UNIVERSITY OF TURKU
Turku School of Economics

Policy-Driven Determinants of Foreign Direct Investment in Finland's Hydrogen Sector

International Business
Bachelor's thesis

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22.04.2026
Turku

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Subject: International Business
Author(s): Roope Klemola
Title: Policy-Driven Determinants of Foreign Direct Investment in Finland's Hydrogen Sector
Supervisor(s): D. Sc. Henna Leino
Number of pages: 33 pages + appendices 1 page
Date: 22.04.2026

Abstract

This thesis examines how public policies and regulatory frameworks affect the flow of FDI into the green hydrogen sector in Finland. As the European Union is accelerating the transition to green energy sources, green hydrogen has emerged as one of the most relevant industries to tackle emissions produced by hard-to-abate sectors. The EU and its member states have implemented regulations to secure demand and reduce the riskiness caused by high capital intensity of investments and the perceived high asset specificity. Given the limited domestic ability to finance these investments, investments flowing from abroad serve as key tools to achieve both national and EU-level targets.

The thesis aims to address the main research question by analysing the following factors: the role of formal regulatory structures in shaping FDI flows in general, how EU and Finnish national-level legislation shapes financial feasibility and risk for foreign actors, and what location advantages the current regulatory environment creates for Finland as a host country. The thesis integrates Dunning's OLI paradigm, Williamson's Transaction Cost Economics, and Scott's Institutional Theory into a single theoretical framework. The analysis relies on secondary data from, for example, EU and Finnish legislation, industry reports, and existing academic literature.

Main outcomes of the analysis find that high asset specificity and large upfront capital requirements contribute to the perceived high-risk profile, which would deter FDI without government involvement. Examples of this government involvement include risk mitigation with EU's RED III directive and fiscal incentives with Finnish national-level legislation such as Act 148/2025. The analysis also introduces the contradictory role of legislation, which not only mitigates but also introduces new transactional costs.

The thesis concludes that Finland's competitive location advantages originate from the combination of competitive resources, such as low wholesale energy prices, and proactive institutional signalling. Regulatory frameworks do not only reduce risks but help to manufacture a baseline for financial feasibility. By creating this baseline, the natural strengths of Finland begin to function as key location advantages to attract foreign capital.

Keywords: Foreign Direct Investment, Institutions, Transaction Cost Economics, OLI Paradigm, Green Hydrogen, Location Advantages, Finland, Renewable Energy Policy

Kandidaatintutkielma

Oppiaine: Kansainvälinen liiketoiminta
Tekijä(t): Roope Klemola
Otsikko: Lainsäädännölliset määrittävät tekijät ulkomaisiin suoriin investointeihin Suomen vetymarkkinoilla
Ohjaaja(t): KTT Henna Leino
Sivumäärä: 33 sivua + liitteet 1 sivu
Päivämäärä: 22.04.2026

Tiivistelmä

Tässä kandidaatintutkielmassa tarkastellaan, miten julkiset toimet ja sääntelykehykset vaikuttavat ulkomaisten suorien sijoitusten virtaan vihreän vedyn alalle Suomessa. Euroopan unioni on kiihdyttänyt siirtymistä vihreisiin energialähteisiin viime vuosina. Tämän seurauksena vihreä vety on noussut yhdeksi merkittävimmistä toimialoista ilmastonmuutoksen torjumiseksi aloilla, joilla päästöjen vähentäminen on haastavaa. EU:n jäsenvaltiot ovat ottaneet käyttöön säännöksiä kysynnän luomiseksi sekä korkeiden transaktiokustannusten pienentämiseksi. Koska kotimainen kapasiteetti näiden investointien rahoittamiseen on rajallinen, ulkomailta tulevat investoinnit ovat keskeisiä välineitä sekä kansallisten että EU-tason tavoitteiden saavuttamisessa.

Tutkielma tarkastelee kolmea alatutkimuskysymystä. Tutkielma tarkastelee yleisellä tasolla, miten sääntely vaikuttaa ulkomaisten suorien sijoitusten virtaan. Lisäksi se pyrkii vastaamaan siihen, miten EU:n ja Suomen kansallinen lainsäädäntö vaikuttaa ulkomaisten toimijoiden rahoituksen toteutettavuuteen ja riskeihin, sekä mitä sijaintietuja nykyinen sääntely-ympäristö luo Suomelle sijoituskohteena. Opinnäytetyö yhdistää Dunningin OLI-paradigman, Williamsonin transaktiokustannusteorian ja Scottin institutionaalisen teorian yhtenäiseksi teoreettiseksi viitekehykseksi. Analyysi perustuu toissijaisiin lähteisiin, esimerkiksi EU:n ja Suomen lainsäädäntöön, toimialaraportteihin ja akateemiseen kirjallisuuteen.

Analyysin keskeiset päätelmät osoittavat, että alan korkeaan riskiprofiiliin vaikuttaa investointien vahva sitovuus paikkaan ja suuret alkuinvestointivaatimukset. Ilman valtion puuttumista nämä tekijät voivat estää ulkomaisia suoria sijoituksia. Esimerkkejä valtion osallistumisesta sijaintietujen luomiseen ovat EU:n RED III -direktiivi, joka luo kysyntää ja vähentää transaktiokustannuksia, sekä kansalliset verokannustimet, kuten laki 148/2025. Analyysissä käsitellään myös lainsäädännön ristiriitaista roolia, sillä se ei ainoastaan vähennä, vaan myös lisää uusia transaktiokustannuksia.

Tutkielman johtopäätös on, että Suomen sijaintiedut syntyvät kilpailukykyisten resurssien, kuten alhaisten energian tukkuhintojen, ja ennakoivan institutionaalisen signalloinnin yhdistelmästä. Sääntelykehykset eivät ainoastaan vähennä riskejä, vaan auttavat luomaan perustan taloudelliselle toteutettavuudelle. Tämän perustan luomisen myötä Suomen luonnolliset vahvuudet alkavat toimia keskeisinä sijaintietuina ulkomaisen pääoman houkuttelemiseksi.

Avainsanat: Ulkomaiset suorat investoinnit, institutionaalinen teoria, transaktiokustannusteoria, OLI-paradigma, vihreä vety, sijaintiedut, Suomi, energiapolitiikka, uusiutuvat energialähteet

TABLE OF CONTENTS

FIGURES

1 Introduction

1.1 Background

While traditional literature on foreign direct investment (FDI) often indicates that low-cost labour and natural resources function as the primary investment determinants, recent research suggests that the country's institutional and regulatory framework is a main determinant of FDI decision process. According to research by Dellis et al. (2017, 20), the euro area has seen a shift in its attractiveness as an investment destination. They analyse several factors that could make the euro area a more attractive destination for FDI. Quality of institutions and economic structures are highlighted as main determinants of FDI, meaning that legal frameworks, market regulations, and fiscal policies often outweigh traditional factors like market size or geography (see also Ali et al. 2010, 215; Bénassy-Quéré et al. 2007, 780).

