LUT UNIVERSITY
LUT School of Engineering Science
Master's Degree in Global Management of Innovation and Technology

Hugo Alejandro López Díaz

EVALUATING THE OPENNESS OF THE MEXICAN ENERGY MARKET FOR COLLABORATING WITH FINLAND

Examiners: Associate Professor, Docent Ville Ojanen
D.Sc. (Tech.) Antero Kutvonen

ABSTRACT

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Evaluating the openness of the Mexican energy market for collaborating with Finland

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The Mexican energy market has been under recent change due to political reforms regarding energy. This has opened the door for foreign companies to enter the market and start doing business in Mexico, fostering innovation and technological growth. For a Finnish company, this could represent the opportunity for expanding its operations into the Mexican market. Nevertheless, a collaboration like the one proposed in this research must overcome a series of hurdles, many of them originate from the cultural, political and technological differences between both countries.

This research was aimed to evaluate the openness of the Mexican energy market regarding renewable energy and for collaborating with Finland in a project involving it. The analysis included both the Mexican and Finnish perspectives in the areas of open innovation, energy markets and energy policies. The research included a literature review followed by a quantitative and qualitative analyses of the gained data. The results of the research conclude that a collaboration between both countries is recommended but there are a series of risks that need to be considered for the project to be successful. A risk mitigation model was proposed to deal with those risks.

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Alejandro López.

November 24th, 2018

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1 Introduction

1.1 Background

Before coming to Finland to do my masters I was trying to decide the area I would like to focus my studies on, one that was unfamiliar to me and would have relevancy in the market (and the way the world is going). I chose renewable energies and took the energy business minor. Coming from a country like Mexico that has a long history of depending of traditional energy sources and a closed market controlled by a few government monopolies, the prospect of learning a new topic with such impact on the current situation the world and while in a country that has a more open energy policy was enticing to me.

The following thesis work is done about the topic of using open innovation in the context of renewable energy, specifically in the Finnish and Mexican markets. The topic was chosen mainly because of the opportunities it might present to establish future collaborations between both countries in developing sustainable projects sharing technology, resources and practices.

On one hand Finland is a country with high technological expertise and quick to adapt to change and take advantage of market opportunities. On the other hand, its weather conditions make it difficult to take advantage of certain renewable energy technologies, like solar. Mexico has weather and terrain conditions that facilitate the implementation of build renewable energy installations but until recently, lacked the political sponsorship and market opportunities to make the best use of them. The innovation system in Mexico is complex and has areas of opportunity to grow, for example, venturing in external collaborations and entrepreneurship (Graf, Braun 2013a). The mindset of the Mexican population is changing towards adopting renewable energies and how they can benefit the environment (Reyes-Mercado 2017). Recently, the Mexican energy market has been opened to foreign companies and other energy sources (Viscidi 2018), this has created an opportunity for a collaboration with Finland in this particular topic.

Both countries have differences between them that cannot be understated, to list a few: Climate, culture, politics, quality of life, research and development investment and

education. Between the many differences both countries present between each other the one that I want to focus is the openness they have to accept renewable energies and their respective technologies and the prospect to work with each other to develop projects that take advantage both of the Finnish technological expertise and the Mexican climate conditions.

1.2 Main problem

The main question that is to be answered at the end of this thesis is the following: How open (technologically, politically and culturally) is the Mexican energy market to collaborate with Finland?

This research work will also aim to answer questions related to the main topic of the work: What are the key barriers (cultural, political, economic and technological) in Mexico that could prevent the proliferation of renewable energies on the country grounds? If the country is deemed closed to renewables; How can we improve its situation using open innovation?

Another important part of the research is to apply risk mitigation to an open innovation project like the one proposed. A collaboration between two countries as different as Finland and Mexico has the possibility of presenting a number of risks that need to be considered and dealt with if encountered.

The focus on answering these questions was chosen due to interest in the topic of open innovation and renewable energies and knowledge gotten during coursed of minor studies. A Finnish company that wanted to do business in Mexico was approached and interest was shown on how such collaboration could be done efficiently.

The end goal of the thesis work is to be able to identify how open are both countries for a collaboration like the one proposed in the thesis work and to implement a risk mitigation mechanism for it, using open innovation. This could help Finnish companies to enter the Mexican energy market more efficiently. The results could also help a Mexican company to understand the Finnish energy policies, current state of the market and how available Finnish technology could be brought to Mexico, taking the involved risks into account.

1.3 Aims

After the thesis work is complete the questions raised at the beginning of the research will be answered and the relationship between level of openness in Mexico and how it is related to the country current economic, political and cultural status will be found. The same relationship will be also studied in Finland to help make a contrast with the Mexican case.

The final aim of this research is (after understanding the current situation of the Mexican and Finnish renewable energy markets) to determine how open are both countries for a renewable energy collaboration and how to mitigate the risks involved. Another component will be information regarding the recent law changes (mostly in Mexico) that open the country borders to foreign firms. The bureaucracy that needs to be considered to enter the Mexican market will be mentioned because it is an issue that should not be underestimated.

1.4 Scope

The literature review part of the thesis be mainly delimited in the topics that comprise the main aspects of the research. First, Open innovation literature will be studied to understand more about the theory and make a contrast between it and the information gathered regarding the technological and cultural openness or closeness of both countries.

Another key aspect will be renewable energy technologies and markets. The current state of both the Finnish and Mexican energy markets will be consulted to understand how each region is faring and where they are going. The literature on the technological aspect of the technologies will be consulted to gain insight on how new developments disrupt the market therefore their complex technical aspects will not be delved deep.

In addition, literature regarding international global networks is going to be consulted and use the insight gained to help establishing the implementation of the guidelines for a Finnish-Mexican renewable energy operation.

The first goal that needs to be attained to consider this thesis work successful is to gain an understanding of the Mexican and Finnish energy market conditions and finding a way of

pinpointing opportunities for companies to take advantage of having cooperation between the two countries.

Information about the disruptiveness of renewable energy technology in the Mexican energy market will be gathered to understand how a joint project with Finland could affect countries, their markets and their cultural environments. This will depend on which country the project is made. Due to the convenience of having the contact of a firm that has experience in the topic an assumption has been made that a Finnish project on Mexican soil is more likely to happen than the opposite (Mexican project on Finland) due to Mexico being closed to renewable energy spread until recently.

Regarding the empirical part of the thesis, it will be delimited to consultation of experts and researches in the main topics of the research (open innovation, renewable energy, international networks and energy markets. Their insight will be valuable to better understand what can be done to implement the technology transfer mechanism.

This research will be focused on a literary review and information gathering from experts. The Finnish company will be contacted, and they will be asked about their experiences doing business in the Mexican energy market. Their experience in the topic would prove valuable and might strengthen the research.

1.5 Research methods

A qualitative research was made to understand the cultural, economic and political situations of both countries regarding openness and the adoption of renewable energies. The goal was to get a whole picture of the openness stare of both countries and how it can affect a possible joint project between them. This was done via a series of interviews and reviewing the energy policies of each country and the history related to them. To reinforce this part of the research

In addition, a quantitative research was conducted to gather information about the renewable energy markets in Mexico and Finland. This was done to understand the current situation of both markets; the areas of opportunity and which energy sources are being exploited. At the same time, a review was made on the open innovation support programs available in each country. The availability of such support could have an impact on a project like the one

proposed in the thesis, because these support mechanisms could be used in a future collaboration. In the case of the Finnish support mechanism, the number of projects were assessed to get the previous precedent of support in Mexico.

The literature review was based on a series of documents comprising scientific papers, books, market studies and web material that cover the topics of open innovation, renewable energy technologies, renewable energy markets in Mexico and Finland, renewable energy policy in Finland and Mexico, risk mitigation and entrepreneurship.

A triangulation was done after gathering the data (market studies, openness level, and interviews) to find the relationship between them, how they affect the success of renewable energy projects in both countries and how they can complement each other to make cooperation successful.

Other important topic covered in the literary review is the concept of risk mitigation in open innovation projects. Collaborating in an international project between two countries as different as Mexico and Finland might bring several risks varying from cultural to political to technological readiness. Therefore, is important to take these different factors into account before starting a joint Finnish-Mexican project. An additional literature review was conducted in order to be able to build a framework that involves the different risks that can be present, a way of dealing with them and being able to start the project.

The following figure illustrates how the research methods process was made.

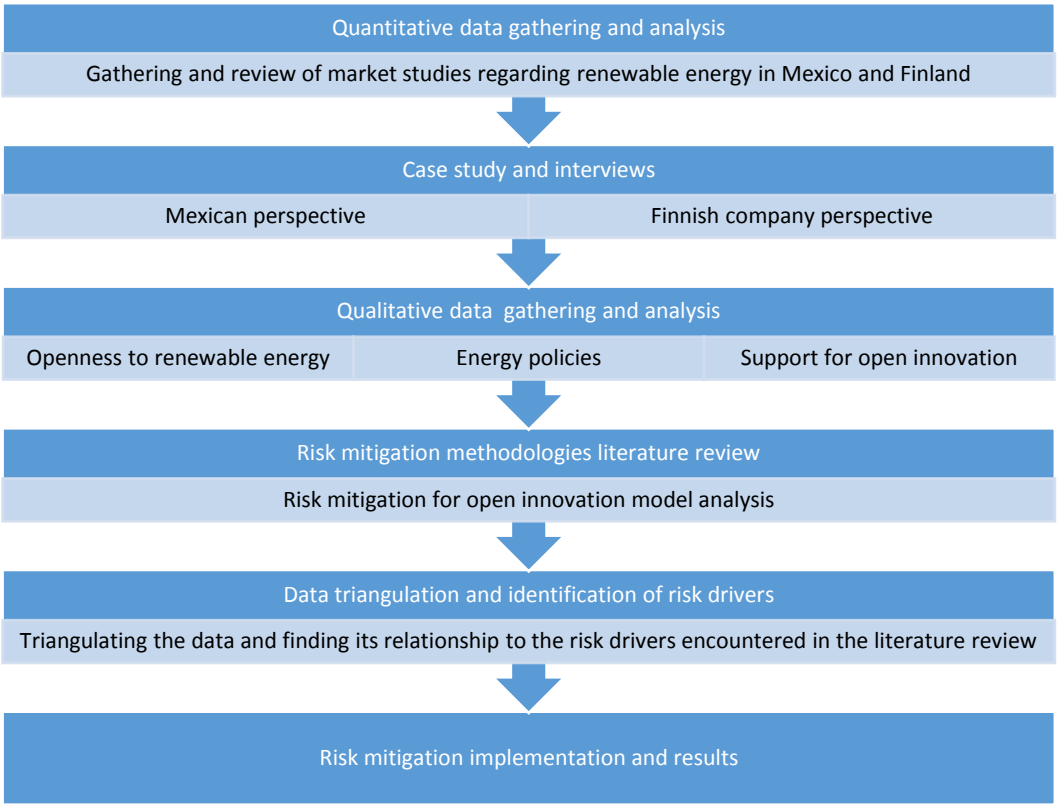

Figure 1 Research methods process during the thesis work

The following figure categorizes and quantifies the literature consulted in the review:

Table 1 Classification of literature sources

Literature source topic	Number of sources
Energy policy of Mexico	11
Energy policy of Finland	8
Mexican energy market	14
Finnish Energy Market	13
Open innovation	17
Risk mitigation	7
Total sources	70

2 Literature review

2.1 Key concept

Open innovation:

Open innovation is a term defined by Chesbrough (2003) where companies can share and gain knowledge while opening their borders to outside interactions. It departs from the previously prevalent closed innovation model. For the case of SMEs, open innovation is of valuable importance due to the performance benefit it could bring. According to Vanhaverberke et al (2015) open innovation and external knowledge sourcing can improve the innovation performance of a SME. It can affect the success of a company while launching an innovation and its financial value.

In the closed innovation model, the companies have their knowledge boundaries set strongly inside the firm. The technological developments and research are done by their own employees while the resulting intellectual property is used to protect the knowledge from being used by the competition to gain a commercial advantage. In this model the company uses its own resources to funnel the newly development innovations into the market.

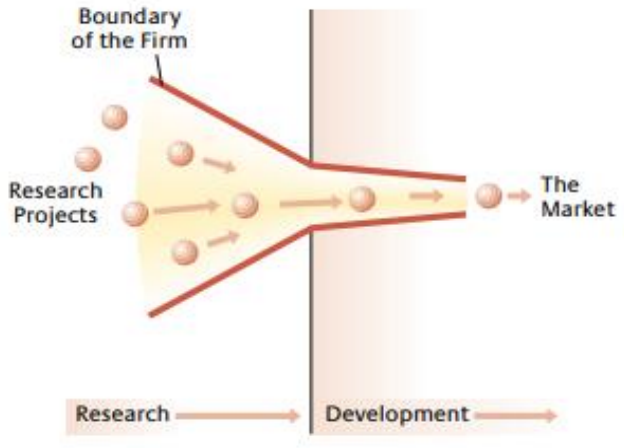

Figure 2 Closed innovation model (Chesbrough 2003)

On the other hand, open innovation tries to reinforce the knowledge that firms have by getting it from entities from outside (for example other companies, research centers and universities). Another difference that open innovation has in comparison to closed innovation is how failed projects are managed. The concept of false positives (Chesbrough 2003) is related to how the companies handle projects and technologies that, while showing initial perspectives of bringing market advantage, latter fails to meet the expectations of the company. While both models try to filter out this false positive projects, open innovation also has a way of dealing with the false negatives. The latter are developments that fail to meet their initial promise in the area they were designed for but later, show potential in an area that was not considered when the technology was initially conceived.

According to Chesbrough (2003), a key difference between open and closed innovation is the concept of where knowledge is generated and how to take advantage of it. In the closed model, all the knowledge taken to the market should be created inside the company. Oppositely, in open innovation, companies can monetize knowledge developed outside their borders. The open innovation model sees the outside knowledge as an opportunity to add value to the one that the company already possesses while the closed model disregards it because in principle, only the knowledge generated inside the borders should be considered.

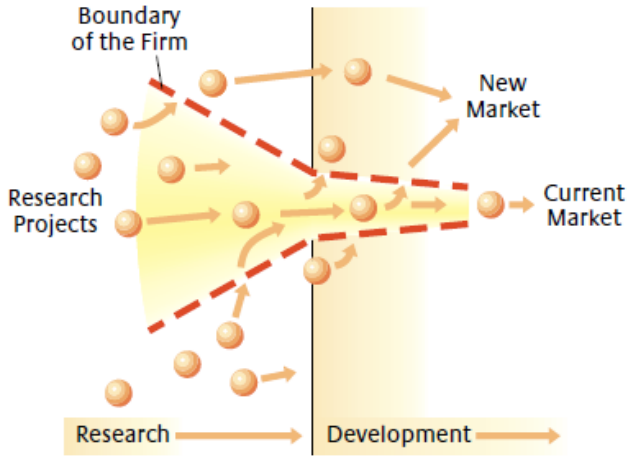

Figure 3 Open innovation model (Chesbrough 2003)

2.2 Political and historical overview of the energy sector in Mexico

Mexico has a long history of relying on traditional energy sources as its source of power. Oil and gas have been the main source of energy. Since the early 20th century, commercial production of oil has been one of the main sources of income to the country. During these early years, foreign companies started to invest money into the Mexican soil and started to gain influence inside the country.

In 1937 the Comision Federal de Electricidad (CFE) was created for the purpose of providing and regulating electricity in the Mexican territory with the exception of the capital area. That job was done by Luz y Fuerza del Centro (Eljuri, Johnston 2014), an entity that took care of Mexico City electricity generation alongside some municipalities in the states of Mexico, Puebla, Morelos and Hidalgo since 1903.

The situation changed in 1938 when Mexican president Lazaro Cárdenas declared that all of the oil reserves inside the borders belonged to Mexico (and by default to the government) and therefore expelled the foreign energy firms out of the Mexican soil(United States Department of State). This event is known as the Mexican oil expropriation and it is a national holiday celebrated on the 18th of March.

Figure 4 Mexican 5th grade history book depicting Oil expropriation (Campuzano 2013)

After the expropriation, the Mexican government created an organism to control and extract all the oil reserves in the country, said organism was called Petroleos Mexicanos (Pemex) and was founded in June 7, 1938 (PEMEX 2013). Pemex would be in charge of all oil related activities in Mexico since its inception to this day, having full control of oil until 2013.

The three energy organisms formed their own trade unions to protect their workers and gained a significant power in Mexican politics in return. Pemex has the Sindicato de Trabajadores Petroleros de la Republica Mexicana (STPRM), CFE the Sindicato Unico de Trabajadores Electricistas de la Republica Mexicana (SUTERM) and Luz y Fuerza del Centro had the Sindicato de Trabajadores Electricistas (SME) (Marta Subiñas 2016). The history of the power trade unions became synonym with corruption, illicit enrichment and abuse of power within the country, stagnating productivity and losing money.

Besides the corruption of the energy unions, the state of Mexico energy sector had other type of problems, such as, infrastructure. Due to negligence's from CFE, the Mexican transmission and distribution networks were in a state of disregard and from 550,000 miles of lines; almost half of them were 20 years old. The bad state of the lines brought electricity losses during distribution. In 2012 16% of the total transported energy was lost according to CFE, part of it being stolen.(Eljuri, Johnston 2014). The longevity of the rule of the energy trade unions is similar to the one of the Partido Revolucionario Institucional (PRI) (Bonetto, Storry 2010).

PRI was founded in with the name of Partido Nacional Revolucionario (PNR) in 1929 and governed the country undisputed for 71 years until the elections of 2000 where it was defeated by the Partido Accion Nacional (PAN) (Carreón-Rodríguez, Jiménez et al. 2006).

