanischen Grünen Wasserstoffmarktes ein?

Questionnaire for companies not in the market:

Beschreibung der Aktivität im Markt
1. In welcher Form ist Ihr Unternehmen im Markt für grünen Wasserstoff aktiv? / Welche Rolle spielt grüner Wasserstoff in der langfristigen Strategie Ihres Unternehmens?
2. Weshalb sind Sie an dem marokkanischen Markt (für grünen Wasserstoff) interessiert und inwieweit haben Sie sich bereits mit diesem beschäftigt?
Risikenbeschreibung
3. Weshalb sind Sie mit Ihrem Unternehmen noch nicht in den Markt für grünen Wasserstoff in Marokko eingestiegen? Mit welchen Risiken sieht sich Ihr Unternehmen konfrontiert?
4. Wie abhängig ist Ihr Unternehmen von der Entwicklung des globalen Wasserstoffmarktes/ Infrastrukturentwicklung?
Markteintritt - Lösungen
5. Was muss sich ändern, damit Sie in diesem Markt in Marokko aktiv werden?
6. Welche Unterstützung wünschen Sie sich von welchen Akteur*innen/ aus welchen Bereichen?
Aufbau deutsch-marokkanischer Markt
7. Was wird Ihrer Meinung nach benötigt, um den deutsch-marokkanischen Grünen Wasserstoff Markt zu entwickeln?

8. Wie schätzen Sie die Zukunft des deutsch-marokkanischen Grünen Wasserstoffmarktes ein?

Appendix 4: Coding guide for the interviews

Category	**Definition**	**Example**	**Coding Rule**
A: Market Entry	All data that refers to how companies got into the Moroccan market	Interview 5, Personal Communication, 24.10.2024: " Aus unterstützenden Aktivitäten heraus haben wir da Netzwerke aufgebaut, wo die uns im Projekt sozusagen jetzt mit mitnehmen."	Code includes both the entry into Morocco, and the entry into the market for green hydrogen in Morocco
B: Company information	Data that refers to the size and sector of the company	Interview 6, personal communication, 30.10.2024: "Projektentwickler"	Code only includes factual answers
C1: Risk Aversion	All data that refers to how and why risk aversion is a limiting factor in the market	Interview 7, personal communication, 30.10.2024: " Da sieht man auch, egal welche Fördermaßnahmen, jetzt von der GIZ H2Uppp, eigentlich will jeder immer nur was Sicheres fördern."	Code includes risk-aversion by all market players

C2: General Market Development	General market development factors which are limiting German companies in this market	Interview 7, personal communication, 30.10.2024: " Der Nachteil ist einfach, dass wenn wir den Wasserstoff erzeugen, dann machen wir das zu anderen Kosten als das, was wir heute mit fossiler Energie machen."	Code includes only passages that refer to factors that are non-country-specific; includes passages regarding the price, infrastructure, competition etc.
C3: German and Moroccan Market	Factors in the Moroccan market for green hydrogen which are limiting the market development and pose a challenge to the activity of German companies	Interview 2, personal communication, 24.10.2024: " Da gibt es dann eben falsche Konkurrenten lokal, die natürlich viel preiswerter sind, weil die keine Anreise haben, weil die andere Stundensätze haben."	Code includes only data regarding Morocco and Germany, not any other countries
C4: Company-intern challenges	Factors that are limiting for a company, but are due to a specific feature of the company type: size, resources etc.	Interview 8, personal communication, 22.11.2024: "(…) wir haben halt limitierte interne Ressourcen und das ist ein Kampf interne Ressourcen (…)."	Code only includes factors which are unrelated to the market development
C5: Political & Regulatory Challenges	Limiting factors due to political situations, government initiatives, and law frameworks	Interview 5, personal communication, 24.10.2024: " wir sind halt zu bürokratisch und dann diskutieren wir noch, ob der Kraftstoff dann in Auto gehen darf	Political challenges in other countries which influence the Moroccan-German cooperation may also be included

		oder lieber doch nur in Flugzeuge (…).“	
D: De-Risking Solutions	Support and mechanisms which could help mitigate or reduce the limiting factors	Interview 10, 03.12.2024: “This could also be supported by contracts for difference or all kinds of regimes to subsidize, to give certainty (…).”	Code includes all possible political, financial or legal action suggested by the interviewees

Appendix 5: Use of AI tools

Name of the AI tool	Use in the thesis
ChatGPT	Brainstorming, spell and grammar checking, translation of the cited interviews passages, reordering of sections after chapter was written (notably in Chapter 4.1.1)
Restream	Transcription of the audio-recorded interviews

Word count: 14,970