Additionally, Meyer and Sinani (2009, 1075) point out that both poor and rich countries benefit from inward FDI and the spillovers to the local economy it causes. Hence it is vital for countries to receive investments from abroad to maintain competitiveness. They suggest that spillovers happen, for example, in areas of technology and human capital when foreign companies bring new technologies or how-to knowledge to the FDI destination country. As the global trend towards more sustainable solutions continues, green hydrogen has also become a viable option to tackle emissions. As shown by Staffel et al. (2019, 483), hydrogen can be part of replacing fossil fuels, for example, in the mobility industry alongside electricity.

As hydrogen is a secondary energy carrier, it must be generated with renewable energy to be considered a renewable energy form, which is why this thesis will focus solely on hydrogen produced with energy from renewable sources. The European Investment Bank has stated that developing EU-wide green hydrogen infrastructure will "require investment in the hundreds of billions of euros over the coming decades" (2022). In the context of this thesis, FDI refers to greenfield investments and strategic joint ventures. Hill et al. (1990, 120) have identified that these modes represent the high resource commitment required to build physical production facilities and distribution infrastructure.

On a country-specific level, Finland aims to become a leader in the hydrogen value chain in Europe. A resolution by the Finnish government (2023, 11-12) states that achieving the goal requires, for example, regulation that supports investments and a favourable operating environment. Additionally, necessary skilled labour and use of new hydrogen technologies have been identified

as key requirements for achieving the target in the resolution. This means international investment becomes the primary vehicle to achieve the national and European level goals.

Investments in hydrogen are becoming increasingly important in the EU, primarily fuelled by its strategies focused on reducing emissions. The European Council has thus introduced three primary strategies to work as the catalysts of hydrogen economy development, which are explored in this thesis: ‘Fit for 55’ package, REPowerEU and The European Green Deal. REPowerEU aims to, among other goals, accelerate the transition to clean energy sources. It builds upon the Commission’s legally binding framework of the European Green Deal, which states a goal to become climate neutral by 2050. The 'Fit for 55' package provides the specific legislative quotas to execute these targets. (European Commission, n.d.-d)

By establishing the legally binding frameworks, the EU practically transforms the environmental objectives into market signals for organizations looking to invest in the European, and Finnish, hydrogen sectors. For example, by establishing these legally binding strategies introduced in the previous paragraph, the EU creates regulatory certainty which also helps to ensure long-term demand for green hydrogen. This reduces the risk for foreign investors looking to commit to making capital-intensive investments into the national hydrogen sector.

1.2 Research Objectives and Thesis Structure

The topic of green hydrogen and the use of hydrogen as an alternative energy source is widely researched from the technological perspective in recent years (Parra et al. 2019; Staffel et al. 2019; Yue et al. 2021). On a larger scale, the topic of green hydrogen is recent and the regulations pushing towards clean energy sources have mostly been introduced in the 2010s and 2020s within the European Union.

Research about how policies and regulations affect the FDI flowing into the energy sector, and specifically in Europe, is limited. The energy sector poses its unique traits, such as close relation to national politics and government control, which is why further research about the subject is needed. Choosing Finland as the landscape for this research, the thesis focuses on both how EU- and national-level legal frameworks and incentives impact the FDI flowing into the hydrogen sector.

The main question examined in this thesis is **how public policies and regulatory frameworks affect the flow of foreign direct investment (FDI) into the green hydrogen sector in Finland?** The thesis is divided into three sub-questions to answer the research question, and these are presented in the below paragraphs.

First, to understand how regulations affect FDI flow into the hydrogen sector, it is important to understand how regulations and policies shape FDI on a general level. To explore the relationship between regulations and FDI flows, this thesis combines three complementary theoretical frameworks: Dunning's OLI paradigm, Williamson's Transaction Cost Economics, and Scott's Institutional Theory. Together, these frameworks allow for an examination of the first sub-question: **How do formal regulatory structures and political stability affect the flow of FDI on a general level?** Current EU-level regulations push for growing green energy use across industries, which can also contribute to the increasing demand in green hydrogen. The theoretical framework of this thesis is particularly appropriate since it considers regulations not only as external factors, but as the rules that determine risk and transaction cost for foreign investors.

To fully comprehend the impact of current EU-level regulations and national-level subsidies on foreign investment decisions, it is crucial to understand how the regulations and incentives affect financial feasibility and mitigate risk, beyond simply creating market demand. The second sub-question is thus formed taking this into consideration: **How do EU- and Finnish national-level legislation and incentives shape the financial feasibility and risk for foreign actors in the hydrogen sector?** While the regulatory landscape for energy is vast, this thesis narrows its focus to two mechanisms within the second sub-question: financial incentives and sustainability mandates. By focusing on these factors, the analysis can indicate how the connection between EU and national policies determine the financial viability of hydrogen projects for foreign firms.

Lastly, to analyse the recent newsfeed regarding planned investments into green hydrogen in Finland, section 2.1 introduces location advantages created by regulations in Finland, according to the OLI paradigm. In the context of green hydrogen, location advantages are no longer solely about natural resources but also increasingly affected by public policies. By applying the OLI framework, this section builds the ground for analysing how EU- and national-level legislative frameworks and incentives transform the regulatory environment into an advantage that attracts FDI. This forms the last sub-question of this thesis: **What are the specific location advantages in the Finnish hydrogen sector created by the current regulatory environment?**

2 Institutions, Risk, and Location Advantages: A Theoretical Framework

2.1 The OLI Paradigm and Location Advantages

The theoretical framework of this thesis starts from the OLI paradigm (also known as eclectic paradigm), which is a framework intended to assess the importance of initiating and growth factors affecting foreign production by companies. According to the Dunning's framework, the structure determining company's international production is divided into three advantages: Ownership (O), Location, and Internalization (I) (1988, 2-5). According to the framework, Ownership advantages refer to firm-specific assets, such as exclusive technologies and company's brand, which allow a company to overcome the cost of operating in a foreign market. Internalization advantages refer to the strategic benefits a firm obtains by bypassing open markets and keeping operations inside its own corporate structure.

While Ownership and Internalization explain *why* and *how* a firm chooses to internationalize, the location advantage explains *where* the foreign direct investment is directed. Dunning (1988, 4) classifies these as reason/s to why a specific host country can attract foreign investments, which in this case are capital intensive green energy investments. Traditionally, FDI literature viewed location advantages through the lens of static, naturally occurring geographical factors, such as access to low-cost labour, abundant natural resources, or proximity to consumer markets (Dellis et al., 2017, 6-7). However, the research by Dellis et al. points out that in the modern global economy and in the OECD countries, these static factors are often insufficient to fully explain the complex flow of capital.

Because the emerging green energy sector is defined by 21st century technological shifts rather than historical resource extraction, this thesis utilizes the modern extension of the OLI paradigm. Dunning and Lundan (2008, 583) argue that formal institutions, such as regulations and tax subsidies, must be considered as part of a country's Locational advantages. Under this interpretation, an attractive business environment for foreign investors is not only found in physical resources but also manufactured by policymakers who design institutional frameworks to reduce transactional costs and operational risks for market actors.