The energy sector in Mexico needed a change due to the lack of efficiency and productivity of the energy organisms (Eljuri, Johnston 2014). An early step was made in 2008 with the signing of the Law for the Development of Renewable Energy and Energy Transition Financing (LAFAERTE). The objective of the law was to regulate renewable energy production, financing projects regarding renewables and the future steps to have an energy

transition. The latter was going to be followed by the next set of legislation aimed specifically for this objective.

In 2012, in response to the threat of climate change and global warming with the General Law of Climate change. The law was made with the goal of having 35% of total energy in Mexico be produces with renewable energy sources by 2024(The Mexico-US Climate Law Network 2015).

After more than 70 years of national control of the energy resources in the country, the situation required a change that could lead to the opposite effect of the 1938 oil expropriation, starting with a reform that would open the borders of the country to outside players was proposed: The Mexican Energy Reform in 2013 (Mills 2014).

The main driver of the reform was making the price of electricity lower, promoting competitiveness and making the market grow (Sarah Fister Gale 2015). Another advantage of changing the paradigm that was held for 75 years was the possibility of bringing foreign firms to Mexico, with their technologies, money and knowledge. Before the reform the population and industry would have one energy provider option (CFE), now the Mexican population can choose which provider suits their needs, making the market more competitive. Nevertheless, during the first years after the reform, industries were the only ones capable of choosing between providers (Sarah Fister Gale 2015).

After the Energy Reform, more changes came to the energy policies of the country. The threats of climate change and global warming demanded action, therefore the Mexican government was one of the first pledgers of the 2015 Paris Agreement. The main obligations of Mexico will be committing to increase the energy production provided using renewable sources by 35% in 2024 and reducing the greenhouse gas and black carbon emissions by 30% and 51% respectably in 2030 (International Energy Agency 2016).

Figure 5 Timeline of the evolution in the energy sector in Mexico

The same year, the Energy Transition Law was passed to reinforce the previous legislatures for renewable energy and at the same time creating the framework for clean energy production, energy efficiency and greenhouse gas reduction.

2.3 Political and historical overview of the energy sector in Finland

Finland is located in the northern hemisphere and in terms of climate it is known for its long and harsh winters. Due to the difficult weather conditions and need of heating, Finland ranks among the top regarding energy consumption per capita among the European Union countries (Muranen 22/06/2012).

The Finnish electricity market had a change in 1995 when the Electricity Market Act (EMA) was passed. The Act gave the Finnish population the possibility of choosing between energy providers according to their personal needs and preference. This opened the market for competition and economic growth (Ministry of Economic Affairs and Employment).

Aside from the EMA, the electricity sector is regulatory framework include other acts such as the Electricity and Natural Gas Market Supervision Act (amended in 2013), the Act on Production Subsidy for Electricity Produced from Renewable Energy Sources (amended in 2010), the Land use and Building Act (amended in 1999) and the Competition Act (amended in 2011) (Waselius, Ekqvist 2016).

The Finnish energy sector policy is governed by the Ministry of Economic Affairs and Employment (MEAE). Part of the tasks of the MEAE is regulating, developing and securing the supply in the energy market. Other policies that fall into the jurisdiction of the Ministry include regulating nuclear energy, promoting renewable sources, emission trading and mitigation efforts (Ministry of Economic Affairs and Employment).

Other key figure that regulates the energy sector is the Finnish Energy Authority (previously named Finnish Energy Market Authority until 2014) was founded in 1995. The Authority is an agency that works under the MEAE and is in charge of executing the energy policy approved by the government inside the country and outside it (Energy Authority). The authority works alongside other European Union energy governance agencies regarding emission trading, energy efficiency and renewable energies

There are many companies in Finland that make business generating electricity, the energy sector is populated by a large quantity of providers. In 2016, they were 120 companies generating electricity inside the Finnish territory and around 400 power plants. Among those firms, the ones that generate power above 1MWA are registered by the Finnish Energy Authority (Waselius, Ekqvist 2016).

On other side of the spectrum, there is only one company in charge of electricity transmission in Finland: Fingrid (Waselius, Ekqvist 2016). The company was the result of an effort from part of the government on centralizing electricity transmission and the grid business. The company came to be in 1996 from the merger of Imatran Voima Oy and Pohjolan Voima Oy (Muranen 22/06/2012). After the passing of the EMA in 2011, Fortrum Oy and Pohjolan Voima Oy sold their shares of Fingrid to the government, making the Finnish State the primary owner of the company (Rosendahl 2011).

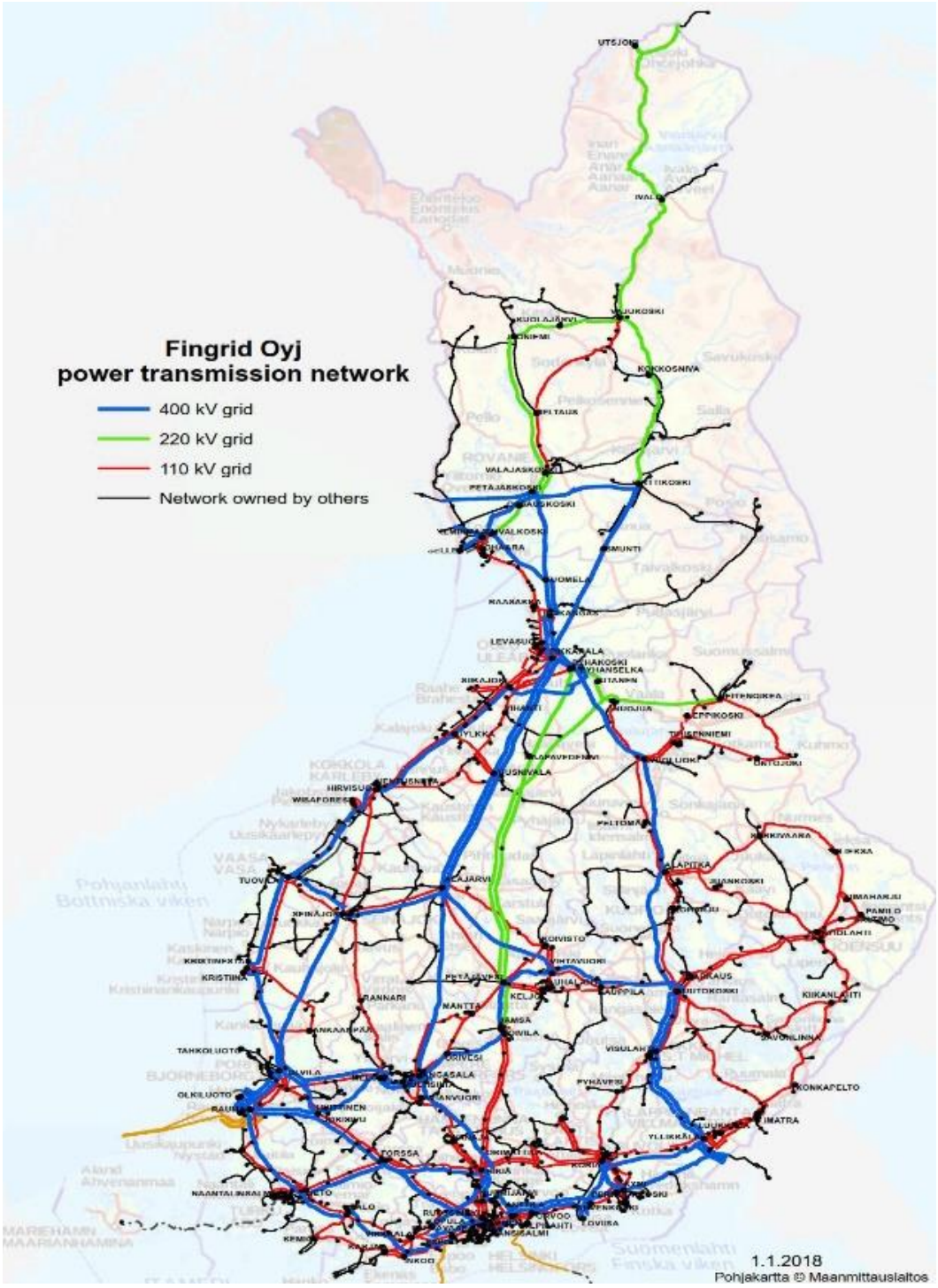

Figure 6 Power transmission network of Fingrid alongside the Finnish Territory (FIngrid 2018)

In the case of energy distribution networks, the Energy Authority accounted for 80 operators in 2016. Distribution in Finland is owned by the municipalities, regional and local energy companies and private investors (Waselius, Ekqvist 2016).

In his Doctoral dissertation, Child (2018) mentioned that Finland could achieve the full percentage of renewable energy in the future. For being able to achieve said transition, he commented the that political support is needed and most importantly, innovation. Said innovation needs to be both technological and be supported by innovative policy strategies. According to Child., to increase the share of renewable energies in Finland to its full potential, the support should could include concrete support schemes, financial incentives and market designs necessary for a full transition. He mentioned that the energy sources that represent an opportunity for Finland are wind, energy, bio energy, hydro and solar.

2.4 Renewable energy situation in Mexico

The energy market in Mexico is changing. The country holds the 9th place in crude oil production and with it alongside natural gas it provides 88% of the total energy consumption (Reyes-Mercado 2017). After decades of rule by government sponsored monopolies, the country is facing a radical change in who can provide energy to the population and industry. The same is reflected on the effort to stop depending on traditional energy sources, mainly oil and natural gas, the landscape is opening towards cleaner options.

Currently, Mexico has various legal resources to help the promotion of renewable energy technologies. The first one is the General Law of Climate Change. The second is the Mexican Energy reform and the Energy Transition Law.

The energy reform put an end to the previous closed market and has opened the borders of it to new players, private and international. This will lead to bigger opportunities of growth, making the exploitation of the Mexican hydrocarbon resources more sustainable with the knowledge and technology from entrant companies while at the same time taking renewable energies into account. (International Energy Agency 2016).

The region is an attractive destination for installing renewable energy technologies due to a series of factors, including the natural resources that provide good conditions for installing different kinds on energy plants. The main sources in renewable energies in Mexico are geothermal, hydro and solar. Nevertheless, the country has potential in other areas such as bio energy and wind.

In the case of solar energy, the geographic position of the country lies in a favorable location in the sun belt. The daily irradiation is 5.5 kilowatt per square meter (Secretaria de Energia 2012). This provides better conditions to exploit sunlight compared to other regions, for example in Europe. The main difference is that in more developed countries, for example, Germany, the government efforts to promote renewable energies have been made earlier with good implementations therefore providing a better support mechanism (Viscidi 2018) . A capacity increase of 5,400MW is expected in 2019 after the developments that will come with the projects approved by the auctions of 2015 and 2016 (Secretaria de Energia 2017).

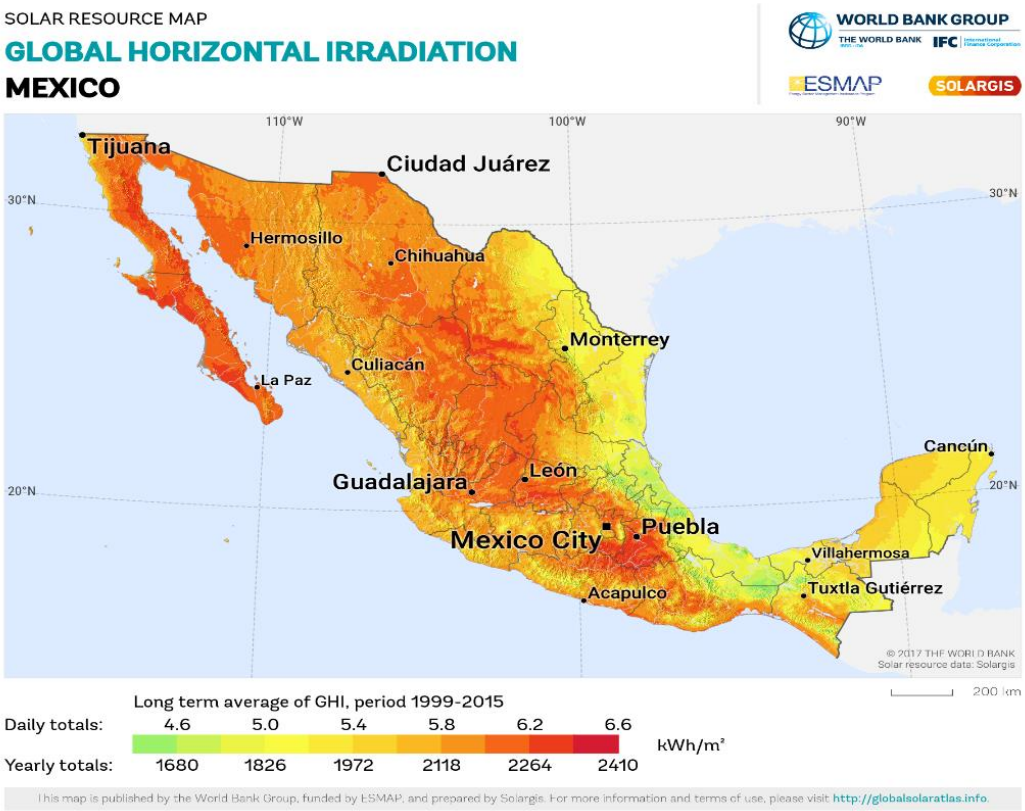

Figure 7 Global horizontal irradiation in Mexico (Solargis 2017)

Mexico has strong volcanic activity, offering geothermal energy potential to exploit. Currently it places sixth in overall global capabilities. According to preliminary studies made by the Mexican Energy Agency, the region has reserves with possibility of harnessing geothermal power equivalent to 10,644 MWe distributed in different parts of the territory (Secretaria de Energia 2012).

Figure 8 Distribution of geothermal resources in Mexico (Secretaria de Energia 2012).

The geothermal sources were being exploited in four areas inside the country, but this was changed after the implementation of the Geothermal Law in 2014 which was made in league with the Energy Reform to implement the legal framework to activities surrounding the use of geothermal resources. This includes the exploration and exploitation of new sites, prospecting and concessions to private companies (International Energy Agency 2015). The opening of the market to has provided with results such as the finding of new sites by private

companies such as Grupo Dragon, a renewable energy conglomerate which was one of the first non-government entities to receive a concession of harnessing geothermal energy (Expansion 2016).

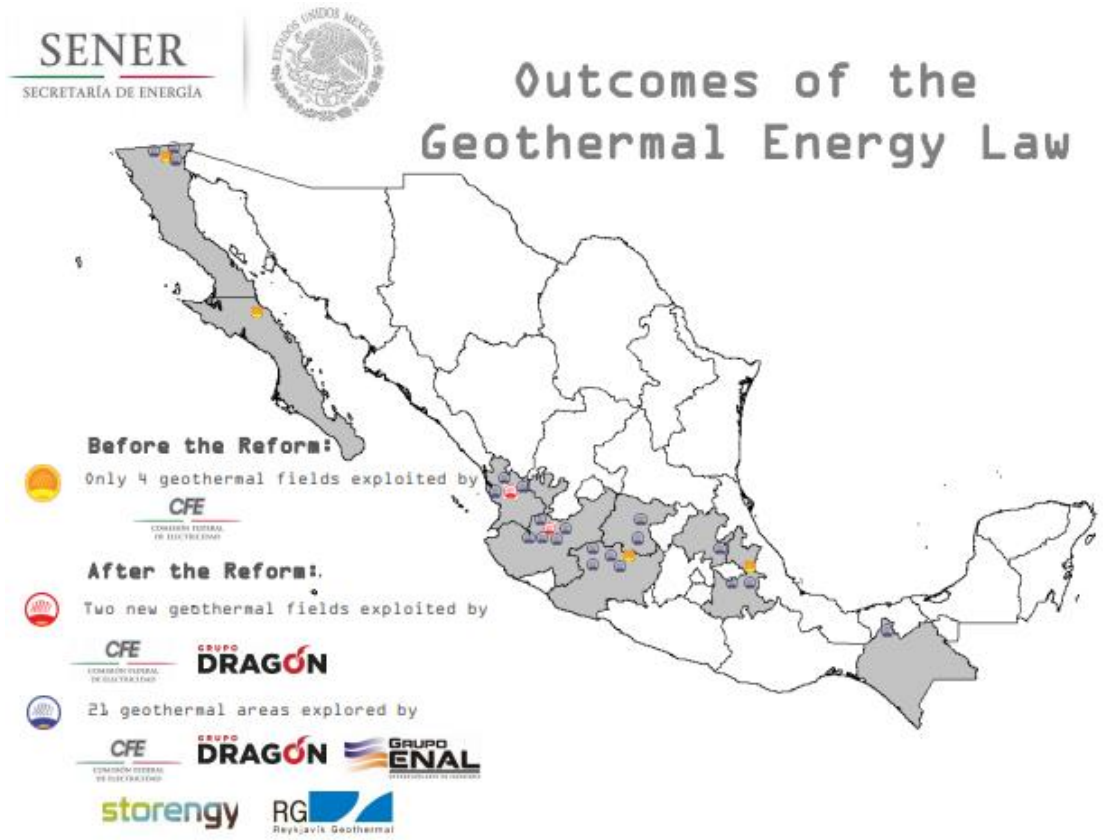

Figure 9 New developments after the Geothermal Energy Law (Secretaria de Energia Feb, 2017).

