

ENVIRONMENTAL TECHNOLOGY EXPORT PROMOTION: A study of governmental initiatives in selected countries



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SUMMARY

Introduction-This report is based on structured literature reviews and brainstorming sections on governmental export promotion initiatives for environmental technology in selected countries. It is intended to answer two fundamental questions: *why* governments intervene to promote environmental technology export and *how* this intervention is actually executed. These questions emerged in-light of two general challenges: 1) the lack of vivid scientific insights with robust theoretical underpinnings on governmental efforts to promote environmental technology export, 2) the necessity to diffuse environmental technology across borders based on the facts that some environmental technologies have a pressing demand in countries other than their home origin and that most emerging economies are now facing environmental challenges which have long existed in many developed countries.

Approach-A structured literature review which covered public export promotion agencies and export credit agencies in the top three environmental technology exporting countries (Germany, USA, and Japan); Scandinavian environmental technology competitors to Sweden (Finland, Denmark, Norway); other European competitor (Austria) and China as an emerging exporter was employed to identify governmental export promotion initiatives. For a deeper insight Austria, Denmark and Sweden were purposively selected for an analysis into their public "action" plans to promote environmental technology including exports. The empirical findings were then discussed in brainstorming sections using theories and best practices to come out with conclusions, some recommendations and further questions.

Findings-The economic justification for government involvement in export promotion is based on the theory of asymmetric information and other market failures. The market has so far not shown enough signs of inherently diffusing environmental technologies to the desired societal level, thus the need for government intervention. Governmental intervention for environmental technology export promotion are organised by one or a combination of the following in the reviewed countries: by prioritized target countries; by prioritized environmental technologies; by alternative services (information, financial, training and education, trade and mobility related programs); by firm size (large vs. small) and by firm stage in internationalization. With regards to specific action plans, crosscutting focus remains on support for small and medium enterprises; strategies in Austria and Denmark to promote environmental technologies in aggregation focus on policy information provision to enterprises whiles technology and business development is given priority in Sweden.

Concluding remarks-The report concludes with some remarks and further questions to stir up the debate and understanding on governmental initiatives for environmental technology export promotion. Highlights include 1) the recommendation for the provision of more detailed market information to export oriented firms recognizing the importance of externalities involved in gathering such information by private firms, 2) the need for mutual collaboration between governmental export promotion agencies and their initiatives which could be confusingly large within a country and 3) a hybridization of focus on policy instruments and technology & business development in-line with the complex ecosystem of interactions between market information and the innovation of environmental technologies.

Further questions-Several questions remain to be answered. Among them include: 1) Which theories could be used to justify governmental intervention through export promotion of environmental technologies? 2) What, When and How to measure the effectiveness of such governmental export promotion initiatives and 3) How the inherent characteristics of environmental technologies have (or should) influence their export promotion remain to be answered.

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List of abbreviations

"AHK" German Chamber Network

"BAFA" Federal Office of Economics and Export Control

"BMWi" Federal Ministry of Economics and Technology

DFID Department for International Development

"EKF" Eksport Kredit Fonden

EP Export Promotion

ET Environmental Technology

EU European Union

EXCA Export Credit Agency

Ex-Im Export-Import

EXPA Export Promotion Agency

"GEIK" Guarantee Institute for Export Credits

"GTAI" Germany Trade & Invest

JBIC Japan's Bank for International Cooperation

JETRO Japan External Trade Organisation

ICETT International Center for Environmental Technology Transfer

"KPC" Kommunalkredit Public Consultancy

NEXI Nippon Export and Investment

OECD Organisation for Economic Co-operation and Development

R&D Research and Development

SME Small and Medium Enterprise

US-AEP United States-Asia Environmental Partnership Program

1. Introduction

The world faces great challenges in the quest for sustainability. Partly, this also means technology change possibilities (invention, innovation and diffusion). This represents an opportunity to create new jobs and businesses and to improve social and environmental welfare. Environmental technologies hold out a three-fold promise; to deliver economic competitiveness with environmental and social benefits. The successful transfer of environmental technologies from developed to less developed countries has often been argued as a pathway to global sustainability (Hoekman et al., 2005). Since most developing countries are moving into the same industrial sectors that developed countries have long been involved in, many environmental products and services in developed countries could mitigate challenges in emerging economies; not to underestimate their usefulness in other developed countries as well.

Export remains one of the most common ways to transfer technology (Leonidou at al., 2011). To some extent, this is spurred by its minimal resource requirement, lower risk and the room for greater structural and strategic flexibility compared to other routes such as foreign aid and foreign direct investment (ibid). With an estimated global export market of SEK 6,000 billion as of 2010 the environmental technology market segment is growing faster than any other export sector (Swedish Environmental Protection Agency, 2004). Environmental technology export embeds the benefit to exploit a country's full production potential, increase employment opportunities for locals, generate foreign exchange and tax revenue which deliver economic competitiveness for a country while potentially contributing to global sustainability.