Therefore, the modern institutional extension to the OLI paradigm acts as the reason for selecting OLI paradigm as the primary theoretical framework. In the renewable energy industry, a host country's ability to attract FDI relies heavily on its institutional capacity to offer regulatory

certainty (Polzin et al. 2019, 1259-1260). This policy-driven view of the location advantage builds the foundation to understand why these transaction costs must be regulated in the first place.

2.2 Transaction Cost Economics and Asset Specificity

Within the OLI paradigm, the relevance of formal institutions is based on the principles of Transaction Cost Economics (TCE). As stated by North (1991, 97), institutions are rules created by people "that structure political, economic, and social interactions". North argues that institutions, such as sanctions and laws, have been created to bring structure and reduce unpredictability in exchanges and therefore they regulate transaction and production costs. Building on Transaction Cost Economics, Williamson (1979, 239-240) suggests that transaction specific investments, in other words, investments possessing little value outside the specific context, are the primary drivers of risk. According to Williamson, in high asset specificity sectors the investor becomes dependent on the continuation of the transaction. In industries that require massive, non-transferrable physical capital, the risk of regulation change or market uncertainty creates therefore significant barriers to entry.

Within the green energy sector, these transaction costs are especially high due to the industry's high degree of asset specificity. As Fornaro et al. (2025, 11) mark, green energy projects require large investments beforehand under uncertain returns in the long-term future. The high capital intensity reflects Williamson's concept of asset specificity. Due to the sector´s nature, investments are locked into a particular technological path, which increases vulnerability to regulatory adjustments. Additionally, Martin et al. (2024, 5) suggest that low-carbon energy and green technologies are more dependent on external financing. Therefore, the transaction costs of securing capital are highly sensitive to the perceived stability of the host country's business environment.

The reason for integrating Transaction Cost Economics into this thesis is to explain the fundamental barrier to foreign direct investment in sustainable infrastructure. Because emerging energy sectors require massive, non-transferrable physical capital, the inherent risks of market uncertainty create nearly insurmountable barriers to entry (Kim & Park, 2016, 238).

The high asset specificity and upfront capital requirements identified by Fornaro et al. (2025, 11) would make large-scale green investments too risky for international companies, if executed independently. Consequently, FDI host countries must actively intervene to lower these transaction costs and manufacture location advantages artificially (Dunning & Lundan 2008, 588; Polzin et al. 2019, 1259-1260), a process that is reliant on the regulative pillars of institutional theory.

2.3 Institutional Theory and the regulative Pillar

As argued by Dunning and Lundan (2008, 588), regulations act as ‘rules of the game’ that are vital part of the location advantages firms perceive when making FDI decisions. In the context of Finland’s hydrogen sector, these ‘rules’ are best understood through Scott’s regulative, normative, and cultural-cognitive pillars. While normative and cultural-cognitive pillars focus more directly on norms, values, and shared conceptions, which in turn affect the regulatory environment of a country, in this thesis the primary focus is the regulative pillar of Scott’s institutional theory (2008, 59-66).

The regulative pillar of institutional theory is composed of formal rule-setting, monitoring, and sanctioning activities (Scott, 2018, 58-61). According to the theory, this pillar represents the most direct side of institutions, as it relies on government authority to implement and enforce rules. In this framework, social actors, such as multinational companies, comply with the set rules primarily because of their own interest to avoid legal sanctions, and subsequently gain financial benefits.

Additionally, the regulative pillar is the most agile out of the Scott’s three pillars. While changing normative or cultural-cognitive pillars may take generations, formal laws and subsidies can be changed, in comparison, rapidly. This speed makes regulative actions the primary tool for host countries that aim to quickly shape and signal new location advantages to attract foreign capital.

In highly capital-intensive sectors, such as green energy infrastructure, host countries actively deploy this regulative tool to alleviate investment risks. As Li et al. (2025, 2) outline, investment risk is the main deterrent in renewable energy projects, which hinders technological deployment. To counter the risks of asset specificity and market uncertainty identified by Transaction Cost Economics, governments utilize the regulative pillar to artificially manufacture stability through binding regulations and direct financial subsidies. By doing so, the state curates a competitive location advantage, transforming a high-risk environment into a viable destination for FDI (Polzin et al. 2019, 1250).

2.4 Policy-Driven FDI Framework

The theoretical framework of this thesis synthetises Dunning’s OLI paradigm, Williamson’s Transaction Cost Economics, and Scott’s Institutional Theory into a cohesive mechanism to explain FDI in the capital-intensive green energy industry. As illustrated in the Figure 1, the mechanism begins with the inherent problem of green energy investments: high asset specificity and market

uncertainty create substantial transaction costs and financial risks as outlined in section 2.2. A state intervention to overcome this risk profile is viable, albeit not all risks can be cleared with purely state-driven actions.

The host country can leverage the regulative pillar of Institutional Theory as an active policy tool, implementing formal laws, financial subsidies, and market guarantees, which is illustrated in the second box. These state-initiated regulations create artificial market stability, which directly aims to neutralize the transaction costs. By mitigating these risks, the country generates a more competitive, manufactured location advantage (OLI paradigm) that successfully attracts foreign direct investment.