Wind is the second most used renewable energy source in Mexico after solar, in 2016 it represented the 5% of the total installed capacity and has the potential of reaching the 30GW wind potential mark (Viscidi 2018) from the overall 50GW overall potential the country has. The areas of most prominent opportunities are dispersed among the different states of the country but by the year 2016, 80% of the total installed wind capacity came from the Tehuantepec Isthmus, in the state of Oaxaca (International Energy Agency 2016). The Mexican Association for Wind Energy is a group made by different organisms and companies that aims to promote and develop wind energy inside Mexico. They predict that

for 2022 there will be an installed capacity of 12,896MW of wind power in farms scattered in 17 different states around the country.

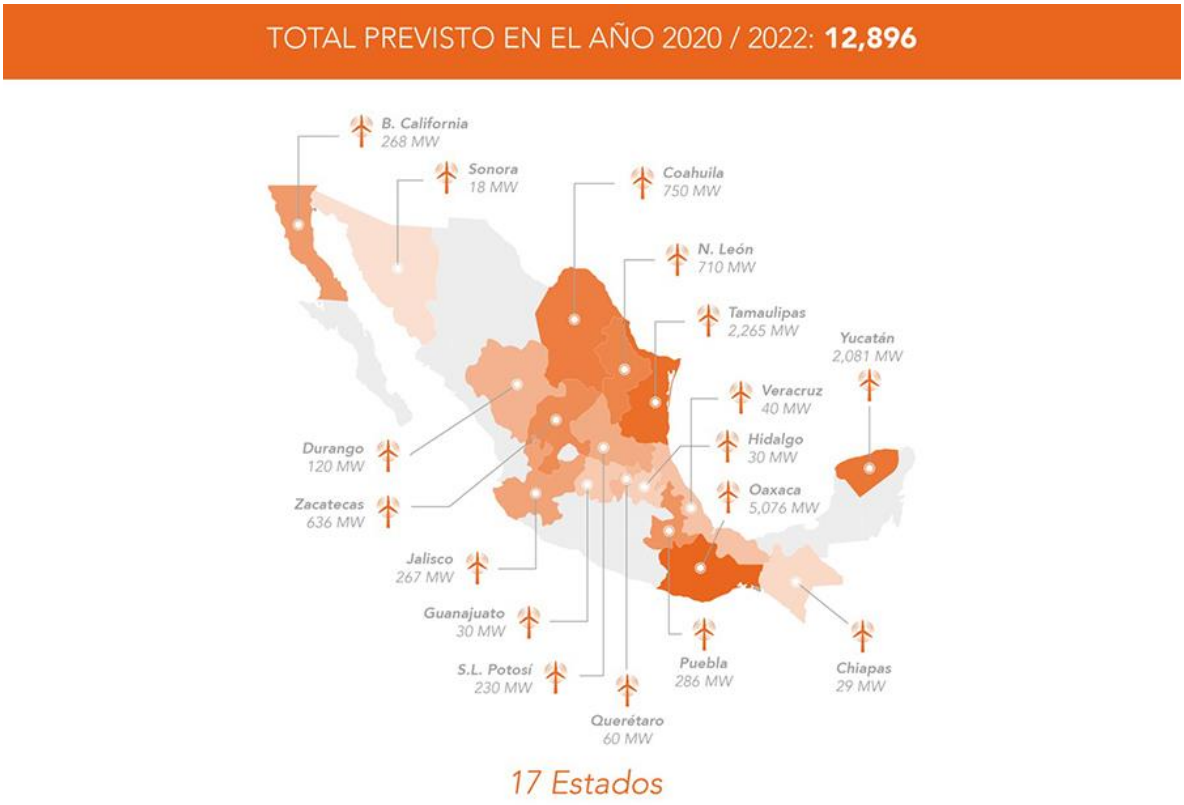

Figure 10 Predicted wind power in Mexico for the year 2020-2022 (Asociacion Mexicana de Energia Eolica 2016)

The share of renewable energies in the total energy installed capacity and production has increased after the Energy Reform was passed and the first energy auctions were made in 2015 and 2016, providing the opportunity for foreign and private renewable energy companies to enter the market.

According to a report made by the Mexican Secretary of Energy (Secretaria de Energia 2017), after the auctions and until the end of 2018, there will be an investment of 6,600 million USD from companies and the opening of 52 new renewable energy centrals. Other aspect that has changed after the auctions is total share of installed capacity and energy generation, having an increase of 10.17% and 3.04% respectively, from 2015 to 2016.

Fossil fuels had a 71.19% of the total share of the installed capacity, with 52,331.12MW. The same year, renewable energy sources had 25.17% of the share, with a capacity of 18,503.19MW. Other clean sources (nuclear, black liquor, etc.) had a share of 3.64% with 2,676.12MW.

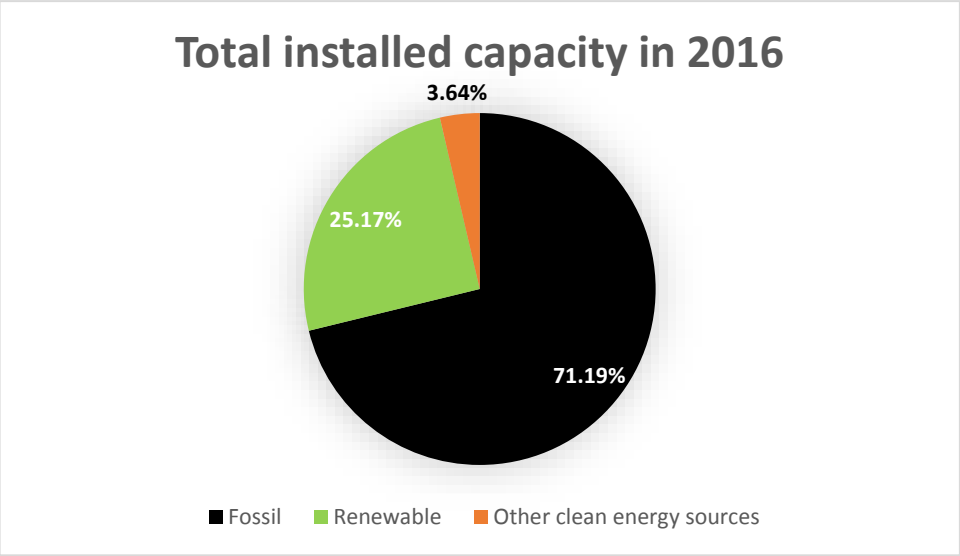

Figure 11 Total installed capacity in Mexico in 2016 (Secretaria de Energia 2017)

A similar trend can be seen from the numbers of energy generation in 2016. The share of fossil fuels was of 79.69% with 254,495.55GWh. Renewables in the other hand, had 15.41% of the total share, providing 49,206.21GWh. Lastly the other clean sources represented the remaining 4.9% with 15,661.77GWh.

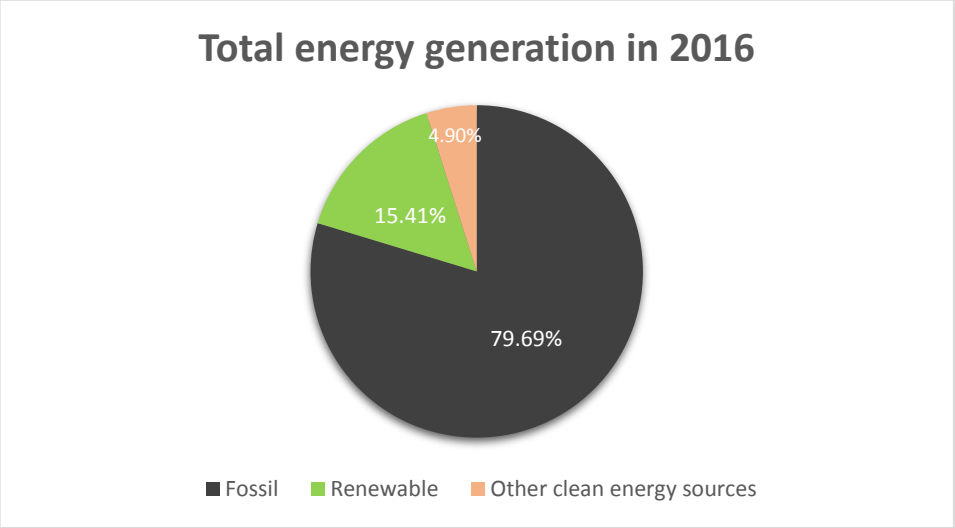

Figure 12 Total energy generation in Mexico in 2016 (Secretaria de Energia 2017)

The energy market in Mexico is having an improved support, proved by the different efforts by the government such as the different laws and newly established institutions to manage renewable energy sources and their exploitation. Nevertheless, the improvements are vulnerable to different factors that had an impact on previous governing bodies like CFE and Pemex, such as corruption and nepotism.

2.5 Renewable energy situation in Finland

Finland main source of electricity is nuclear energy, providing about 33.7% of the electricity generated in 2015, followed by hydro power and biomass. According to data gathered by the Energy Authority, fossil fuels were providing 25% of the total electricity in 2014 (Waselius, Ekqvist 2016).

Despite the predominance of nuclear-powered electricity in the country, the Finnish government is making an effort on giving incentives to energy producers that use renewable sources. This goes along with the Act on Production Subsidy for Electricity Produced from Renewable Energy Sources (APSEPRES). The main goal of the act is to promote renewable energy production (from wood chip, biogas, wind, wood fuels) and to make the electricity market more competitive and diversified (Energiavirasto 2010).

The Finnish government made a renewable energy action plan (Ministry of Employment and the Economy 2010), following the European Union Renewable Energy Directive 2009 in which the country was legally bound to promote and make use of renewable energy sources and make them account for 38% of their total electricity produced. In 2014, the Energy Authority reported that the goal was achieved (Waselius, Ekqvist 2016).

Regarding the different kinds of electricity generation using renewable sources, Finland has the potential of taking advantage of different types of them. Wind, bio, hydro and solar energy plants have been built during the past years around the country and have proved that Finland does not need to rely only on fossil or nuclear energy to survive.

Wind energy has been present in Finland since the late 1980´s as the first wind turbine was installed by the Ministry of trade and Industry (now the Ministry of Economic Affairs and Employment) for research purposes. The early projects where made to calculate the wind potential of the country and developing wind turbines. The first Finnish wind farm was constructed in Vaasa in 1991, consisting of four turbines, each with a capacity of 200kw. The wind potential in Finland has grown from having a handful of turbines to 260 with a capacity of 627 MW in 2014 (Nidal Abu Shanab 2015).

In the case of solar energy, contrary to the popular opinion, the Finnish territory has potential of taking advantage of the sun and building solar power plants. The nights are long in the country during winter and that the temperatures are lower than in southern and central Europe, but this is compensated during the long days of summer that come with warmer temperatures. The irradiation levels during summertime can be similar or even higher than warmer countries like Germany (Haukkala 2015). Solar panels don't work properly when covered in snow (present during winters in Finland), that is another aspect that has to be taken into the account while installing solar panels in the country alongside possible solutions, like hydrophobic coating (Pasonen, Mäki et al. 2012).

Finland is covered in deep forest, a resource that has been vital to the population survival since its early days. The forestry and pulp industry have a long history of providing jobs and economic growth to the country. Biomass accounted for 16.5% of the total energy production

in 2015 (Waselius, Ekqvist 2016). The bio fuel that is generated from the residues of the forestry sector is then used in combined heat plants (CHP) to give heating to the population (Nidal Abu Shanab 2015). The use of energy from forest residue continued to grow in 2016, where 60% of total renewable energy produced came from woodchip and black liquor.

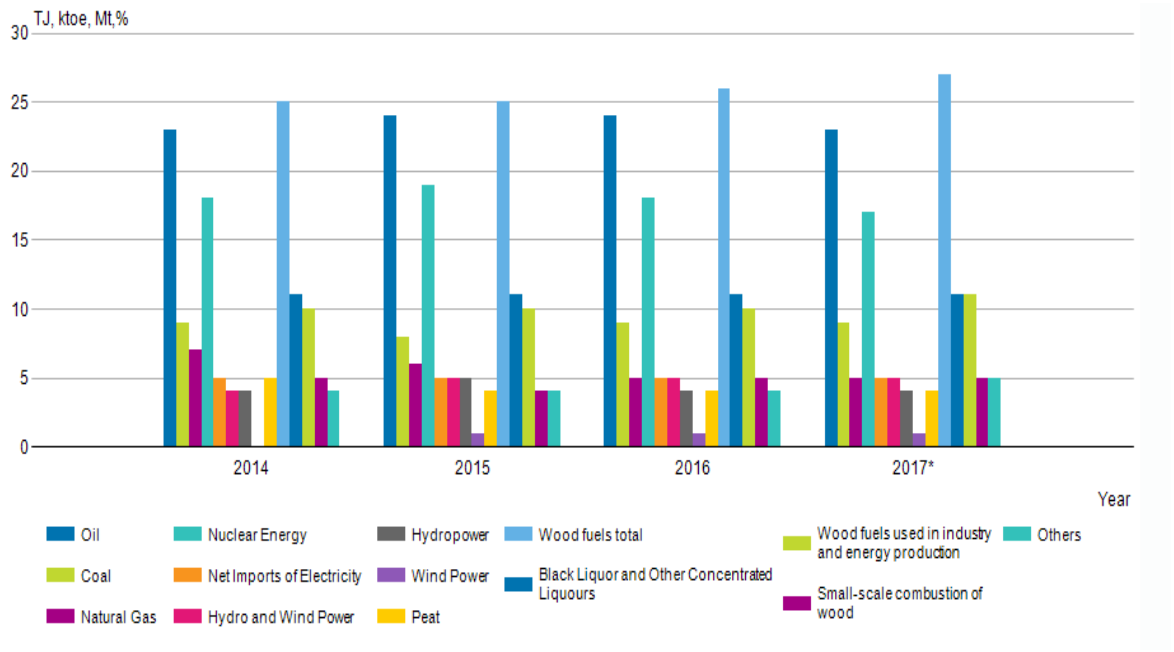

Figure 13 **Energy consumption percentage per source in Finland 2014-2017**

In 2017 the Finnish Government introduced a new renewable energy scheme, with an addition to the Act on Subsidies for Electricity Produced from renewable Energy Sources. This was done with the publication of the Government Bill 175/2017, an introduction of a new scheme for renewable energy (Björn Nykvist, Laura Leino 2018). The bill, alongside a number of amendments made to the Act were approved by the Finnish Parliament in May of 2018 with the now called Amendment Act.

The main aim of the Amendment Act is to establish the requirements that an energy producer needs to meet in order to receive the support of the government. The first requirement is that the power plant needs to be located inside Finland. The following requirement is that the power plant needs to be new, excepting the foundation of it and the building (they can be recycled). Also, the project cannot have had previous government aid with the exception of newly repurposed plants that had previous support from the state before operating with

renewables. The minimum total annual electricity output that providers need to have to meet the requirements of the scheme is 800 MWh. Providers can enter various plants and projects into the same bid but each of them needs to correspond to the same kind of renewable energy technology, provide a total annual output of 800 Mwh and not exceed 10,000 MWh.

Regarding the production of electricity, the Finnish government set in 2016 the goal of reaching the annual production of 2 TWh, this will be supported by the new scheme. Nevertheless, there has been an interest from the government banning the use of coal, but it needs the approval of the parliament. If the banning proceeds, it will lead to a reduction of the annual production from 2 TWh to 1.4 TWh.

2.6 Open innovation situation in Mexico and the acceptance to renewable energy technologies.

Mexico has its own parastatal agency to make and regulate science, technology and innovation, the National Council of Technology (CONACYT), founded in 1970 (CONACYT 2012b). It acts as a bridge between the Federal Government and the different ministries regarding innovation and science. Another responsibility of CONACYT is to promote science and technology inside companies.

CONACYT promotes innovation and at the same time regulates and maintains record of affiliated researchers and companies using National Registries. Firms are registered in the National Registry of Scientific and Technological Institutions and Companies (Reniecyt), a national instrument used to identify and support organizations that perform activities related to technological development and innovation. Companies that are listed in Reniecyt can apply for government funding if they meet the right criteria for example, aiming it as high technological developments (CONACYT 2012c).

Researchers are registered into the National Researchers System (SNI), an agency made by the government to promote research quality in the country. The requirements for being able

to form part of SNI are high, but so are the benefits that come with the membership. Researchers require to have a certain number of publications per year, contributing to intellectual property and form part of projects relevant to the needs of Mexico (CONACYT 2012d). The system has fourth different levels and each of them comes with steeper yearly requirements but at the same time bigger funding for research.

Finally, other tool used by CONACYT to help promote and develop better researchers and professionals in Mexico are the National and International scholarships for masters and doctorate (CONACYT 2012a). They are meant for improving the national knowledge and expertise by supporting post graduate students inside and outside the country. The scholarships are awarded to candidates that are going to take part into degrees related to topics related to the strategic growth areas proposed by CONACYT. Recipients are required to return to the country after graduation, the latter is required to avoid "brain drain" and to assure the use of the newly gained knowledge inside the country.

The innovation system of Mexico has different challenges and can be compared to the other Latin American countries. These hurdles make the innovation process harder and might impact how open Mexico can be. The Mexican government does not direct a big part of its Gross Domestic Product (GDP) on researching and developing new technologies. In the year 2016, the authorities spent the 0.5524% of the GDP for said purpose (Trading Economics 2018).

However, low expenditures in R&D is not just relegated to Mexico. Oher Latin American countries like Argentina and Chile have similar numbers (0.58% and 0.384% respectively). Compared to the money spent during the same year by European countries like Finland, France or Germany; the difference is notable.