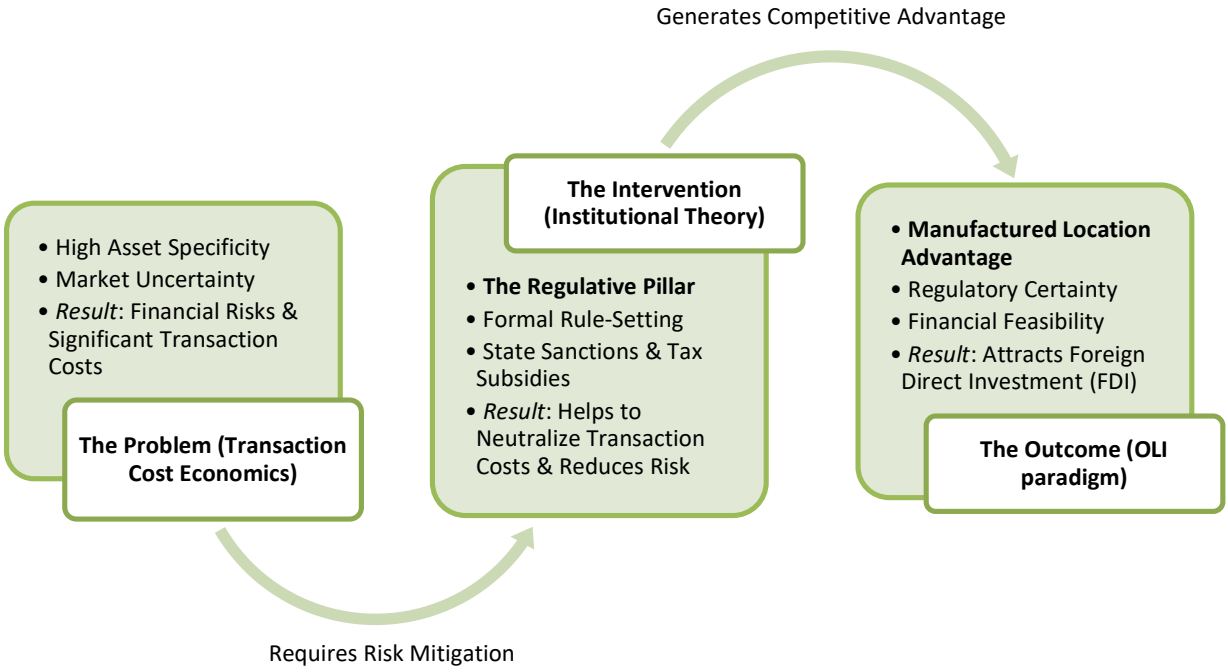

Figure 1. A policy-driven framework for attracting FDI in capital-intensive industries
(Synthesized from Dunning 1988; Williamson 1979; Scott 2008).

3 Hydrogen Industry Environment in Finland

3.1 The Green Hydrogen Value Chain

Before introducing the regulatory environment dictating the green hydrogen sector, it is necessary to establish the physical realities of the green hydrogen value chain. The production requirements define the extreme capital intensity of the industry since production requires building a specialized facility for hydrogen gas (H_2) separation, which in the case of green hydrogen, requires renewable energy. As outlined by IRENA (2024, 24), the green hydrogen production is a multi-stage process that begins with the generation of renewable energy, typically from wind or solar installations or hydropower. Through a water-intensive electrolysis process, the electrolyser uses the renewable energy to split water molecules into oxygen (O_2) and pure hydrogen gas.

Once produced, the hydrogen gas must be compressed and transported via a specialized pipeline infrastructure, like those used in natural gas transport. Alternatively, produced hydrogen gas, or green hydrogen, can be converted into derivatives, such as green ammonia for the shipping industry. In the final stage of the value chain, the hydrogen gas is utilized to reduce emissions in hard-to-abate sectors, such as heavy transport and fossil-free steel production. The green hydrogen value chain is visualised in the figure below.

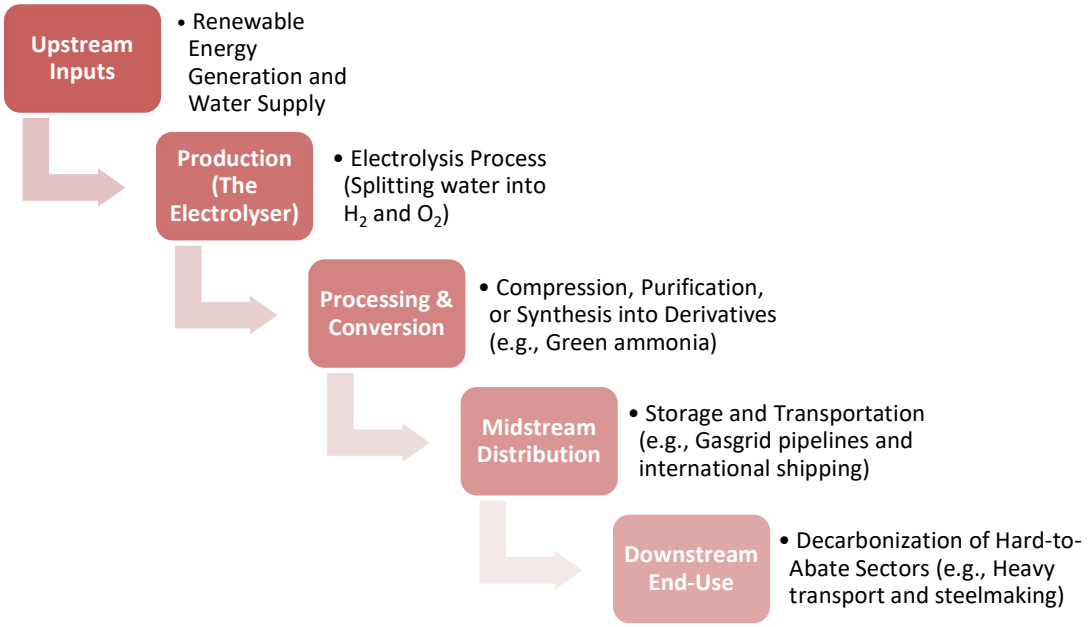

Figure 2. The green hydrogen value chain

(Adapted from IRENA, 2024, 24).

3.2 Legislative Landscape in Finland

3.2.1 European-level legislation

Like in other EU member states, the Finnish national legislation is deeply integrated with the supranational EU law. The EU law is binding at a national level, and the type of legislation defines its interaction with the Finnish legal system (Ministry of Justice of Finland, 6.1). For instance, EU Directives require the Finnish national legislative system to translate the binding goals into domestic legislation, whereas EU Regulations are directly implemented into the legislations in Finland as is without national implementation (European Union, n.d.). The hydrogen sector is primarily governed by these binding regulatory frameworks. Therefore, this thesis focuses on the main supranational tools used to regulate green energy sector: regulations and directives, which dictate the green hydrogen ecosystem from production through to distribution and usage.

The EU's climate and energy transition frameworks can be considered one of the most ambitious regulatory frameworks in the world. Based on the strategy outlined by the EU Green Deal, which acts as an umbrella for EU's climate and energy related policies and regulations, EU aims to make the union climate neutral by 2050 (European Commission, n.d.-d). To achieve the legally binding emissions targets solidified by EU Climate Law, the European Union introduced the 'Fit for 55' package (European Commission, n.d.-c).

A central pillar of the 'Fit for 55' package is the revised Renewable Energy Directive III (RED III), which reshapes the energy market by mandating specific, legally binding usage quotas for green hydrogen and other renewable fuels of non-biological origin (RFNBOs). RFNBOs are produced using renewable electricity and water rather than being derived from biological materials (Directive (EU) 2018/2001, as amended, Arts. 2(36), 22a(1)). This piece of legislation translates climate goals set by the EU Green Deal into guaranteed market demand.

Second pillar of 'Fit for 55' package is Alternative Fuels Infrastructure Regulation (AFIR), which sets "mandatory national targets for the deployment of alternative fuels infrastructure within the EU" (European Commission, n.d.-a). The source outlines hydrogen sector implications of, for example, how hydrogen fuelling stations must be within certain range of each other in the main transit corridors in the EU. As a regulation, this is directly transferred to the national legislation without the need for a legislative process in Finland.

Building on the 'Fit for 55' package, the EU has introduced a more recent plan to phase out Russian energy and further strengthen market demand of green hydrogen. The plan, RePowerEU, includes

six measures concerning green hydrogen. These range from redefining and tightening RFNBO related legislation to incentivising green hydrogen production and usage with investments into hydrogen clusters. (European Hydrogen Observatory, 2025). These plans highlight the European Commission's aim to build a large-scale and long-term ecosystem around green hydrogen, which signals to potential foreign investors possibilities within the union.

To focus on the hydrogen production specifics, European Commission's Delegated Regulation 2023/1184 governs the production of green fuels. This regulation establishes what classifies hydrogen as a RFNBO, in other words green hydrogen. Specifically, Article 5 introduces the principle of 'additionality', which requires producers to source green electricity from newly constructed electricity sources rather than existing electricity installations. If a new green hydrogen plant connects to the existing grid to source electricity from the national wholesale market, they must secure Power Purchase Agreements under Article 27 to fund new green energy (Delegated Regulation (EU) 2023/1184, Art. 5 & 27).

To support the supranational hydrogen regulatory environment, the EU has also introduced policies to meet these targets. These include most notably the Net-Zero Industry Act (NZIA) and the European Hydrogen Bank (EHB). The NZIA seeks to enhance the capacity and scale production of net-zero technologies in Europe, which also include hydrogen technologies (European Commission, n.d.-f). Simultaneously, the EHB functions as a financing instrument aiming to establish hydrogen value chain within the European Economic Area (European Commission, n.d.-e), which functions on an auction basis. It provides selected green hydrogen projects subsidies to bridge the gap between renewable hydrogen and fossil fuel alternatives.

In addition to production legislation and incentivising policies, the EU has implemented the Carbon Border Adjustment Mechanism (CBAM). It regulates the import of carbon intensive goods in the EU, and explicitly includes hydrogen energy (European Commission, n.d.-b). The regulation requires producers of hydrogen, among other goods, to buy import certificates which correspond to the price of production if the hydrogen had been produced in the EU. This legislation aims to prevent leakage of carbon emissions outside of the EU and make the industry more even for European producers against non-European competitors.

3.2.2 National-level legislation

Besides the implemented supranational EU legislation, the Finnish government has enacted national-level laws and policies, which directly concern the hydrogen industry in Finland and

therefore the FDI flowing into the industry. A main policy introduced on the national level is the government resolution on hydrogen, which acts as the national-level hydrogen strategy similar to the EU Green Deal. In addition to the goal introduced in section 1.1, where the Finnish government aims to become a leader across hydrogen value chain on a European level, the strategy also includes a target of producing 10 % of the green hydrogen within the EU (Finnish Government, 2023, 11). This strategy highlights that Finland will not only consume hydrogen but also aim to become a major exporter, which also signals to potential investors and guides legislative planning.

Secondly, the Act on Promoting the Use of Biofuels in Transport (446/2007), commonly referred to as the distribution obligation (*Jakeluvelvoitelaki*), is a direct implementation of EU's RED III quotas into a domestic law. Specifically, Section 5 of the act mandates that transport fuel distributors must supply a steadily increasing percentage of renewable fuels for consumption each year. RFNBOs are incorporated as part of this legislation and recent amendments to the Act have introduced minimum share obligation (*Vähimmäisosuusvelvoite*), which mandates distributors to ensure a specific percentage of sold fuels are made of RFNBOs (Act 446/2005, 5§). This regulation covers additionally to green hydrogen also derivatives that use green hydrogen as part of the production process, such as green ammonia and methanol (IRENA, 2024).

Additional legislative pieces include the Act on Guarantees of Origin for Energy (*Laki energian alkuperätakuista*), which ensures the green hydrogen produced must be certified. Overseen by the Energy Authority (*Energiavirasto*), the lifecycle of green hydrogen will be tracked (Act 1050/2021, 9 §). Since the production of renewable hydrogen is an electricity-intensive process, it also falls under the national legislation governing the power grid. Specifically, the adapted Electricity Market Act (*Sähkömarkkinalaki* 588/2013) dictates that network operators, including the national transmission system operator Fingrid, have an obligation to connect new, technologically compliant, industrial facilities to the network under reasonable terms (Act 588/2013, 20 §).

Electricity Market Act is a critical enabler for the planned hydrogen ecosystem since clean hydrogen production requires massive amounts of energy, which is why these projects require upgrades to the main grid of Finland (Fingrid & Gasgrid Finland, 2023, 13). The act guarantees that foreign investors building large-scale hydrogen plants have the necessary access to the main grid capacity.

Lastly, while Electricity Market Act governs the energy inputs, the physical construction of new hydrogen infrastructure and the operation of those facilities fall under Environmental Protection Act (*Ympäristönsuojelulaki*) and the Water Act (*Vesilaki*). As the production of green hydrogen is

highly water intensive as the production uses an electrolysis process, foreign investors must comply with the environmental permitting process to secure rights for natural resources, such as water (Act 527/2014, 27 §). Even as a study conducted by IRENA & Bluerisk highlights that green hydrogen is the most efficient of all clean hydrogen types, the production still requires, on average, 17.5 to 24.2 litres of water per kilogram of hydrogen produced, making permitting a critical regulatory step for market entry (2023, 6).

3.3 Hydrogen Industry Environment: Current State

As important as the legislative environment for companies pursuing hydrogen infrastructure investments abroad is, investment decisions are determined by economic factors. These are also affected by more traditional determinants, such as electricity prices. As EU Regulation 2023/1184 mentions new hydrogen infrastructure connecting to the national grid infrastructure requires Power Purchase Agreement(s), the financial viability of these investments is tied to the local energy markets. Because a Power Purchase Agreement (PPA) is a long-term contract to buy electricity at a fixed rate, the financial benchmark for the corporate PPA negotiations is fundamentally anchored into the regional wholesale electricity prices. This dynamic is based on the electricity developers' decision to sell the electricity to the market or to a PPA party.

In the case of secondary energy carriers, such as hydrogen, a country's location advantage is dependent on electricity prices. Therefore, the Finnish business environment is highly competitive, as shown in long-term tracking by the International Energy Agency (IEA, 2025). The tracking shows that between 2018 and Q2 2025, the Nordics (defined as Denmark, Finland, Norway, and Sweden by the IEA) have consistently had the lowest wholesale electricity prices in Europe, while remaining more insulated from the price volatility experienced elsewhere within the region. Eurostat's extended dataset on non-household electricity prices confirms that Finland has historically sustained, and currently offers, some of the cheapest industrial electricity rates in the entire EU (2026).

Beyond electricity prices, building a national hydrogen ecosystem in Finland also requires physical infrastructure. As stated in the report by Fingrid and Gasgrid Finland, Gasgrid (2023, 14; 52) plans to construct a national hydrogen pipeline network spanning approximately 1 500 kilometres in Finland. This plan integrates three major cross-border initiatives detailed in the report: the Nordic Hydrogen Route, the Baltic Sea Hydrogen Collector, and the Nordic-Baltic Hydrogen Corridor. Notably, the development of these cross-border networks is not only state-driven but also involves participation from private international companies such as OX2 and Copenhagen Infrastructure

Partners co-developing the Baltic Sea project. The planned infrastructure is estimated to require six billion euros in investments by 2030.