According to Graf and Braun (2013) another aspect that affects the Mexican innovation system is the low connection between science and industry. Companies are dependent on know-how from outside Mexico. This weak connection also reflects on the perceived weakness of Mexican science and lack of skilled workers. They found during their research that most of high technological development was done by a few, big companies while the

rest of smaller sized ones were relegated to low-tech sectors. Finally, Mexico is a country divided into states, each with their own constitution and governments. The states have different levels of development and education and it depends on different factors. Nevertheless, this also makes the innovation system of the country less homogeneous (Graf, Braun 2013a).

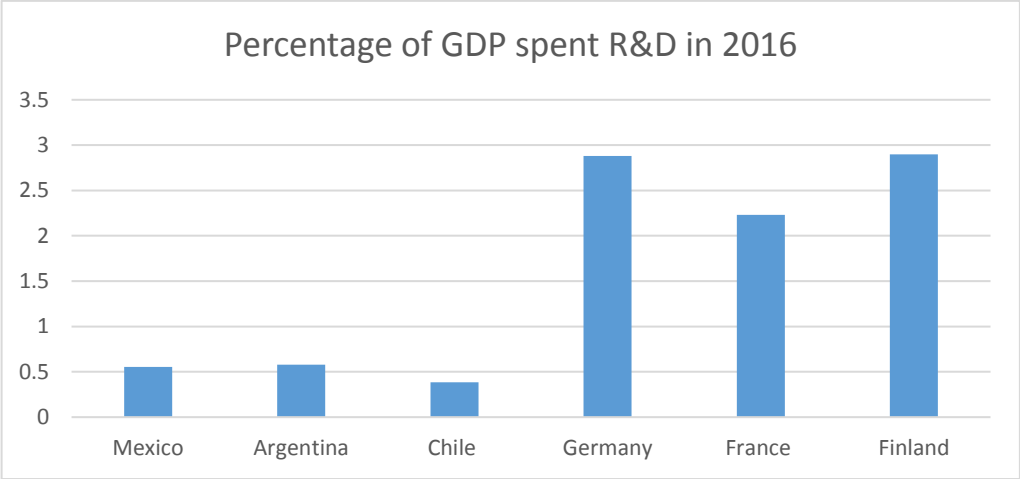

Figure 14 Comparison of the percentage of GDP spent in R&D of Mexico and other countries (Trading Economics 2018)

Nevertheless, the Mexican government is making an effort to improve the innovation landscape inside the country. With CONACYT in charge, there are diverse programs that aim to make change inside the enterprises and research institutes. One such example was the AVANCE program, ran from 2006 to 2012, it had the mission to promote and help developing new business based in the technological potential of their ideas (CONACYT 2011). The fund was aimed towards entrepreneurs, researchers or individuals that were looking to create a startup based on a newly developed technology. For applying to the funding, the individuals needed to be registered into Reniecyt.

AVANCE had a branch program called Ultima Milla (Last Mile). As the name implies, the objective of Ultima Milla was to help the beneficiaries during the last stages of developing a technology with the potential of having commercial and technological advantage. The final step was to commercialize the technology. For being eligible, the applicants needed to have

a tested technology in precommercial stages of development. The program was later renamed Nuevos Negocios due to the focus on creating a new business and improving the market landscape by introducing technologies with a competitive advantage into it.

Regarding the openness of Mexico in the adoption renewable energy technologies, there are different factors that affect the interest, varying from the government to the consumers. According to the study made by Reyes-Mercado et al (Reyes-Mercado 2017) , there are several factors that influence the acceptance of renewable energy technologies in Mexico. The team did several surveys in Mexico City to evaluate how open was the population to adopt solar technology in their households and what are the main drivers related to it. The interviewee population came from different social standards, backgrounds and genders. The researchers built a statistics model around different variables including the knowledge about the technology, how it interpreted and spread among the users. Subsequently comes the uncertainty and the perceived risks associated with the adoption. The research team also mentioned the effect of consumer asymmetric behavior, in other words how because Mexican consumers energy habits have a routine behavior, they remain using fossil-based sources. They concluded that the most important stakeholders in the country are aware and concerned about the changes in the environment and the impacts of adopting renewable energy technologies for energy purposes but that the adoption process is low. In the paper they mentioned the importance of spreading the knowledge regarding the technology among the population because low consumer knowledge was one of the main factors, they found was affecting adoption. In addition, there was a mention of the importance of social networks for sharing the advantages of renewable energy adoptions and the benefits of the innovations they provide.

In the case of taking national technology to the global market, the government of Mexico, is making an effort to support the small and medium enterprises that show technical and market advantage with different initiatives. Some of them are focused on specific countries or areas. The United States of America is the northern neighbor of Mexico as well as a strategic partner in commerce, technological and economic development; For that reason, they have a special focus by the Mexican government in the form of programs to develop cooperation

between both countries. One of them is the United States-Mexico Foundation for Science (FUMEC), and organism created after the North American Free Trade Agreement (NAFTA) to facilitate binational cooperation in science and technology between both countries. FUMEC, alongside the Secretary of Economy and the government of the different states provide support to companies in form of the Enterprise Technological Assistance System (SATE) (FUMEC 2018). The SATE has the job of aiding firms with high technical potential to develop their growth strategy using innovation. The system has different tools of planification and articulation and at the same time provides the means to strengthen the strategy locally, nationally or internationally (FUMEC 2016). FUMEC, alongside the Mexican Secretary of Economy created TechBA a program made to help technological companies to the global market, improving the national economy, making the market more competitive and attracting investment. TechBA has established a network of business accelerators inside the United States and in Europe.

2.7 Open innovation situation in Finland and interest in participating in international renewable energy projects

The innovation system in Finland is ruled and promoted by the government but it is driven by the different regions and their respective industrial and scientific players. Innovation is an important factor for regional development in Finland, but there are other important factors for regional development. Having a strong higher education system and capable workforce are other aspect that permeate in the more developed cities in Finland (Makkonen, Inkinen 2015). This can be reflected in the higher development that the regions in the southern and western parts of the country (e.g. Helsinki and Turku) have in comparison to the northern regions. According to Sotarauta et al (Sotarauta, Kautonen 2007) policies in Finland regarding science and technology had three major landmarks where different changes came to the country and the structure of the system and the corresponding support from the government. The first period of change came after the Second World War and continued until the 70s, during this time the first institutions and structures to support science and technology were created. The efforts to establish the base of the Finnish scientific

development included, among others, the creation of the Science Policy Council and developing doctrines and politics to rule research and development. Another important action was the expansion of higher education institutions from the Helsinki area and Turku to the other regions in Finland (Saarivirta 2010). This includes the cities of Oulu, Jyväskyllä, Joensuu, Lappeenranta, Tampere, Vaasa and Rovaniemi.

The second one came during the 80s and was focused on technological orientation. Finally, during the 90s, the third landmark came to be and with it the development of the Finnish innovation system and a knowledge-based society.

An important organism for supporting innovation in Finland is Business Finland, an agency in charge of funding research, working under the Ministry of Economy and Employment. It came to be after the funding of Tekes and Finnpro in 2018. Business Finland provides an array of services and funding for companies of different sizes, research institutes and municipalities (BusinessFinland 2018) .

In recent years, the Finnish government has been making efforts regarding the possibility of working with developing countries in projects that aim to improve their sustainability. An example of this has been manifested in the Finnpartnership program, launched in 2006, which provides an array of services to Finnish companies or institutions that wish to enter foreign markets and seek to improve societal functionality in foreign countries (Finnpartnership b). These services include project funding, helping companies to find matching local partners in the expected country and consulting.

With the program, firms can get funding for the initial phases of starting a project (planning, development, training and pilot) in the desired country. Companies or institutions need to meet a specific criterion in order to be eligible for the funding. The eligible projects include joint ventures, subsidiaries, franchising, importing and developing educational programs. The amount of support that can be provided depends on the project, the size of the company and the target country level of development (in compliance with the OECD Development assistance committee). The percentage of economic support is higher if the firm is smaller and the target country is in lower stages of development.

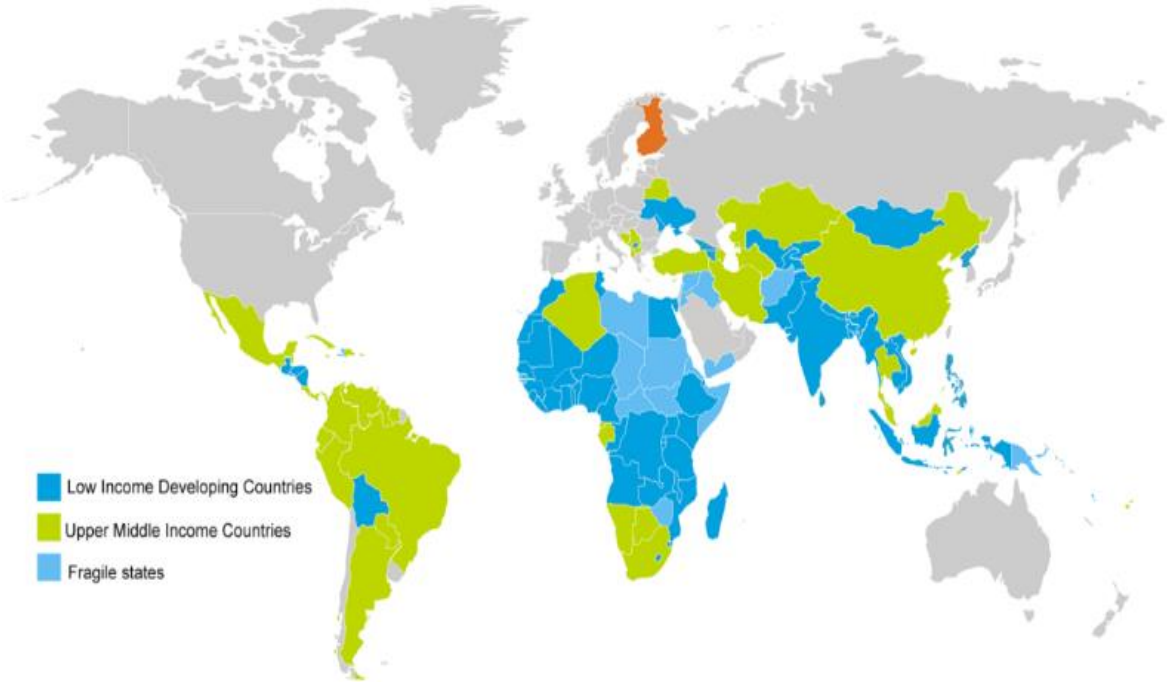

Figure 15 Target countries where support from Finnpartnership is available (Finnpartnership a)

According to the Finnpartnership report of the first 10 years (Ahlberg 2017), projects funded since the beginning of the program have been focused in developing countries where projects can make a positive impact in society. More than 50% of the subsidies (537) have been done in Asia since 2006 to 2016; The leading countries being China with 139 projects, India with 116 and Vietnam with 99. The Africa region has been the second place regarding percentage of grants, with 278. During the first 10 years of Finnpartnership support, the share of the total support has increased from 10% to 40% of the total projects. The three countries with most support were Kenia and Tanzania with 45 projects and Ethiopia with 26. The Latin American region holds the third place, with currently roughly 10% of the funding (112 projects); The leading countries were Brazil with 32 projects, Peru with 19 and Chile with 13. There was an initial interest in the European region during the first years of Finnpartnership, but the percentage of total projects has decreased over the years. Ukraine and Turkey have had 25 and 13 projects funded, during the first 10 years. The first three

major industries with most grants were: information and computer technologies with 155, energy with 82 project and sustainability with 80.

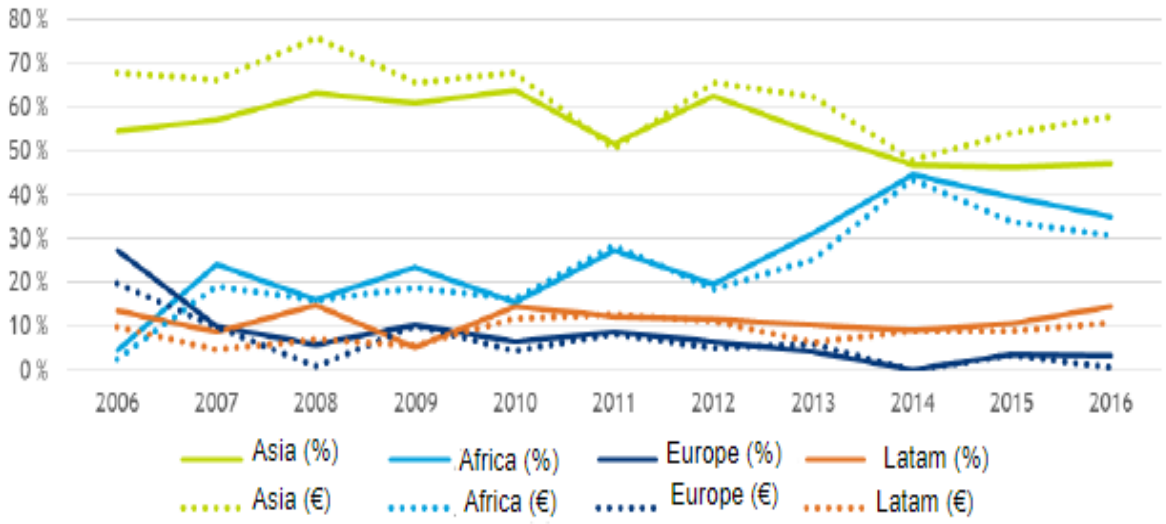

Figure 16 Percentage of Finnpartnership supported projects by area 2006-2016 (Ahlberg 2017)

2.8 Risk management in open innovation involving SMEs

After having the experience with the case of the company, a need was identified for including a risk management methodology for helping to make successful renewable energy projects between Finland and Mexico. A project like this can have many obstacles that need to be considered, disregarding them might bring consequences and affect the project success negatively.

The first step was to classify a collaboration between Mexico and Finland similar to the one presented in the case study as an open innovation project. An exchange of knowledge and technology was going to happen if the project had been approved and the Mexican partner would have obtained the tools developed in Finland, hypothetically gaining an advantage over the competition.

The second step was to consult relevant literature to understand the main factors that can undermine an open innovation project and how to mitigate them. A triangulation was made to synthetize the aspects considered the most important to make a Finnish-Mexican collaboration successful.

According to Johnsøn (Johnsøn 2015) a competent risk management model should have three important components. The first one is to identify the risks that could affect the project. The second one is to assess the magnitude of each risk, taking their probability of happening and making a relationship with the impact it could present. The third component is mitigation, the actions needed to lessen the impact of the risk and monitoring their efficacy.

In the case of risk identification in open innovation projects regarding SMEs, the risks could come from factors inside the company or outside. A previous research made in Romania (Coras, Dumitru Tantau 2013) synthetized some of these "risk drivers" after making surveys to 500 SMEs in the region of Bucharest. The companies told the team which kind of factors could affect the open innovation process. In the case of the internal drivers, three main categories were found: workforce, organizational structure and collaboration.

The main threat regarding the workforce category could manifest by employees resisting collaborating with other companies therefore closing the firm form the inside. This is an example of the Not Invented Here (NIH) Syndrome, stance that companies and employees adopt to prevent external knowledge from entering the company. There are managerial implications when the NIH syndrome is present in a company and the firm is about to enter an open innovation collaboration. For dealing with the NIH at this kind of situation, the manager could assess the attitudes and openness of the team members in regards of collaborating with an external source (Antons, Declerck et al. 2017). This lack of openness could also be present at a managerial level, where the lack of understanding of innovation might bring low levels of support to the collaboration process.

The second internal category was related to the organizational culture and structure of the company, the readiness to be able to absorb knowledge from outside and how the levels of awareness of the top management can affect the success of the OI process. Organizational

culture is an important factor that can be influence directly the success or failure rate of a company efforts towards change (Mitrovic, Grubic-Nesic et al. 2014). An organizational culture that fosters innovation (innovative culture) could be beneficial for a company because it could possibly affect flexibility, knowledge absorption capabilities and cooperation (Jolanta Mazur, Piotr Zaborek 2016).

In the case, the different organizational culture practices can affect the success of open innovation. Muzamil et al (Muzamil, Kaur et al. 2014) made a study to find out how organizational culture can enable or retard open innovation in Malaysian companies. The team concluded that a highly hierarchical culture, where the different levels of management and employees are clearly divided can be detrimental for enabling inbound open innovation. The opposite results were seen in companies with an integrative culture, therefore, innovation levels were higher.

Bad practices in organizational culture include poor work ethics, lack of thrusting the external partners. This can be a liability and impede knowledge sharing. For example, if a company is perceived as corrupt and having a bad ethical behavior, potential partners would detract from collaborating. The interviewed firms by the Romanian team that where perceived as having a poor organizational culture manifested a fear of losing the grip and control over their knowledge to the outside (Coras, Dumitru Tantau 2013). Lastly, the collaboration risks are related to the ability of the SME to adapt to the complexity of managing outside knowledge. The lack of training and preparation in managing the innovation process can bring a firm to lose control on the resources and technologies, bringing down with it the innovation process.

The following table (Coras et al, 2013) represents the risk drivers inside a SME that can be present during open innovation collaborations:

Table 2 Internal risk drivers of open innovation for SMEs (Coras, Dumitru Tantau 2013).