To ensure viability of these capital investments made by different market actors, the Finnish government has secured initial political and commercial frameworks to advance commercial possibilities. A state-level alignment acts as an indicator for the industry actors and potential investors, which is exemplified by the Joint Declaration of Intent signed between Finland and Germany (Ministry of Economic Affairs and Employment, 2026). The declaration of intent establishes a common framework for hydrogen infrastructure, technology, and cross-border trade, suggesting that Finland could supply hydrogen to a market with significant industrial demand, such as Germany.

Additionally, Finland's location advantage is strengthened by a growing ecosystem of industrial early adopters. Building upon the existing legislative frameworks and incentives, actual international business demand is already materialising within the Finnish market. For example, a Polish energy company ORLEN signed cooperation agreements in January 2026 with developers operating in Finland to secure supplies of renewable hydrogen and its derivatives, such as the ones discussed in section 3.1.2 (ABO Energy, 2026). As ABO Energy, ORLEN's partner in the deal, is a German-based renewable energy developer, this agreement illustrates how Finland's environment attracts international developers who subsequently secure cross-border export contracts (ABO Energy, 2026).

Rather than relying solely on exported hydrogen, international heavy industry is building operations in Finland to use the green energy on-site. One example of this is the Norwegian company Blastr Green Steel, which is planning a massive foreign direct investment in the steel industry in Finland (Krogerus, 2025). For foreign investors, this signals attractive dual advantage of possibility to export green hydrogen and its derivatives to Central European markets combined with guaranteed base of industrial customers operating in Finland.

4 Analysis: How Policies Shape Investment Risks and Finland's Competitiveness for Hydrogen Industry

4.1 Mitigating the Risk of Asset Specificity Through the Regulative Pillar

To address the second sub-question of this thesis, *how EU and Finnish policies shape financial feasibility and risk*, it is first beneficial to analyse the standard risk profile of the green hydrogen industry using Transaction Cost Economics. As established in the theoretical framework, investments in emerging energy sectors, such as green hydrogen, are negatively influenced by high upfront capital costs and high asset specificity (Kim & Park, 2016, 238; Fornaro et al., 2025, 11).

In the Finnish hydrogen sector, this theoretical risk is further intensified by the current economic realities of the industry. Green hydrogen production costs have not yet reached organically competitive levels with fossil fuels, such as natural gas shown by Matthes and Brauer (2025, 3–16). According to their research, the cost of producing green hydrogen in Germany exceeded 7.50€/kg, with electricity procurement accounting between 54% and 89% of the total production costs in the long term. Although the study by Matthes and Brauer specifically analyses the prices of hydrogen production in Germany, the situation can be on some parts generalized to apply in Finland with largest changes coming from national electricity prices and possible government incentives.

Given that hydrogen production requires massive, unmovable physical infrastructure, such as electrolysers, as shown in Figure 2, the investments are highly asset specific in Williamson's (1979, 239-240) terms. Additionally, green hydrogen production is vulnerable to electricity price volatility, which increases the riskiness for foreign investors. Without external intervention from the government, this combination of high asset specificity and market uncertainty translates into a risk profile that deters market entry without external intervention.

The large transaction costs created by price volatility and high asset specificity can generally be considered too high for the open market to bear without intervention. This is why the EU and Finnish governments must actively utilize the regulatory pillar of institutional theory to artificially manufacture financial feasibility. The institutional risk mitigation initiated by authorities works through two distinct mechanisms: securing demand and subsidizing capital expenditure.

The European Commission's RED III directive serves as a tool for substantial regulatory certainty. By legally mandating sectors, such as heavy industry and transport, to adopt minimum share of renewable fuels, RED III translates broad climate goals into guaranteed market demand for

renewable energy producers. From a Transaction Cost Economics point of view, this legislation successfully reduces the uncertainty over future demand, drastically lowering the uncertainty experienced by foreign investors.

The Finnish government enforces legislation to directly lower the financial barriers created by high asset specificity. Act 148/2025 functions as a powerful regulative incentive by granting a 20 percent tax relief for large-scale investments exceeding fifty million euros. The effectiveness of such policy tools is supported by empirical research by Wall et al. (2017, 1). They demonstrate that fiscal measures, such as tax incentives, have a significant and positive impact on attracting foreign direct investment into renewable energy projects. By implementing these formal financial subsidies, the Finnish state absorbs a substantial portion of the upfront capital risk. These regulative interventions successfully reduce the transaction costs identified by the Transaction Cost Economics, transforming a theoretically high-risk environment into a financially viable environment for multinational enterprises.

While the regulative pillar successfully mitigates market risk, it simultaneously introduces new operational complexities through strict sustainability mandates. Specifically, the principle of additionality, established in the Delegated Regulation (EU) 2023/1184, can be interpreted as a significant ex-ante transaction cost. Under this regulation, green hydrogen qualifies as a RFNBO only if produced from renewable electricity meeting strict temporal and geographic correlation requirements. In practice this means that dedicated, newly installed capacity, needs to be built rather than green hydrogen production using existing grid power.

From a Transaction Cost Economics perspective, this regulatory requirement meaningfully increases asset specificity beyond what the electrolyser investment alone would entail. A foreign investor cannot simply procure electricity from the national grid but must instead secure a long-term PPA tied to a specific renewable installation or invest in that installation directly. This effectively ties two capital-intensive assets, the electrolyser and the renewable energy source, into a single, highly interdependent investment structure. Following Williamson's (1979, 239-240) research on asset specificity, this physical dependency between assets creates a lock-in risk, which is inherent in green hydrogen production.

However, an evaluation of this environment reveals that these policies are highly interdependent. While EU-level regulation, such as RED III, create the essential market demand, this demand applies universally across the European Union. It does not explicitly direct capital toward Finland, especially when competing against traditionally more industrialized EU member states, where the

producer and user of green hydrogen would be co-located. Therefore, national policies like the Finnish Act 148/2025 provide the necessary ‘push’ by incentivising investors to locate production facilities within its borders.

The government-provided tax credit still leaves investors bearing a substantial majority of upfront capital risk despite the strong national legislation. Because regulatory measures alone are insufficient to guarantee FDI inflows, this remaining risk must be offset by other qualities offered by the host state. To ensure financial feasibility for FDI, Finland must offer highly competitive, resource-based location advantages, such as comparably cheap electricity and ready infrastructure. The electricity prices introduced in the section 3.3 indicate, that Finland possesses an advantage over affordable electricity prices over many of its European competitors. This is the case in countries in Central Europe, where the production and heavy-industrial usage are co-located on a much higher level.

While financial incentives and supranational directives successfully lower financial risks, such as the Finnish government's introduction of Act 148/2025, the regulative pillar also creates non-financial risks into the investment environment. Specifically, the development of large-scale green hydrogen projects in Finland is tightly governed by national legislation, primarily the Water Act and the Environmental Protection Act. Navigating these regulations and completing the required permitting process introduces uncertainty to projects and can significantly extend their timelines. Assessed through the lens of Transaction Cost Economics, these permitting processes function as large ex-ante transaction costs, representing difficult-to-avoid administrative barriers prior to market entry.

4.2 Consolidating Finland’s Location Advantages

After addressing how asset specificity related risks can be mitigated, this section will focus on analysing the third sub-question: *What are the specific location advantages in the Finnish hydrogen sector created by the current regulatory environment*? By applying Dunning’s OLI paradigm, this section identifies how the regulatory landscape transforms national resources into location advantages. As established in section 4.1, the risks caused by high asset specificity and massive upfront capital requirements are actively offset by the regulative pillar. As the institutional framework reduces risks for market actors, the FDI determinants shift away from purely regulatory view toward efficiency-seeking motives.

Once the institutional framework created by regulations manufactures a baseline of financial viability, international companies shift to evaluate Finland based on its tangible strengths. Such strengths include fundamental economic inputs, like wholesale electricity prices and state-backed logistical infrastructure. These emerge as the decisive, highly competitive location advantages dictating capital flows. Essentially, the regulatory environment in Finland unlocks other advantages by creating a basic level of market certainty.

The most significant tangible location advantage unlocked by this regulatory stability is Finland's highly competitive energy market, which ensures long-term operational cost-competitiveness once the initial capital barriers have been overcome. As previously established, electricity procurement accounts for up to 89% of green hydrogen's long-term production costs. For that reason, access to affordable and stable power is a critical determinant of investment's profitability. Data from the International Energy Agency (IEA, 2025) and Eurostat (2026) indicate that Finland constantly offers some of the lowest and most stable wholesale industrial electricity prices in the European Economic Area. In the context of the OLI paradigm, this transforms Finland's electricity prices and national grid into a significant, cost-saving location advantage for foreign actors looking to invest into green hydrogen projects in Finland.

This cost-saving environment is strengthened by state- and EU-backed infrastructure projects. Gasgrid Finland's plan to construct a 1 500-kilometre national hydrogen pipeline network, connected with cross-border initiatives, would lower transactional costs associated with energy distribution. Together with political alignment, such as the Joint Declaration of Intent with Germany, these state-driven initiatives enable a physical export route to Europe's largest industrial market. This state-level agreement signals concrete and politically backed demand for foreign companies evaluating Finland's location advantages.

It is worth to note that as these infrastructural strengths are currently planned than fully built, a level of uncertainty remains for investors. While they signal strong political commitment, the realization of these location advantages remains dependent on the execution and continued state funding of these projects. State-backed infrastructure projects of this scale are vulnerable to delays in funding allocation, regulatory approval, and political prioritisation. From a TCE perspective the infrastructure intended to lower transactional costs associated with energy distribution at the same time introduces a new form of uncertainty for investors.

Despite the execution risks, some market confidence is already visible. The active involvement of international developers, such as OX2 and Copenhagen Infrastructure Partners in co-developing

these hydrogen networks demonstrates that private sector believes in the viability of this location advantage. Foreign actors committing capital to hydrogen production facilities today are, in part, anticipating on the timely delivery of state-backed infrastructure. This suggests, that while these infrastructure projects function as powerful signals, their actual contribution to financial viability remains dependent on completion.

The market confidence is further supported by institutionally required transparency. For example, Finland's implementation of the Act on Guarantees of Origin (1050/2021) ensures that the produced green hydrogen is officially certified, allowing foreign investors to verify their product for the EU-wide RED III quotas. The inflow of foreign direct investment into the Finnish market demonstrates the effectiveness of this integrated policy and resource-based framework. For example, Polish energy company ORLEN's agreements to secure renewable hydrogen from Finnish developers demonstrate that Finland's manufactured location advantage successfully translates into tangible cross-border trade. (ABO Energy, 2026).

Simultaneously, the Norwegian company Blastr Green Steel's planned direct investment illustrates how the dual location advantage of cheap electricity and regulatory certainty serves as a compelling economic incentive for foreign actors looking to utilize the energy directly on-site (Krogerus, 2025). Through artificially lowering initial transaction costs with institutional regulations, Finland allows its natural and infrastructural strengths to function as highly competitive advantages that attract capital-intensive foreign direct investment.

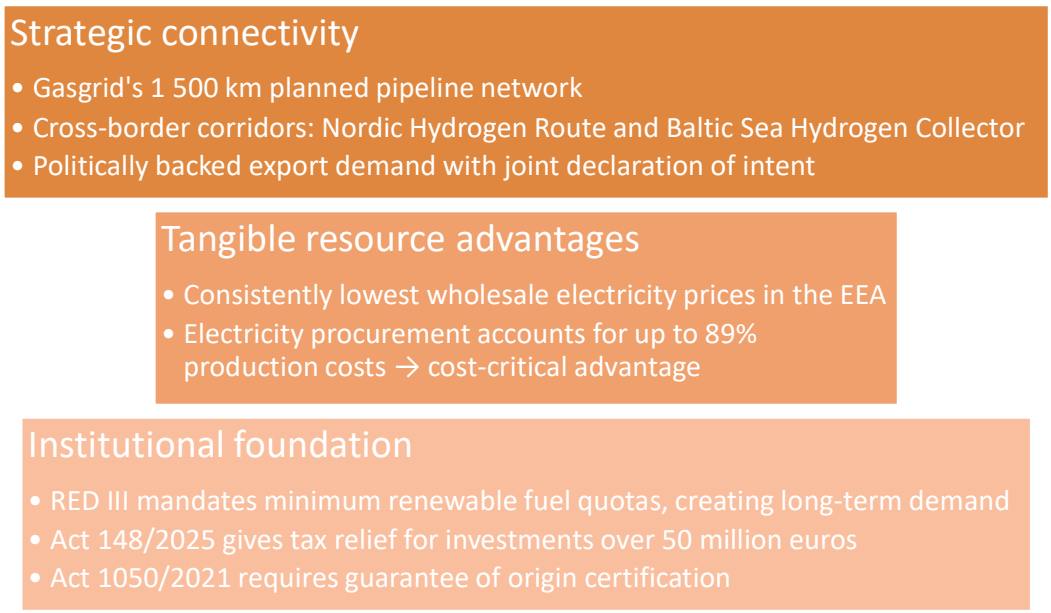

Figure 3. Framework of Finland's policy-driven location advantages in the green hydrogen sector.

The figure 3 above illustrates the factors influencing FDI flows into the hydrogen energy sector in Finland. The framework is structured into three layers, where each layer builds upon the one below it. At the bottom, the institutional layer establishes the baseline for financial feasibility through demand creation and fiscal incentives. Once the regulatory baseline is established, Finland's tangible resource advantages emerge as key cost advantages. The highest layer illustrates the strategic connectivity dimension, which translates the advantages into routes to export markets. The figure aims to show that Finland's location advantages are based on the regulatory certainty, and the upper layers function as competitive differentiators. This framework may help explain the market confidence reflected in the investment plans discussed above, which the following analysis will examine further.