Risk driver	Category	Description
Workforce	Mentality	Employees resistance to innovation and change, poor understanding of their role, safety mentality
	Knowledge	Insufficient technical expertise or training of employees, insufficient knowledge about partners
	Low retention	High staff turnover, difficulty in finding quality employees
Organizational culture/social capita	Poor social capital	Poor work ethic, uneducated workforce generating lack of trust
	Low absorptive capacity	Low ability to absorb external ideas and technologies
	Organizational culture	Organizational fear of losing control over own technologies, cultural differences among partners
	Management support	Low support of top management for innovation, low awareness of risks, insufficient managerial skills
Collaboration	Complexity	Higher complexity of managing open innovation, difficulty in balancing innovation with daily tasks
	Control	Low control of external resources compared to internal ones

The external risk drivers encountered by the Romanian team where related to the outside problems that might be present during an open innovation collaboration. The first ones described there the regulation and market barriers. In the specific case of the Romanian regulations encountered by Coras et al, they were perceived as volatile and ambiguous by the interviewed firms. The input of the government with policy regarding open innovation is important because it can facilitate open innovation process and enable the external entities for easier collaboration (De Jong, Vanhaverbeke et al. 2008). In the case of Mexico, open innovation projects are regulated and supported by CONACYT but currently, the situation has been presented with challenges; Including more need of venture capital and gaps between the regional innovation systems (between each of the states of Mexico), with the less developed areas lagging behind the vanguard states (Graf, Braun 2013b). The Mexican regulations regarding a foreign country entering Mexico to do business are currently in favor of a collaboration like the one proposed in the research, this is due to the Mexican Energy Reform.

Corruption is another risk driver that needs to be considered because it could bring down the innovation efforts of a company (Paunov 2016). In the case of the proposed collaboration between Mexico and Finland, this might represent a risk. There is a big difference in the levels of corruption that both countries have between each other. Mexico occupies the 135th place between the least corrupt countries, Finland is on the 3rd place (Transparency International 2018). This might be a hurdle in the case of a Finnish company trying to enter the Mexican energy market. A report done by the World Economic Forum in 2016 showed that corruption is the most troublesome factor for doing business in Mexico and that institutions are the weakest link for competitiveness, bringing down growth and economic development. The same report showed that inefficient government bureaucracy was the second most problematic factor, after corruption (Schwab 2018). Corruption and inefficient bureaucracy are factors that might be encountered by a firm when trying to enter a developing foreign market. This was supported by a study made by Komendatova et al (Komendantova, Patt et al. 2009) while assessing the risks that where perceived by companies trying to introduce concentrated solar power technologies to North African countries. The two biggest risks that were mentioned in that research were related to the lack

of transparency of regulations in the region and bureaucracy, both being enclosed under a context of corruption. Another important finding was done in a case study done by the same team in Morocco, where they came to the conclusion that the possible source of the regulatory problems was lack of preparation in the civil service and that the ambition was lacking between policy makers. This inefficiency in the bureaucracy was another factor that was considered as a hinderance by the Coras team, according to them, it makes the process of entering external partnerships more difficult, at times bringing with them costs and waiting times that cannot be undertaken by SMEs.

Some of the risks that can be associated with corruption were defined by Johnsøn (2015) in his research about a risk mitigation model for dealing with corruption, in this case, it was particularly aimed at dealing with corruption in the context of development aid agencies. The risks identified in his research were the following:

Table 3 Risks related to corruption (Johnsøn 2015)

Risk	Description
Bribery	The act of dishonestly persuading someone to act in one favor.
Embezzlement	Stealing of misdirecting funds.
Fraud	The act of intentionally and dishonestly deceiving someone in order to gain an unfair or illegal advantage.
Abuse of power	Using entrusted power to e.g. divert benefits to an area of personal interest.
Patronage	Appointing people directly based on personal or political considerations.

Nepotism	Benefits are granted to close friends or relatives rather than on the bases on merits.
Conflict of interest	A conflict between the public duty and private interest of a public official.
Absenteeism	Habitual failure to appear to work or other regular duty without a justifiable cause.

Another external driver describes by Coras is the input of the clients in the innovation process. This is reflected when the customer-oriented capabilities that firms need to implement to meet the changing technological demands of the clients and been able to dynamically adapt for them. Lack of trained personnel and resources could magnify this driver.

The prospect of having an open innovation collaboration with a competitor might bring benefits to a SME in the form of new knowledge, technology and previously unavailable resources but at the same time it can bring a different kind of problems. Poor organizational culture and ethics can lead to mistrusting a partner, which in turn leads to poor communication and not sharing the necessary information needed for the project to succeed. Other threat a firm might encounter are opportunistic practices where the collaborating competitor might take advantage and exploit the newly received knowledge to gain market advantage over the company. The following table was made by Coras et al (2013) to represent the external risk drivers that a SME can encounter during open innovation projects:

Table 4 External risk drivers of open innovation for SMEs (Coras, Dumitru Tantau 2013).

Risk driver	Category	Description
Regulations and market barriers	Regulations	Volatile and ambiguous industry regulations
	Corruption	Unethical behavior of the partners of related to state administration bodies
	Bureaucracy	Large volume of paperwork, administrative burdens
	Market uncertainty	Lack of market information, marketing problems with newly develop products
Clients	Clients	Constantly changing needs of the clients, requiring customized products
Collaboration	Opportunism	Conflicting interests of partners, developing dependency of partners, relational risk
	Lack of trust	Lack of trust and communication among partners, communication suddenly dissolved due to partner leaving
	Knowledge sharing	Lack of protecting the property rights, core knowledge flowing out to competing organizations
	Performance	Collaborating objectives may nor be met due to poor quality of partners or poor management of partnership

Finance	Access to finance	Lack of financial capital to support open innovation, high commercialization costs
Technology advances	Technology	Technology leakage to rivals, risk from technological uncertainty, inability to adapt to technology advances

Figure 17

Nevertheless, if the different risks are considered and mitigated, a SME could survive in an open innovation environment and thrive due to the different advantages it can have. This is related to differences that a SME has compared to a bigger company. According to Spithoven et al (Spithoven, Vanhaverbeke et al. 2013) a SME is more likely to have less resources than a big firm. This can lead the SME to engage in open innovation in order to acquire those resources (technology, knowledge, talent) that it currently lacks. One such example was given in the research done by Parida et al (Parida, Westerberg et al. 2012) where the team analyzed the impacts of inbound open innovation in high technology SMES. In this case, one of their conclusions was that the input given by the client or end user (in this case of a high-tech product) to the SME could improve the innovation outcome.

Chesbrough (2010) defined a series of characteristics that that give SMEs and edge over the bigger companies. The first one is the small size of the company, providing lower entry costs to new trends and niche markets in comparison to the higher overhead costs that a large firm needs to put for cost-effectiveness. The second characteristic is the focus that a SME can provide with a specific technology, client or market compared to the diverse lineup of products and service a bigger company can have. The third advantage is business specialization and how a SME can exploit the opportunity of a certain field, therefore the spectrum of clients and markets becomes wider. The fourth characteristic mentioned by Chesbrough are the entrepreneurial persons. This is related to how smaller firms are more oriented towards products and markets compared to the research divisions of bigger, more

established companies. Finally, SMEs have the advantage of having the capacity of taking and executing decision faster and having as a result better adaptation to quickly changing markets and clients.

The Romanian team mentioned the general advantages that SMEs have over bigger companies, regarding the partaking in open innovation. They mentioned that a smaller firm have more flexibility than the larger ones therefore possessing bigger possibility to adapt to change. Other important characteristics re the close relationship with customers, customizable products/services and a more open to innovation management practices. In contrast with the general theoretic advantages of SMEs that can be found in the literature, the Romanian team noted a lack of manifestation of them from the consulted companies, in this case aligning mostly to a closed management mentality.

After taking the different risks conveyed by the interviewed SMEs, Coras et al made a Risk mitigation model for open innovation collaborations. The model aimed to engage each of the risk drivers with a series of six risk mitigation factors. The team designed the model as a web, where the mitigation factors interact with different risk drivers. Regarding the impact that the model will have in the thesis work, it could be used for the identification of risks part as well for the risk mitigation section.

The team suggested to empower the employees while motivating an entrepreneurial mindset amongst the workforce. This can change the organizational culture inside a company, improve the skillset of the employees and reduce the risks of sharing knowledge with the outside. This is because the workers are more aware of the stakes of opening the borders of the company in relation to the previously closed mindset. This is supported and complement by the research of Mazur et al (Jolanta Mazur, Piotr Zaborek 2016) and Antons et al (2017) where they deemed benefits of having employees that willing to cooperate with open innovation and avoided the NIH syndrome brought positive outcomes to the assessed companies. Another measure that a firm can take is going a step further, during the hiring process of employees and evaluating their openness level (Antons, Declerck et al. 2017).

Another tool deemed useful for reducing the risks of open innovation was communication. Enabling transparency whilst collaborating with a partner brings better understanding and awareness of the collaboration process. This will also lead to less misdirection and misinterpretation of the information and knowledge shared between partners and in return there can be an increase of trust among the involved parties. This trust is the third tool in the risk mitigation model, building with it a better innovation climate and increasing competitiveness instead of not sharing knowledge in fear of losing market advantage. According to Stulz (Stulz 2008) the communication process should include the communicating of the risks themselves effectively to the managerial level. He mentioned that failure of transmitting the knowledge and the importance of the risks to the decision makers could worsen the situation that the risk brings.

Leadership was deemed highly important by Coras et al for achieving success as and SME pursuing open innovation. The goals and rules of the collaboration should be defined clearly and monitored accordingly as a project progress. The management or leaders need to be well informed and able to engage the needs and risks of open innovation. The ability of a firm to learn and adapt to new knowledge is the fifth risk mitigation tool. Naqshbandi et al (Naqshbandi, Jasimuddin 2018) made a study in France to determine the importance of knowledge-based leadership and how it can improve inbound open innovation. After assessing several firms, they concluded that a manager is more likely to perform better in inbound open innovation when presenting knowledge-oriented behavior. The team also concluded that knowledge-oriented leadership could motivate employees for sharing their knowledge to the exterior therefore improving outbound open innovation.

Finally, ethical behavior is need whilst having an open innovation collaboration. The Romanian team encountered corruption as one of the most prevalent risk aspects to open innovation in their interviews. They deemed necessary to do business in an ethical way, thus earning good reputation and not disrespecting the trust placed by the partners on a firm while sharing their knowledge and technology.

The following figure shows their risk mitigation model, it will be used subsequently as a base for identifying the drivers for the research case and for approaching them with similar solutions.

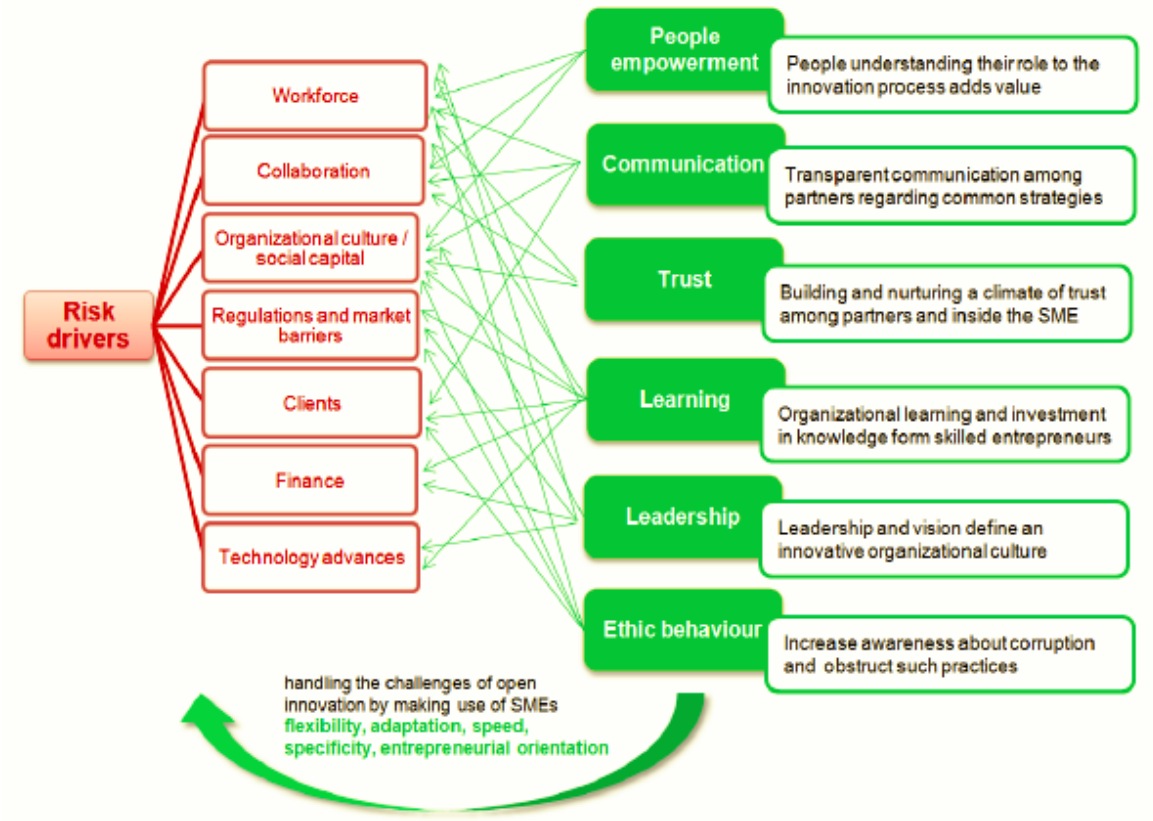

Figure 18 Open innovation risk mitigation model proposed by Coras et al (2013)

After identifying the different types of risks that can be present in a project, the assessment process will follow. There are different approaches for assessing the likelihood and impact of risks. A quantitative impact analysis could be performed using a cost-benefit analysis (e.g. with the revenue loss that an identified risk will bring), providing palpable measures of impact. A qualitative risk impact analysis could help prioritize risks that might bring higher consequences and the identification of areas to improve but will not bring concrete numbers, as the quantitative analysis would (Edmead 2007).

A qualitative risk impact tool that could be used for the assessment is the high-medium-low approach. A report made by the United States National Institute of Standards and Technology (NIST) uses this approach to build a risk level matrix that puts the likelihood of the risk of happening vs the impact it will bring, having as result the level of the risk (Stoneburner, Goguen et al. 2002). The tool was designed for dealing with risks related with information technology (e.g. hacking and cyber-attacks), but it could be used in a project like the one proposed in the research. In this case, for example, identifying the impact that corruption in the Mexican institutions could have in the project.

The risk level matrix described by NIST is a 3x3 matrix that is divided between likelihood and impact. The likelihood is represented by probabilities of 1.0 for highly likely to happen threats, 0.5 for medium and 0.1 for low probabilities. The impact levels are given a value of 100 for threats with high impact, 50 for medium and 10 for low. The NIST matrix will be constructed as shown in the following figure:

Table 5 Risk level matrix (Stoneburner, Goguen et al. 2002)

Threat likelihood	Low impact (10)	Medium impact (50)	High impact (100)
High (1.0)	Low 1.0 x 10 = 10	Medium 1.0 x 50 = 50	High 1.0 x 100 = 100
Medium (0.5)	Low 0.5 x 10 = 5	Medium 0.5 x 50 = 25	Medium 0.5 x 100 = 50
Low (0.1)	Low 0.1 x 10 = 1	Low 0.1 x 50 = 5	Low 0.1 x 100 = 10

In the model by made Johnsøn, he describes the different measures that need to be taken during the cycle of a project to mitigate corruption. His measures were specifically tailored for a different kind of project like the one proposed in the research, but it could prove useful for the interest of the Finland-Mexico collaboration due to the possibility of encountering similar circumstances (e.g. bribery). The first stage of the model is to identify the corruption risks that could be present at the required level (country, sector, etc.). The recommended actions for this stage gave are getting information about the corruption indices of the intended area, political economy analysis (public financial management system).

In the formulation and appraisal stages, the impact and probability of the risks need to be assessed and the resources need to be allocated to manage the risks related to corruption. The mitigation measures should be integrated to the design of the project if deemed necessary. Some of the tools recommended by Johnsøn were: due diligence, value chain analysis, vulnerability to corruption, public expenditure tracking surveys and community monitoring. During the implementation and monitoring stage the selected measures are put into action and afterwards, monitoring the results. The recommended tools were audits, cost effective analysis, internal reporting and whistle-blowing mechanism and quality assurance systems (risk matrices). Finally, in the evaluation stage, the mitigation measures effectiveness or failure should be measured.

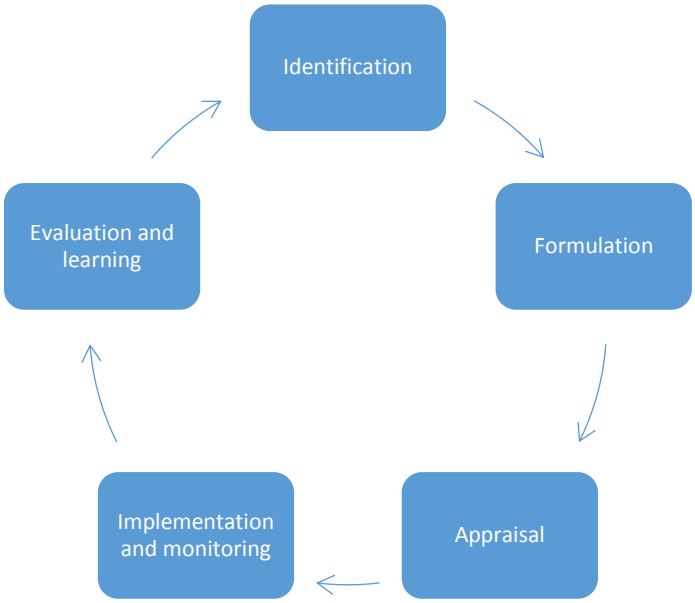

Figure 19 Corruption risk management process during a project (Johnsøn 2015)

The risk level might vary depending on the size of the company that is trying to enter the Mexican market. A small or medium company (SME) is more likely to be vulnerable to the risks of having an open innovation collaboration between two countries compared to a bigger company with more resources. It is important to mention that the Finnish company consulted for the research was a small enterprise.

Rosas et al made a study (Joao Rosas, Paula Urze et al. 2017) to explore the risks that can be present in an open innovation project using a qualitative approach while interviewing companies and quantitative doing text mining to get the most relevant factors associated with open innovation and risks. The team devised a taxonomy for risk management in line with international standards in the topic such as ISO31000 and PMBOK Guide. Their proposed taxonomy is divided mainly into two branches. The first main part of the risk management tree is the assessment of risks and is mainly about on how to identify and analyze the possible risks alongside their sources and probabilities. The other main branch deals specifically with the treatment of the risks and makes a classification between positive and negative alongside the respective activities that can be conducted with them. this taxonomy could be used as a

base for the proposed cooperation methodology, filling the corresponding areas with the ones related to the specific Mexican and Finnish perspectives and their related risks.

The following figure shows the taxonomy presented by Rosas et al (2017) for managing risk:

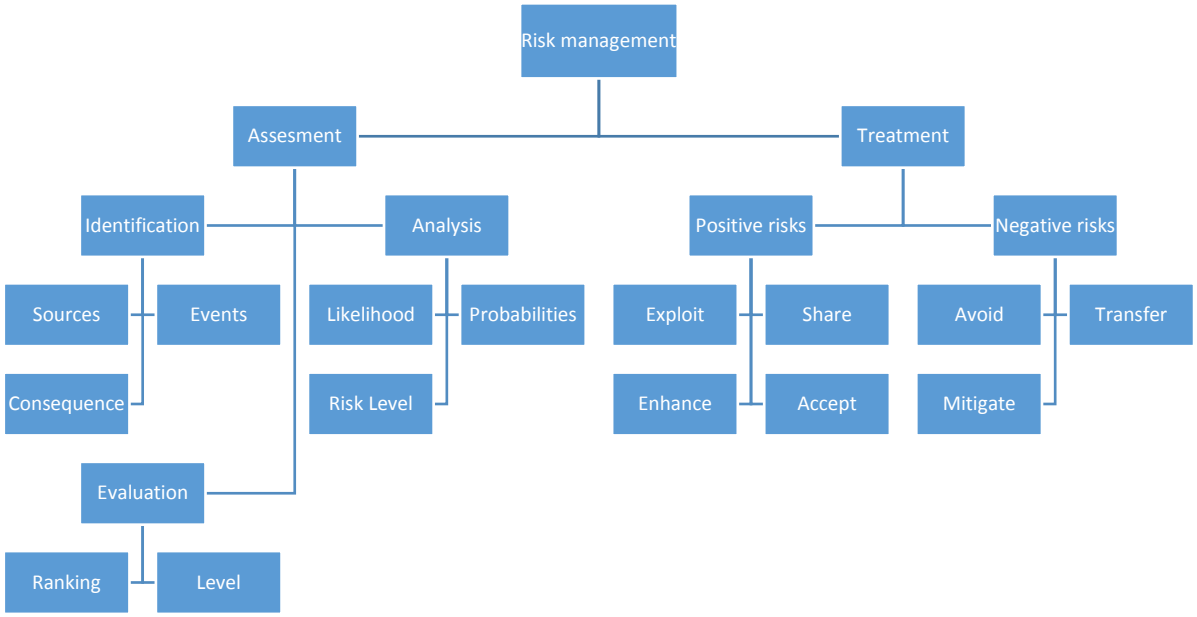

Figure 20 Risk management taxonomy (Joao Rosas, Paula Urze et al. 2017)

The reviewed risk mitigation models could prove helpful for a collaboration between Mexico and Finland. A model that presented some similarities to the case study of the research was the one developed by Coras et al (Coras, Dumitru Tantau 2013) because of the risks they identified were similar to the ones found in the literature (and later in the case study). Another relevant aspect for the research is the approach that the Coras model takes on the

internal and external perspectives from an open innovation collaboration point of view and the risks that can be encountered in each case. The corruption risk mitigation model proposed by Johnsøn (2015) gave a deeper insight into the corruption related risks that could be encountered in a project like the one proposed in the research and how to deal with them. The taxonomy for risk management provided by Rosas (2017) was not studied with the same dept as the previous two models. Nevertheless, it reinforces on the importance of the risk analysis and evaluation while at the same time providing an interesting insight on the concept of positive risks. This specific aspect was not explored further but it could be interesting for further research purposes. These perspectives can be applied to the Finnish and Mexican sides of the collaboration, both from the point of view of a SME (for example, the Finnish company that was approached during the research) and from the side of the partner (the Mexican company). The risks need to be considered before and during the collaboration, as they can affect the success of the project. Examples of the different drivers were seen during the case study, explored in depth in the next chapter.

3 Case study and interviews

During the early stages of the thesis work planning, one of the main ideas was to find a project that had the right characteristics to gain insight of the possible outcome of a Finnish-Mexican renewable energy project. Said characteristics include mainly, being a Finnish entering the newly opened Mexican market. Another important aspect is that the Finnish company develops renewable energy technology in Finnish soil and aims to install it in Mexican soil.

The technology could be of any kind from solar panels, tilting systems, wind turbine, control systems, etc. If the know how comes from Finland, that would mean that not only the Mexican side of the deal would be opened for doing business with a Finnish company in the topic of renewable energies, but also to get new knowledge and technology from the country and at the same time expanding Mexico own knowledge.

For this part of the research, a Finnish company that does business with solar energy, was contacted. They have experience dealing with the Mexican market and it was concluded that their expertise making business in Mexico could prove useful to have an idea of the Finnish perspective in a Finnish-Mexican renewable energy operation. The Mexican energy market is on a state of infancy and the presence of foreign companies is starting to happen. Having an international company doing operations inside the country could be beneficial for economy and knowledge development but due to cultural and political differences, difficulties might arise while doing a project. That was the main reason of interviewing a Finnish company that has firsthand experience with the ups and downs of making business in Mexico and obtain their invaluable insight in the process to able to understand what could happen if more projects like their own happen between both countries.

Unfortunately, and for reasons further explained in the following pages, the project was cancelled. That was the main reason of focusing the research in risk mitigation, in order to avoid this situation form happening. Two further interviews were made, this time to get the perspective from the Mexican side.

For this part of the research a series of interviews were made in order to get different perspectives from this case:

Table 6 Interviews conducted and their main results

Interview	Results
Finnish renewable energy firm project manager	Insight form the point of view of a Finnish SME trying to enter the Mexican energy market and the details surrounding the cancellation of the project.
Mexican Professor, energy specialist	Gained insight from the Mexican academy point of view, the risks that might be present and recommendations for mitigating them.
Mexican lawyer, specialist in energy contracts	Getting information from the legal perspective and the political context that a project like the one proposed could face.

The main findings of the interviews were related to the reasons of the failure of the project and the possible solutions to it. At the same time information about the political, cultural and bureaucratic contexts of both countries were given.

Reasons for a Finnish-Mexican collaboration

The first topic touched in the interviews was the attractiveness of entering the Mexican energy market (and in the case of the Finnish company, the reasons of why doing it). The Finnish company representative mentioned that "The Mexican renewable market is attractive and is currently unexplored by other Finnish companies". Another important factor

was that, the company had a Mexican employee living in Finland, he acted as the local contact during the remainder of the project and had the market preparation required for helping the company to approach a Mexican partner. The company started the project in 2015. The timing of this interest might be possible because the recent passing of the 2013 Mexican Energy Reform.

Regarding the impacts that the reform could have in a project like the one proposed or if it provides the right context for a Finnish (or foreign) company entering the Mexican market, the Mexican Professor commented that "In theory, the reform was made to bring positive changes, but it has yet to reach its full potential". This means that the reform was meant to bring a positive economical outcome to the country, but that it has not yet attained the results that were originally expected. The statement of the professor could be supported by a similar one given by the Mexican lawyer, he stated that the changes that from the technological perspective, the energy reform can bring new technology and sustainable development to the country, but that the process was going to take time This will be related to the corruption problems that where perceived in the case study and commented by the interviewees.

On the level of perception about the openness of the Mexican market ant its readiness to receive international technology and knowledge. The Mexican professor said that country is prepared and that "The level of demand for technology, capacitation and infrastructure are ready". This means that, from the technological perspective, the Mexican market is suitable for entering a collaboration with a technologically developed country like Finland. This was supported by the Finnish firm, he mentioned that he sees it as open and as big opportunity to make business in. Nevertheless, he said that "The bureaucracy slows things down. But still, there is potential, and the project could have been a success". This means that the bureaucratic paperwork and cultural differences between both countries are evident and they had an impact on the operation, but they were not the main cause of the project failure. This will be important on the discussion of corruption and bureaucracy.

Regarding the interest of other Finnish firms on entering a similar project in Mexico, according to the knowledge of the firm representative, there has not been a similar project

like theirs yet. Their main competitors, Fortum, are a bigger firm with presence in other countries and they have not shown interest in the Mexican market. He said that he considers Mexico as a promising market, but entering it is not an easy task for a small company.

The opinion of the Professor about the level of readiness that Mexico current possesses to receive knowledge and technology from Finland was that the country is prepared and that "The level of demand for technology, capacitation and infrastructure are ready", according to his opinion. This means that, from the technological perspective, the Mexican market is suitable for entering a collaboration with a technologically developed country like Finland.

Finnish Mexican Project

The project for the case study was divided into two teams, one in Finland (the Mexican salesperson) and on in Finland (the development team). The Mexican employee, was the person in charge of obtaining a suitable client, interested in acquiring the solar technology developed by the firm. He found an opportunity with a machine manufacturer in Monterrey, a city in the northern side of Mexico, inside the state of Nuevo León. Initial planning was made between both companies, but they did not sign a contract or official agreement to start the development of the project.

The Mexican employee also acted as the sole connection between the client and the company management and technological development unit. His responsibilities included sharing the specifications of the client to the developers and, after obtaining simulations of the solar panel installation, delivering them to the client. This type of interaction was repeated during months. It is important to Mentioned that both companies (Finnish and Mexican) did not sign a formal contract to start the project during the time this exchange happened. The establishment of this kind of channel of communications and lack of formality from the side of the client proved detrimental to the project at the end and were the key factors that led to its cancellation.

Regarding the problems that were encountered by the firm while managing a project in Mexico from Finland, the Finnish representative mentioned that due to the time differences were a factor that affected the project. The interactions with the Mexican employee and the

client were difficult to manage because time sensitive questions not always answered on time. The Finnish representative gave an example of the client needing information at a time were the development team was not available (due to the office being closed).

According to the interviewee, the client started to have some problems with the local government in Mexico and it had an impact on the project, threatening it. According to the Finnish representative, and from talks he had previously with the Mexican employee, the Mexican authorities were going to give economic support to the client for starting the installation of the solar panels. The problem was, that the client had previous tax problems and the government was apparently reluctant to give the money to the project.

Time passed and communications with the client ceased, the Mexican employee did not come with further reports about the situation, neither if the client did not approve the project or if interest on it was lost. By August of 2018 the reports from Mexico ceased entirely, including news from the Mexican employee himself. He stopped working with the Finnish company. An effort of contacting him was made during the research with no avail.

These series of events made the Finnish company to cancel the project. The Finnish representative said that the first mistake that the company made was relying only in one person to act as a communication bridge between both countries. He mentioned that the Finnish side of the operation had little knowledge about the bureaucracy needed for the project to be approved in Mexico. The company was relying on the Mexican employee and their client to carry on with the paperwork needed. The firm did not have communication with the Mexican government.

Another aspect the Finnish representative mentioned that needs to be taken into account when joining a project like the one proposed was to take the cultural differences into account. He said that having a local was an important asset therefore without having an employee with the characteristics the Mexican employee had, entering the Mexican energy market would be harder, if not impossible for a foreign firm. In his opinion, the issue in how the project was handled was that despite having a local connection with the client, there was not enough support to provide immediate answers. In his words “One good person is not enough,

I would think that given enough time and enough technical support he would have made it and it would have been a success". There was a need of having a Finnish employee giving technical support in Mexico, but due to the small size of the firm, they relied on working remotely with the Mexican employee as the only channel of communication.

A possible solution to this problem could have been to have a Finnish employee or team had in Mexico with the mission of providing technical support to their Mexican counterpart, the results might have been positive due to the requests of the client being answered faster, if not immediately.

Other aspect he mentioned would have made a difference in the performance of the project was to know the legal side of the operation. Having an employee or contact in Mexico that was a lawyer would have been an asset to the firm. The company did not know about Mexican law or how to make contracts inside the country, and in consequence, the start of the project was delayed. The Finnish company relied in the client regarding law and bureaucracy, this added to the uncertainty of the project.

Time and resources were other factors that led to the project cancellation. Regarding the efficiency in bureaucracy, the Finnish representative said that "In Finland, if we participate in a public competition it will take a couple of months maybe three" and when comparing it to entering a foreign country he added "In these foreign markets, if we want to enter and develop ourselves as a reliable provider; I say it takes years, but we are too small for it". This provides a perspective of the challenges that type of projects in foreign countries could present for a Finnish SME, taking more time to start than in Finland. According to him it is because of the cultural differences and how bureaucracy is handled. Nevertheless, the bureaucratic problems were perceived between the client and the government not between the client and the Finnish company. He mentioned the experience he had on a previous project in Egypt and that the waiting situation was similar, but the communication channels were better stablished, leading to the project not being cancelled.

The Finnish representative stated that "We had a local contact, a good product and promising potential. I think our (Mexican) employee did a good job but we as a company did not focus

enough". This could mean that a mixture of lack of time and resources which led to stablishing a channel of communications that was not optimal. Despite this, the interviewee said that he still sees the market as a potential place to makes business as a Finnish renewable energy company.

Another recommendation given from the Finnish employee was that resource management inside the company was as important as time and that money and employees are another factor that cannot be underestimated. He drew the comparison of what could have happened if the Mexican employee had a technical support team on site in Mexico, compared to the result obtained after months of offset communications. Nevertheless, this was a situation that the firm was not able to challenge because, as a small Finnish firm, they do not have the resources or employee manpower to do it.

The Finnish representative concluded that he does not see the experience that the company had while trying to enter the Mexican renewable energy market as a bad one. They have learned valuable lessons of the aspects and challenges that a foreign firm can face while making the effort to breach into a new, unexploded market. He mentioned that currently, the company most likely will not pursue another effort to do business in Mexico. This is because the current focus on the Finnish market and not because lack interest. In his words "They need to focus in Finland first".

Corruption and support from the government

The Ministry of Foreign Affairs provided support to the Finnish company for starting the project with the Finnpartnership program, to make the necessary developments during the time that interest and communication with the client was maintained. A similar kind of support was going to be given by the Mexican government to the client but was withheld due to the taxation problems. The exact nature and details of the support mechanism that was going to be handled are unknown.

The Mexican Professor stated that the Mexican Innovation system has support from the government, mainly thought the innovation projects done alongside companies (large and SMEs). The idea is to help enterprises develop their own technology instead of getting it from an outside source. Nevertheless, there is the risk of misuse of the funding due to lack of transparency. He concluded that inside the country, the number of valuable people that can develop and adopt (foreign) technology is commendable.

Regarding the impact that the 2013 Energy Reform had in the Mexican energy market, The Professor stated: "The reform has strong foundations but taking it to the real world is more complex and there is a lack of transparency in the process". This problem comes from inside the government, bringing obstacles with the bureaucratic processes. Another factor that is causing trouble for the reform, according to the Professor, is the corruption inside the system and the lack of transparency. He gave the examples of the management of the national oil system and how the contracts are made with personal interests in mind and the possibility of intentionally making the National Commission of Electricity inefficient to sell it in the future.

The consequences of international companies entering the Mexican are complex. The Professor gave an example regarding the private and international oil brands that are being sold in gas stations around the country, nevertheless he said "When have you seen a pipe from British Petroleum? We do not know if they are stamping international brands on Mexican oil". This raises the question of international companies coming to Mexico to do business, without pumping oil but selling Mexican oil branded as their own.

This kind of problem might surface in the renewable energy market if the lack of transparency persists and if foreign companies are not being let to operate correctly due to obstacles and corruption. Said bureaucratic hurdles can be represented, for example, as the long waiting times that the approval of the project can take. According to the Mexican Professor "If a company wants to cogenerate electricity using renewables, the estimated time for entering the system is between 140-300 able days". This could impact the During the approval waiting other problems might arise.

Another example given was the case of another hypothetic company wanting to connect to the grid from one city in the state of Nuevo León to neighboring town. The same process applies but, in this case, if another firm applied for the permission days earlier and there is only one vacancy, there will be a notification at the end of the process. This will signify a notorious expense of time without any kind of positive result. In the case of a Finnish company wanting to enter the market, the same bureaucracy waiting process should apply. The professor concluded that this kind of inefficient bureaucracy may lead companies to look for less complicated markets even if it means generating less. Nevertheless, he said that the new tendencies within the market will be seen at the beginning of the next year (2019) with the new change of government.

A topic that will be of importance according to the Mexican interviewees is the coming change of government, starting in December 2018. The newly elected president Andrés Manuel López Obrador has stated that the Energy Reform needs to be changed to benefit the Mexican people. The exact nature of these modifications is not certain at the moment but if they are indeed made, they might present an obstacle or enabler to foreign firms aiming to enter the national energy market.