A critical evaluation of this framework must acknowledge the limitation of institutional homogeneity within the European Union. Because supranational regulations, such as RED III, and cross-border infrastructure initiatives apply across the entire European Economic Area, they establish a baseline of market viability but fail to provide Finland with distinctively unique advantage over other member states. To counter this homogeneity, the state must rely on national-level institutional signalling, which the Finnish Government's (2023) national resolution on hydrogen explicitly aims to do. The goals set in the national strategy serve as a unique differentiator from an analytical perspective. They signal to foreign investors that Finland is not only passively complying with EU mandates but also actively designing a state-supported commercial environment. While EU regulations unlock the market, it is Finland's unique combination of cheap wholesale electricity and proactive national policy that strengthens its competitive location advantage.

This observation leads to a broader analytical conclusion regarding Finland's competitive positioning within the European hydrogen market. The differentiation challenge posed by institutional homogeneity cannot be resolved through regulatory signalling alone. Rather, Finland's competitive advantage rests on two factors that only work together.

The first is its resource-based location advantage, which includes the comparably low and stable wholesale electricity prices that directly determine long-term cost competitiveness. It is especially important in an industry, which has a cost structure so heavily reliant on energy prices. This advantage is geographically bounded and cannot be replicated so well through policy choices competing member states in Central Europe.

The second layer is proactive national institutional signalling, exemplified by the government's hydrogen strategy and bilateral agreements such as the Joint Declaration of Intent with Germany. Critically, neither layer is sufficient in isolation. Cheap electricity without regulatory certainty fails to overcome the asset specificity barrier. Regulatory signalling without a genuine resource-based cost advantage fails to differentiate Finland from other institutionally active member states. It is therefore the combination of these two layers that constitutes Finland's defensible and distinctive location advantage in the European green hydrogen market.

5 Conclusions

The core focus of this thesis was to examine how political control and regulatory frameworks affect the flow of foreign direct investment (FDI) into the green hydrogen sector in Finland. By integrating OLI paradigm, Transaction Cost Economics, and Institutional Theory, this thesis concludes that in green energy markets that require massive upfront capital, the actual viability of traditional location advantages is fundamentally dependent on prior state intervention. Because the inherent financial risks of the green energy sector are currently too high to operate outside of a state-driven market in Europe, the host country's institutional framework acts as a necessary mechanism to actively manufacture a baseline of financial viability before natural resources can attract foreign capital.

To address the first and second subquestions, the analysis shows that the high upfront capital requirements and asset specificity inherent to green hydrogen production create a restrictive risk profile for multinational enterprises. To tackle these transaction costs, policymakers utilize the regulative pillar of institutional theory on two levels: supranational and domestic.

On the supranational level, the European Union's RED III directive mandates a certain level of market demand for green hydrogen, which significantly mitigates revenue uncertainty over the long-term. Domestically, the Finnish government applies fiscal mechanisms, specifically the 20 percent tax relief provided by Act 148/2025, to offset a considerable portion of the massive capital expenditure risks. Together, these regulatory structures artificially lower the risk of the investment environment, making the sector financially feasible.

It should be noted, however, that the regulatory framework does not uniformly reduce transaction costs. The additionality principle established in the Delegated Regulation 2023/1184 paradoxically reintroduces asset specificity by compelling investors to secure dedicated renewable capacity alongside their production infrastructure, adding a layer of complexity that purely demand-side policy analysis would overlook.

Addressing the third subquestion, the thesis finds that once this regulatory framework neutralizes the primary market risks, investor motives shift toward operational efficiencies. It is only within the stabilized institutional environment that Finland's tangible strengths emerge as location advantages for foreign investors. Specifically, Finland's comparably low and stable wholesale electricity prices provide operational cost efficiencies over the long term. Meanwhile, state-governed infrastructure projects, such as the Gasgrid's pipeline network alongside strategic political alignments with

Germany facilitate physical export routes. The emergence of massive, planned investments, and strategic partnerships from international actors, such as Blastr Green Steel and ORLEN's Finnish consortiums, provides empirical evidence that this dual advantage of regulatory certainty and cheap energy successfully attracts foreign capital commitments.

This thesis aims to contribute to the existing International Business literature by arguing that location advantages in green energy are not merely geographical, but that those are actively manufactured by policymakers. From a managerial and policy perspective, the thesis aims to highlight the limitation of institutional homogeneity. Because supranational regulations like RED III apply equally across the European Union, they do not provide Finland with a unique competitive edge. Therefore, domestic institutional signalling emerges as a key differentiator for competing member states.

Furthermore, this research is largely theoretical and relies on secondary data. The lack of primary empirical data, such as direct interviews with foreign investors, means that investor motives are gathered through theoretical frameworks and market behaviour rather than explicitly confirmed. The thesis assumes the additionality requirements remain in their current form, and future regulatory changes could alter the transaction cost dynamics identified in the analysis. Finally, because the identified resource-based advantages are highly specific to the Nordic region, the findings cannot be generalized to other European markets. This thesis, additionally, excludes the global geopolitical subsidy competition with global powers, mainly the United States and China, which constitutes an external disruption to European capital inflows.

These limitations highlight several potential directions for future research. Firstly, empirical studies conducting primary interviews with executives of foreign actors looking to invest in the green energy sector in Finland would be highly valuable to validate the theoretical transaction cost dynamics identified in this thesis. Relatedly, further research could empirically examine how the additionality requirement of Delegated Regulation 2023/1184 concretely affects investor decision-making, as this thesis theoretically identifies it as a paradoxical source of compounded asset specificity. Comparatively, studies examining the EU's quota-driven RED III framework against the aggressive tax-credit models of the United States would provide crucial insights into global capital flow competition. Finally, as the Finnish hydrogen economy transitions from planning to execution, future studies could analyse how potential delays in state-backed infrastructure projects, such as the Gasgrid network, impact long-term investor confidence.

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Appendices

Appendix 1 Explanation of the use of AI

In the preparation of this thesis, artificial intelligence tools, Scopus AI, UTU Volter AI, Google Gemini Pro, and DeepL Translator haven been used strictly for research assistance, literature discovery, and language refinement. During the research phase, I used generative AI to identify relevant sources and theoretical frameworks. Additionally, during the writing process, AI was used to translate certain source materials into English and to refine grammatical style.

The list below explains the used prompts:

- Find literature on topic X
- Find specific legislative pieces on hydrogen industry
- Identify relevant international business theories on topic X
- Translate this source as closely to the original language as possible
- How to express this word more academically
- Find alternative ways to express this
- Refine this sentence to match academic writing style

All the information on this thesis has been verified directly from the original peer-reviewed articles, official policy documents, and institutional reports. AI tools have not been used to generate full sentences, paragraphs, or original content.