The lawyer mentioned that a change of political party from power (presidency and congress) could bring radical change to the Mexican Energy system because, after the 2018 elections, most of the seats in the legislative congress and the federal power are concentrated in one party (during the elections the old political groups lost presence in the different aspects of the Mexican government). These radical changes in the political landscape of the country could lead to a different management of the institutions and their funding. He gave an example of the post graduate funding that Conacyt provides and that there have been talks originating from the coming government of reducing the funding due to austerity measures and cutting costs. Nevertheless, the interviewee mentioned that it is too soon to give an accurate opinion of what could happen with the change of government other than speculations.

Regarding the benefits of the Reform vs the corruption of the institutions, the lawyer interviewed mentioned that the Energy Reform can bring new technology and sustainable

development to the country, but that the process was going to take time. From the legal perspective, the changes brought by the Reform have made the energy industry and bureaucracy more transparent, hence reducing the opportunities for corruption. Nevertheless, the interviewee mentioned that previous bureaucratic practices that have been carried from the energy monopolies are yet to be eliminated. The interviewee made emphasis that because CFE and Pemex had a monopolistic hold of the national energy and oil systems, the policy made to regulate the energy in the country was made to be facilitate the operations of these two organisms. This gave them the exclusivity to the law practices regarding their specific areas. After the Energy Reform and the opening of the market to private and foreign companies, the legal framework was also opened to other entities.

Recommendations

The Finnish representative summarized three sides of the operation that, in his opinion, should be considered if a similar project is taken. The first side is sales, knowing the foreign market and the local people. The second is the technical side that knows how the technology works and can provide support to the salespeople when needed. The third one is the legal side that handles bureaucracy and contracts. After his experience with the Egyptian and Mexican projects, he mentioned that time and managing it was of outmost importance alongside the different sides of the company. This includes the time that takes to wait for the approval of a project, the operation duration and the closing. Other aspect is the different time zones and how it affects the speed of the communications with the client and the development team.

The Mexican Professor answered that a radical change is needed to make the processes of the Mexican energy system more efficient, taking out the corrupt elements inside it (officials and practices that facilitate corruption) to have true transparency. Otherwise the country will not take the full advantages of the Energy Reform.

According to the Professor there are three important factors that a foreign company that wishes to enter the Mexican energy market needs to consider. First is the complexity of the

process and the bureaucratic paperwork that is needed. Second are the waiting times. Finally, there is the corruption element that might hamper the start of the project or operation.

The Mexican lawyer mentioned that "The bureaucracy is fundamental for a project like this, you need to have a good local contact. That is how it works in Mexico". This means the waiting times that come as a result from the bureaucracy can be reduced considerably when counting with a Mexican partner that understands the process.

Interviews summary

After the interviews were conducted, the results leaned towards collaboration. This was due to factors that kept surfacing in the different interviews. Said factors include the changes in the Mexican energy policy that opened the market for foreign collaborations and changed the law to support renewable energies. From the Mexican side, the conclusion was that the country is prepared to receive technology developed in Finland. This applies from the market side, infrastructure and the capacitation of the operators. From the Finnish perspective, the government is helping companies (like the one approached during the research) to collaborate in projects in foreign markets. Nevertheless, there are obstacles that need overcoming for a collaboration like the one proposed to succeed. This includes the bureaucracy and the waiting times that persist in the Mexican energy market, factors that were key in the cancellation of the project of the case study. According to the interviews, corruption is another factor that hinders energy market and prevents the full potential of its benefits. Lastly, the cultural differences between both countries can also be perceived as an obstacle to a collaboration, this is related to the working cultures of Finland and Mexico and how it can affect the bureaucracy.

The following figure highlights the topics that were perceived as critical in enabling and hindering a collaboration between Finland and Mexico like the one proposed in the research. After the interviews, the perception that was gotten is that the enabling drivers outweigh the hindering ones. Nevertheless, both sides need to be considered, otherwise the project has a risk of failing.

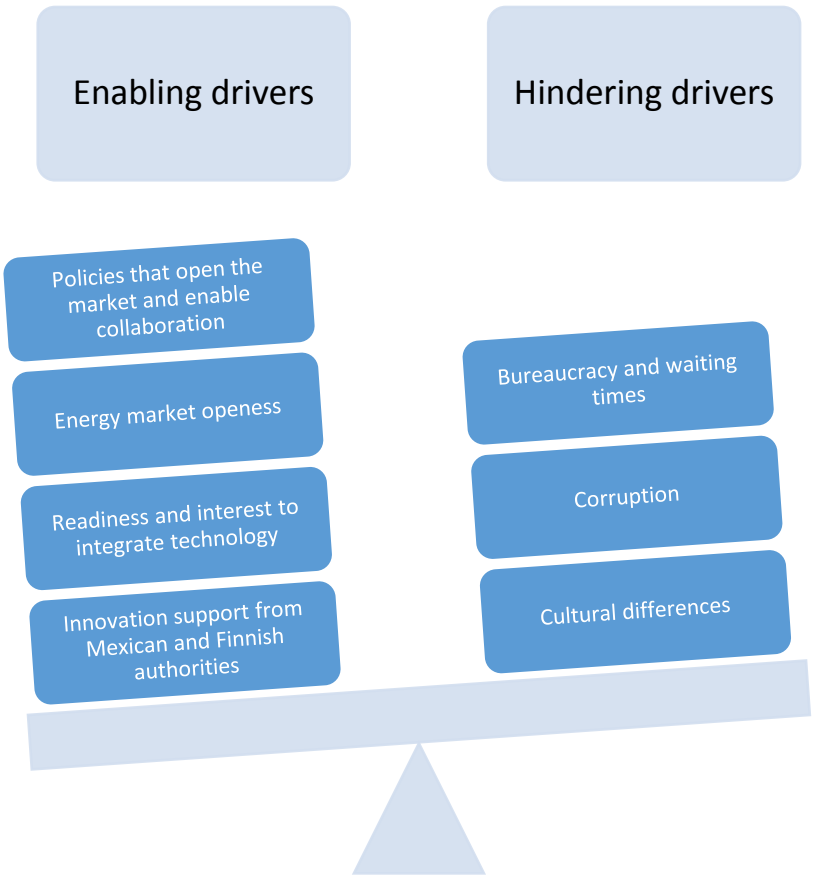

Figure 21 Enabling and hindering drivers highlighted in the interviews

4 Results and discussion

4.1 Risk mitigation

Based on the qualitative information gathered in the interviews, the quantitative data from the market studies and the risk mitigation mechanisms in the literature review; The following section will be dedicated to implementing a mitigation model for a Mexican-Finnish renewable energy projects. Having the knowledge of the risk drivers in the Mexican energy market and a way to mitigate them might prove valuable for Finnish companies that want to enter the market in the future of for subsequent research work.

The reasons of the cancellation of the project were explained in the interview with the employee from the firm. Most of which coincided with the risk drivers mentioned in Coras research for risk mitigation in SMEs (Coras, Dumitru Tantau 2013). For the part of the research related to identification and mitigation, the risk drivers described by Coras et al were used as a base to categorize the ones found in the case study, from the Finnish and Mexican perspectives. The additional information on risk mitigation of corruption given by the model of Johnsøn (2015) will be useful for understanding the specific risks that are related to corruption. This is important for a project like the one proposed in the research, because the regulations and corruption risk drivers kept on surfacing during the case study and literature review.

During the collaboration attempts, the Finnish company perceived some of the internal drivers that a SME could find when working in an open innovation project. The presence and perception of external drivers were also mentioned from the Finnish employee, but due to lack of communication with the Mexican side of the operation from part of the local development team, the full array of reasons for the project cancellation remains uncertain.

On the other side of the collaboration (Mexico), the interviews revealed some of the risk factors that can undermine or stop the success of a project like the one proposed in the research. The first main factor that appeared on all sides of the interviews was the threat of corruption and the consequences that it can bring to such a project. This was manifested during the attempt of starting the project in Mexico by the Finnish SME. According to the

perspective of the Finnish interviewee, there was the speculation that the project was not approved because of an issue that the Mexican partner had with the government. According to the Mexican professor, for energy projects to be approved and for bureaucratic paperwork to be processed; companies resort to bribing the corresponding officials. In consequence, this leads to an environment of corruption and nepotism. Corruption is one of the key drivers that could halt the success of a project like he one proposed, this is supported by the research of Johnsøn (2015), Paunov (2016) and Komendatnova (2009).

For a Finnish company, this might come as a professional hinderance and a notable cultural difference, due to the low levels of corruption present in the country and the transparency of the institutions. There is a big gap in the level of corruption between both countries. In 2017, Finland held the 3rd place in less corrupt countries in the world while Mexico occupied the 135th (Transparency International 2018). In accordance to the recommendations made by the Mexican interviewees, a possible solution for dealing with this environment is having a Mexican partner that is accustomed to the hostile bureaucratic environment and possibly has a network of contacts in the government.

The second factor that was emphasized was that time management was of vital importance and that energy projects in Mexico might take months or even a year to be approved. This time frame presents a notable difference in comparison to the waiting time for a project to be approved in Finland. Unfortunately, as it happened with the Finnish company during the case study of the research, SMEs are vulnerable to uncertainty and volatile waiting times. In this case, the project ended up cancelled because the SME did not have enough resources to send a team to Mexico to speed up the process and at the same time waiting a year for the project to start. According to the Mexican interviewees, the waiting times can be better dealt with, if the Finnish company has access to a local partner that knows the legal and bureaucratic work that needs to be done beforehand.

Another risk driver that was identified during this case was the input that the Mexican client had in the result and cancellation of the project. The Finnish interviewee said that the client needed customized solutions with solar photovoltaic technology and he changed the specifications over time. Due to a combination of not having a Finnish team member

providing answers in Mexico and the time zone differences between both countries, communication was not fluid and the process to meet the technical expectations of the client was slow. It is important to mention that during this stage of the project; the Finnish team was able to deliver the technical knowledge (specifications) that the client was requiring.

It is important to mention that in the case study the risk driver associated with the unreadiness to take advantage and understand the technology (technology advantage) was not present from the Mexican side. The same applies for the Finnish counterpart with transmitting the necessary knowledge regarding the technology. The problem was mostly involved to having a small channel of communication, provided by the Mexican employee of the Finnish firm. The employee was the only point of communication with the client, leading to part of the information about the situation of the client and the Mexican government, bureaucracy and the estimations of time to be lost due to his resignation and that there is not a formal report on everything that transpired.

In the case study and the interviews, recurring matters where drivers were related to regulations and market barriers. This does not mean that the Mexican energy market is closed to collaborating with Finland in a renewable energy project. According to the interviewees from Mexico and the literature reviewed, the Energy reform has been an important step on the right direction for opening country for collaboration and as a result, the national innovation system will become stronger. For these reasons, the market regulations and legal framework make a collaboration possible.

The barrier comes with the previously established bureaucratic mechanisms that bring, according to the Mexican professor, "hindering waiting times". Directly related to the uncertainty of waiting times is related another factor that can be interpreted as a risk driver in this regard, comes from the Mexican bureaucratic side and falls into the workforce and organizational culture categories. This might be related to the Mexican work culture and the fact that currently Mexico is the country where employees work the most hours per day (Leach 2018). This is a factor that lowers motivation in employees and affects the bureaucratic work efficiency. The solution for this situation would be complicated and related to politics and the working conditions of a country. The recommendation will be to

understand the cultural differences and work habits between Mexico and Finland and to take into consideration that paperwork will take time to be processed.

In the area of collaboration risk drivers, during the case study there was an example of opportunistic behavior from the Mexican partner can be observed due to several factors. First there was the dependency on the information that was being relied from the Mexican side of the operation to the Finnish side and the lack of transparency. According to the interview with the Finnish employee, there was the possibility that the partner was having an undisclosed conflict of interest with the government (another risk of corruption), but the information was not fully clarified to them.

This is correlated to the weak communication line that was established and relying on the scarce information given by the partner. A possible solution for being able to deal with a situation like the one encountered in the case study is to do a deeper research in the partner beforehand, therefore avoiding the possibility of dealing with unreliable partners or opportunism. Establishing and maintaining an efficient communication mechanism between company and partner/client will be another important task. If the company has enough resources and man power, sending a representative to Mexico would be a possible solution. This would be a way of providing solutions for the clients in real time and avoiding the time lag of working remotely. For a technological project, it is important to mention that the representative must be able provide the technical solutions. In the case study example, the Mexican employee oversaw sales and he resorted to provide remote solutions, leading to lag in the response time.

After having identified the main risk drivers that might be present in an open innovation collaboration between Finland and Mexico and their possible sources, several solutions are presented. The latter come from the suggestions made by the interviewees, coupled with the ones found in the literature review (mainly from the risk mitigation model section). It is important to mention that not every of the risk drivers mentioned in the list might arise and the presence of other unidentified risks is possible, depending on the project context.

The following figure uses the structure proposed by Coras et al (2013) and shows the risk drivers identified in the research.

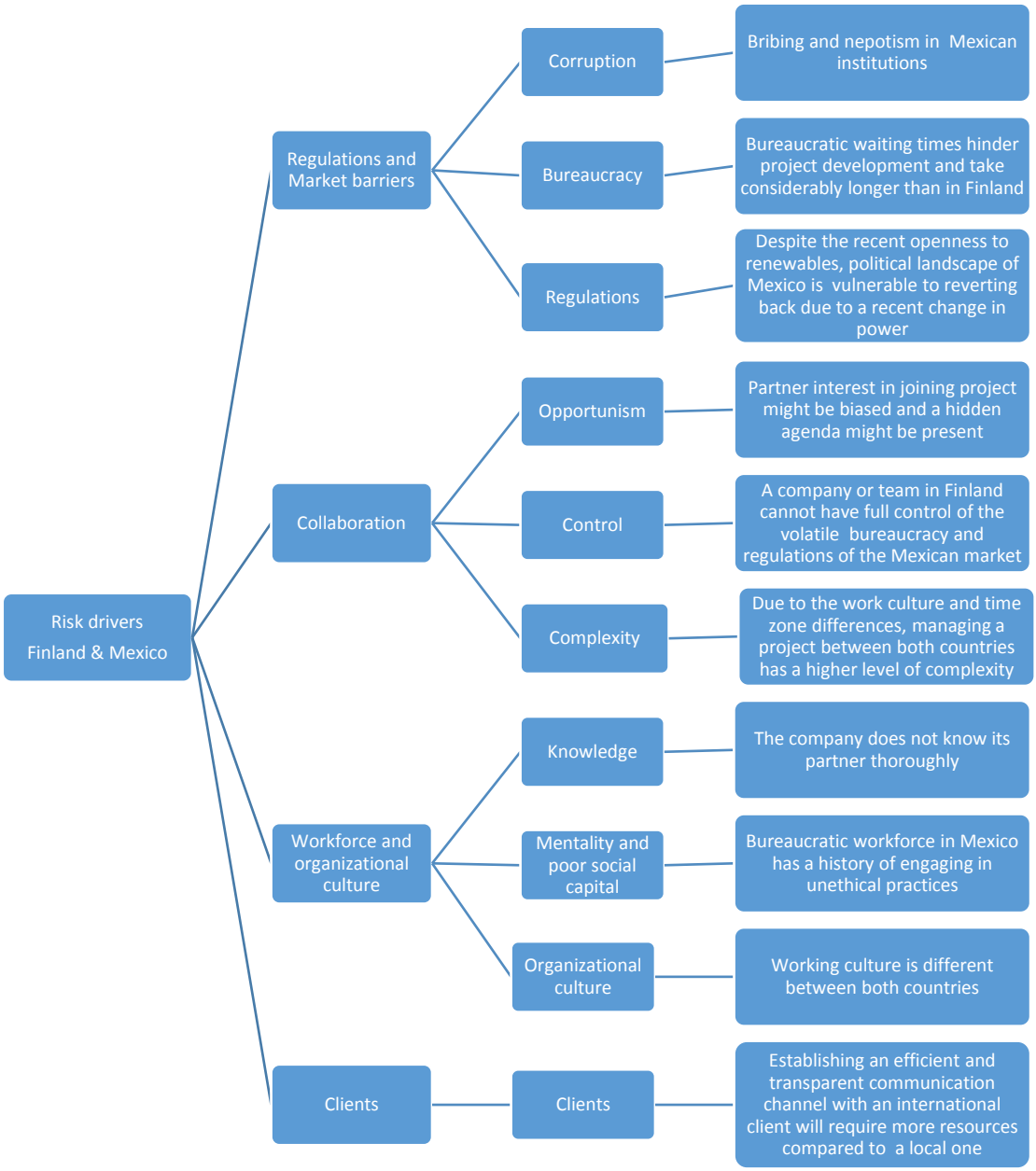

Figure 22 Risk drivers for a Finnish-Mexican open innovation collaboration, encountered in the case study and interviews

The following figure addresses the previously identified risk drivers using the factors/ advantages that Coras et al (2013) identified for dealing with the drivers, mitigating their effect on the project and the interactions they have with the risk drivers.

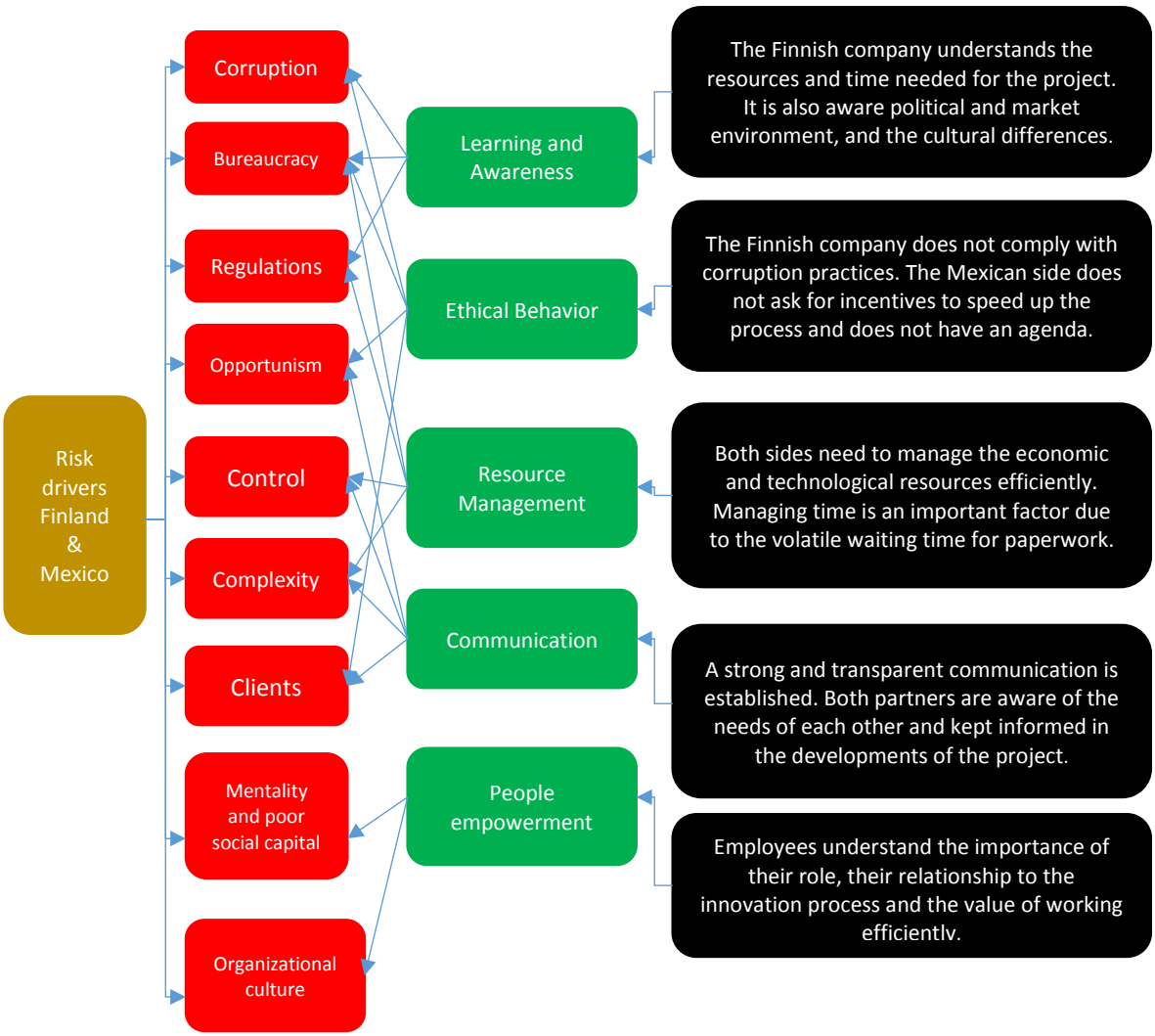

Figure 23 Risk mitigation measures related to open innovation projects and how they can address the risk drivers

The share of the risk drivers encountered during the research and the case study that come from the Mexican side of the operation and are of the external kind (corruption, bureaucracy, regulations, clients and opportunism). The internal drivers come from the Finnish perspective in the case study (complexity and control) but at the same time could be applied

internally to the Mexican workers in the governmental institutions (organizational culture, mentality and poor social capital). The latter represents a factor that can affect the project due to the perception the extended waiting times and compared to the Finnish bureaucracy, is less efficient.

In order to assess the impact of the risks that might be encountered during the project, a tool like a risk matrix could be used, pitting the probability of the risk to happen vs the impact that the risk would have on the project. In the specific case of corruption related risks, the model proposed by Johnsøn might prove useful. It is important to mentioned that due to the proposed project been amongst different countries with different legal instruments, the efficiency of the measures proposed by that model should be analyzed beforehand. The extent of pressure that a Finnish SME could have on the Mexican institutions were not explored further in the research.

It is important to mention that the drivers shown in the figures are the ones that were encountered in the research and were mentioned in the interviews, therefore they were reflected in the proposed risk mitigation model. Regarding the other risk drivers that were encountered in the literature review, there is still the possibility that depending in the state and internal practices of both sides (Finnish and Mexican) the situation may change. For example, there could be the hypothetical case that a Finnish renewable energy SME wants to establish a collaboration with a Mexican firm in wind market of that country and additional internal risk drivers could be present. Hypothetically the manager from the Finnish company is not providing enough support to the employees, which in turn do not have the right preparation to deliver to the technological demands of the Mexican partner. Using the Coras model (2013), this would present additional risk rivers related to workforce and organizational culture, specifically the managerial support and knowledge drivers respectively. Other scenario that could involve drivers not present in the case study (at least not directly mentioned by the interviewees) could involve two additional risk drivers, in this case lack of finance from the Mexican partner and the lack of trust between both sides. The first driver has the possibility of halting the project due to economic reasons that, for example, could involve not having enough funds to start the project or mishandling the

funds. The second one might result in the dissolution of the partnership due to uneven communication and partners not sharing the necessary information and not trusting each other.

4.2 Cultural and political background regarding openness to renewable energies

Finland and Mexico have notable differences in culture, technological advances and how the energy policy has been established. Nevertheless, both countries have previously established innovation systems that provide support to the research and development of new technologies with their respective support mechanisms and funding opportunities. Regarding openness to renewable energy sources in comparison to relying in traditional sources (oil, gas and carbon), both countries have different perspectives.

In the case of Mexico, the abundance of oil as an energy source and the historical background of monopolistic practices of the national energy and oil systems have made accepting and developing renewable energy technologies slow in comparison to Finland. Having centralized organisms like Pemex and CFE governing whole aspects of the energy system inside the country and a history of corruption and fund mismanagement has led to stagnation in exploring the benefits of renewable energy sources.

Nevertheless, in recent years the Mexican government has been making efforts to make the transition to renewables, starting with changing the energy policy. The Energy Reform changed the landscape of the Mexican Energy market and made possible for private and foreign companies to bring knowledge and technological advances to Mexico.

An important driver of adopting renewable energy in the country has been climate change and signing of the 2015 Paris agreement. The authorities have pledged to decrease the amount of greenhouse gas emissions, therefore continuing with the previously established energy practices is not an option for been able to meet the goal for 2030. After the reform

was approved and enforced, the energy law was subsequently modified to support and monitor the different types or renewable energy sources inside the Mexican territory. The change in the law has also made the energy legal framework wider and more open for other organisms and companies not like in the past where CFE and Pemex had the exclusive grip of the energy market.

The political climate of Mexico is a factor that needs to be considered regarding the openness to renewable energies due to the impacts that the change of government can bring to the energy policy. Mexico was under the rule of a single political party for 71 years, during which the reliability of traditional energy sources was not put into question. After the change of party in the year 2000, the first steps towards changing the energy law of the country started to take shape, this culminated in the passing of the Energy Reform years later.

Finland has a different history than Mexico in the topic of renewable energy. One such example is the possibility for the consumer of having access to different energy providers instead of a single monopolistic government-sponsored-company. This was possible in Finland in 1995 with the Electricity Market Act, giving the Finnish energy market 18 years for companies to grow and develop.

On the other hand, there is a precedent of entities that govern certain aspects of the energy services. Fingrid and the Finnish Energy Authority are responsible of managing the energy transmission grid and the execution of energy policy respectively. Notwithstanding, both organisms are monitored and regulated by the Ministry of Economic Affairs and Employment and they do not have single control of the complete Finnish energy system. In contrast, even if the current state of the Mexican energy system is a different to the previous monopolistic approach of CFE, employees carry on with some of the old practices related to it.

The conducted interviews gave insight from both sides of the equation about the interest of collaboration and the different resources that each country can provide for making the collaboration beneficial for both sides. In the case of Mexico, the renewable resources are available and unexploited in different regions. Complimenting this and according to the

interviewees is the fact that after over-relying in conventional energy sources, Mexico is behind the more advanced countries (like Finland) technologically-wise in regard to renewable energies.

Nevertheless, Mexican universities and research institutes have been preparing professionals to be able to understand the technologies, the benefits, possibilities and requirements that renewable energies can bring to the country. In words of the Mexican professor: "The people are ready to receive the technology and there is talent in the country". The Interviewee also mentioned that another open door for a possible collaboration between Mexico and Finland, in the renewable energy sector, could be at university level. According to him, the Mexican academy is well prepared to receive technological knowledge form Finland.

The Mexican government is making an effort on supporting the innovation process in its different states. In the level of research and development, the support is given through Conacyt and the different economic support programs to research and post-graduate studies. The same applies for the support given with the Nuevos Negocios program to newly established companies that have a competitive advantage that want to get funding for finishing the development of their technologies and taking it to the market. It is important to mention that, according to the Mexican interviewees, while kind of governmental support is beneficial to the innovation process; It is vulnerable to the political landscape of the country, including changes in power and corruption (leading to mismanagement of money, nepotism and cancellation of the funding). The same risk could also apply for the recently opened borders of the Mexican energy market, a change that has given the opportunity to foreigners and private companies to start doing business in Mexico. At the moment of the research, only a handful of international companies have been granted governmental support during the initial energy auctions. As stated in the interviews, sudden changes in the Mexican energy law due to the change in the government remain as speculations.

Finland in the other hand, has similar programs, as it is the case with BusinesFinland, for supporting innovation in firms. The support can be given to a startup that presents a competitive advantage and need funding for finishing the development of their technologies and take them to the market; research institutes that want to develop new businesses coming

from their research or bigger companies. More importantly and for supporting the subject of this research, is the Finnpartnership program, specifically aimed for companies that need funding for venturing into projects that improve the life quality and sustainability in developing countries. This has a direct impact in the prospect of a Finnish company wanting to do a renewable energy project in Mexico because it meets the main requirement of the program: doing a project that is going to have an impact on the quality of life in a developing country. According to the employee from Finnish company that was approached for the case study, the project had been supported by the Finnish government via the Finnpartnership program; this was verified while reviewing the 2016 Finnpartnership report of projects.

In the case of the energy markets of Mexico and Finland, the market studies revealed that both are open to renewable energies and their numbers in the subject are growing. Both countries exhibit aptitudes in an array of different renewable energy technologies, due to the difference in weather and natural resources between each of them. Due to the threat presented by climate change and global warming, both countries pledged to reduce their respective CO2 emissions in the 2015 Paris Agreement. After the pledge, the governments of both countries have made clear their intention of achieving their respective pledges. The efficiency and timing for the delivery of the reduction of the emissions is another notable difference between both countries. In the case of Finland, the pledged goals have been achieved before the accord, since the year 2014.

5 Conclusion

After conducting the research in the topic of starting an open innovation collaboration between Finland and Mexico, the results have proved positive towards it. The answer for the main question of the research was: How open in Mexico for a collaboration with Finland? At the end of the thesis work, it can be given as open with areas of opportunity. The recently approved energy policy change gives the market an opening it did not have before since the Mexican oil expropriation (making the country politically open).

From the technological perspective, the country is open to receive foreign renewable energy technology. This is supported by the Mexican innovation system and the opening of the market (leading to the introduction of technology by foreign frim). The government of Mexico is supporting the universities, research institutes and entrepreneurs with mechanisms for research and development and businesses based on technology. An area of opportunity to grow is in the cultural side, more specifically the working culture of Mexico. The bureaucratic paperwork in the country is not efficient in comparison to Finland and it has been identified as a risk driver related to the workforce and organizational culture. This does not mean that the Mexican culture is closed to renewable energies, it means that this aspect (working culture) can be a barrier for an open innovation project.

The main barriers for a project like the one proposed in the research come from the risk drivers identified in the literature review and case study. The most important are the practices related to corruption in Mexico (some of them carried from the previous energy monopoly). The time needed for bureaucratic processing could also represent a barrier if not considered during the project planification. They are directly related to the organizational culture inefficiency,

The research has covered different aspects of both sides of the hypothetical collaboration including the political situation regarding renewable energies in both countries, their respective energy market, both perspectives in open innovation and the programs to support it (and by default a project like the one proposed in the research). The project had several major changes during its development, the most important of them was the cancellation of

the project that was initially proposed during the early stages of the research. This had a deep impact on the scope of the case study and the primary data that was going to be gathered working alongside the company and the Mexican team. Nevertheless, this event at the same time gave the opportunity to approach the research topic in a different light, in other words, how to avoid the same outcome in the future.

The last part of the research was focused on applying risk mitigation to a hypothetical collaboration between Finland and Mexico. A literature review was done in order to understand how such a model works and could be applied to the specific context of the research. Most of the proposed model was based on the previous research done by a team in Romania, in which they were implementing a risk mitigation model intended to be applied in open innovation projects and involving SMEs. Said research had a similar context that the one that the one proposed in this research work as it was meant for projects involving SMEs in Romania, but the mechanism could be applied for the Finnish-Mexican case. The addition of corruption risk mitigation measures was added due to corruption being the strongest risk driver identified.

During the review, case studies and interviews, an array of factors that could affect a project like this (positively and negatively) were encountered. The factors come from a variety of sources including the many differences that both countries exhibit between each other, ranging from climate, culture, technological development and corruption level. These aspects kept on surfacing during the interviews and literature, the most notable of them was the bureaucratic differences between Mexico and Finland. This was a key factor in the cancellation of the case study project.

The challenges that were present during the case study and the ones mentioned in the literature review and interviews were sorted as risk drivers, in accordance to the Romanian model. The internal risk drivers were defined as the ones seen from the SME perspective in the literature, in the case of this research they were applied the hypothetic case that a Finnish SME wanting to enter the Mexican energy market. The presence of internal drivers was also identified from the Mexican side, most notable the government workers, that oversee the processing the paperwork and, in some instances, delay the processing of the project. The

other risk drivers that were perceived were the external ones. These apply for the external factors that can affect a project like the one proposed in the research. In the context of the case study, these drivers came from the Mexican side of the operation. Nevertheless, if the context would be reversed (a Mexican company trying to enter the Finnish energy market) some of the external drivers seen in Mexico (corruption, organizational culture and regulations) would not be present.

After sorting out the different risks, mitigation measures were given in order to engage them on time. These measures come from a mixture of the ones given in the literature review and interviews and are mostly on understanding the differences between both countries and how to not get caught off guard when entering the market. The conclusion for the risk mitigation aspect of the research is that, for a Finnish company to make a successful incursion in the Mexican energy market; It needs to know the risks involved, mostly related to corruption. Another recommended activity is to establish a transparent channel of communication with its partner and consider that the bureaucratic time is going to be considerably longer than in Finland (affecting time and resource management).

Managerial implications

From the managerial perspective, the results of the research could be used to prevent a similar outcome like the one form the case study. This means anticipating the possibility of the risk drivers to emerge, assessing their impact on the project adjusting the project plan accordingly. The corruption risks were one of the significant drivers that need to be considered by the managerial level when considering entering the Mexican energy market. The corruption mitigation measures mentioned in the research of Johnsøn could be considered while assessing their impact. Knowledge-based leadership might be important to have in both sides of the operation in order to implement an effective open innovation mechanism. It is important to mention that the adapted mitigation model was not put into practice during the thesis work, but it could lead to further research, if the opportunity is presented. Another aspect that was not delved further and could be explored deeper in the future are the positive risks that were mentioned in the Rosas research.

Final conclusions

Both countries are working to keep in line with climate change and global warming mitigation pledges they did during the 2015 Paris agreement. The political mechanisms of both countries support a future collaboration for a project like the one proposed. The recent opening of the Mexican energy market to foreigners and the support programs to innovation and sustainability of the Finnish government on international grounds create an environment where collaboration is feasible. The final conclusion is that, even if both countries are different in many ways, both could benefit from collaborating with each other, achieving greater innovation.

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Appendices

Appendix I: Interview questionnaires

Interview format for Mexico

- What is your opinion about a possible collaboration between Mexico and Finland in terms of Renewable Energy?

- How open is the Mexican energy market to receive knowledge and technology from a country like Finland?

- How is Mexico affected when foreign companies enter the energy market?

- What is your opinion about the technological readiness level of the Mexican Energy market to receive international technology? In terms of solar panels, wind turbines and other renewable energy technologies.

- Could the cultural differences between Mexico and Finland affect a project like the one proposed in the research?

- What is your opinion about the level of innovation in Mexico?

- What measures do you think should be taken in order to make a Finnish-Mexican collaboration successful?

- Which factors should be considered to mitigate risks at the moment of entering the Mexican energy market?

- What are the regulations that apply when a foreign company tries to enter the Mexican energy market?

- Is corruption a factor that can affect negatively a project like the one proposed? If yes, to which degree?

- Can a reverse collaboration be made (Mexican talent bringing knowledge to Finland)?

- What is the future of the Mexican energy market? Is the changing political climate going to be a factor?

- Could you give any further recommendation?

Interview format for Finland

- When was the first time you saw opportunity to enter the Mexican renewable energy market?

- What was the reason to choose Mexico as a place to do business?

- During the initial interactions with Mexico. How did you perceive the country? Did you see good reception from them? Or did you find any initial resistance?

- What is your opinion about bureaucracy or politics in Mexico?

- What is your perspective as a Finnish company in this situation? Do you think the Mexican market is ready?

- Do you think cultural differences are a factor that needs to be considered in order to entering the Mexican market?

- Do you think that the Mexican counterpart was encouraged to receive your technology?

- Do you have information about other Finnish companies trying to enter the Mexican Market?

- Did the project had support from the Finnish government?