Sweden maintains a top international reputation in innovation due to high commitment research and development (Swentec, 2008). Currently ranked third in the global cleantech innovation index behind Denmark and Israel (Cleantech Group, 2012). A number of governmental organisations play key roles in the environmental technology sector providing different types of support along the value chain. Investigations into these support systems indicate that, more often, they have been targeted at the early stages of the product value chain i.e. R&D with less frequent support going to the commercialisation phase (Swentec, 2008). Thus Sweden needs more commercialisation both home and abroad activities from its R&D activities (Swentec, 2008). This creates a scope for Swedish companies to export technology in areas of Swedish expertise with a great opportunity to consolidate and in particular further enhance Sweden's global competitiveness. Recognising these opportunities and challenges, the government tasked the Swedish Environmental Technology Council (Swentec) in March 2008 to prepare a basis for the governments' continued support for this sector. To this effect an action plan aimed to create new jobs and increase export was formulated.

Sweden's vision to take a driving seat and supply world-leading environmental technologies is not an isolated case. Many governments in the OECD offer a variety of export promotion initiatives to enable firms overcome barriers in the internationalisation process. So far there is no indication that the market on its own will find the right level of investment in innovation

and diffusion of environmental technologies (Jaffe et al., 2005; Swentec, 2008). The environmental industry is essentially policy-driven. Therefore questions on policy intervention play an important role (Jänicke & Zieschank, 2008). This gives an unwavering indication for central government steering instruments and incentives to give environmental technologies a clearly defined market value and penetration.

To a large extent, there is a lack of scientific studies on how such environmental technology export promotion initiatives are (or should be) organised in general and for a Swedish learning interest in particular. This study employs for an overview a structured literature survey of governmental environmental technology export promotion initiatives in the top three ET exporting countries (Germany, USA, and Japan); Scandinavian competitors (Finland, Denmark, Norway); other European competitor (Austria) and China as an emerging exporter. An in-depth analysis of purposively selected countries (Denmark and Austria) is undertaken to highlight some similarities and differences in specific ET "action" plans. Swedish learning opportunities are then played up in-line with previous studies and best practices in the general area of export promotion with some concluding remarks and further questions.

1.1.Aims

The study aims to identify and analyse governmental initiatives in selected countries to promote environmental technology export. In doing so, the study will examine the framework of such initiatives; highlight some similarities and differences between dedicated environmental technology export promotion "action" plans and ultimately provide some learning outcomes for a Swedish learning interest.

To meet these aims, the study emphasises on the following paths:

- 1. The theoretical justifications for government intervention in a free market to promote the diffusion of environmental technologies through export.
- 2. The services of government export promotion and export credit agencies in selected countries to promote environmental technology export.
- 3. The framework of "action" plans to promote environmental technology export in selected countries for a Swedish learning interest.

1.2. Scope and delimitation

This study confines itself to government export promotion activities. It does not examine the efforts by the private sector to promote environmental technology export. In addition, this study covers only the initiatives of national governments and not the export promotion activities of various sub-national and regional governments in the surveyed countries. As a note of caution, this study should not be regarded as comprehensive documentation on environmental technology export promotion but rather as a general picture of how environmental technology export can be organised in the developed world using selected country examples. The term environmental technology includes goods and services mapped into two broad categories as either end-of-pipe (pollution control) or clean technologies (pollution prevention). It should be noted that because of the mutable nature of export promotion programmes, the various government practices and programmes referred to in this study may have been modified or terminated, and new programmes not necessarily mentioned here initiated.

With these remarks, export promotion in this context refers to all governmental initiatives that actually and/or potentially enhance exporting of environmental technologies at the firm, industry or national level and/or induces the commencement of such activity at any such levels.

2. Theoretical framework and previous research

Export of environmental technologies seems desirable; at least from an economic perspective not to mention the potential environmental and social benefits. Why then the need for government intervention to promote it?

From economics, the justification for government intervention in a free market could be attributed to the theory of asymmetric information and other market failures (Beltzér and Zetterqvist, 2008; Lederman et al., 2010). Market failure describes a situation in which the free market fails to arrange production and/or consumption in such a way that the allocation of resources is efficient (Borooah, 2003). What this implies is that there exist other practices where market participants can be made better-off without making any players worse-off. The inability of the free market to create sufficient demand for environmental technologies which need a high market penetration and wide adoption to be effective calls for government intervention (Jänicke and Zieschank, 2008). Government's concern here is to implement instruments which correct such failures when they occur. These could be direct financial support to firms, information provision and training on foreign trade participation.

2.1.Financial aid related programmes- Government's response to lack of financing Government support for export credits remains the most common export promotion initiative among OECD countries (OECD, 1994). The justification associated with such export insurance schemes supported by government is rooted in the levels of political and economic risks associated with international trade (Lederman et al., 2010). The unwillingness of private commercial firms to provide such levels of support due to the risks levels cannot also be overlooked. Simply put, export credits allow the buyer of exported goods to defer payment. This offer may be extended by the exporter or in other cases the exporter's banks to the buyer (or his/her bank). Official export credit agencies may offer insurance to both types of credits (OECD, 1994).

This support may take several forms such as *financing support* which entails the offer of direct credits; refinancing and interest rate subsidies. Another form could be *pure cover*, where support is provided by the government to insure either domestic exporters or lending institutions against economic and/or political risks in foreign markets. Political reasons for payment default could include shortage of foreign currency on the part of the importer, events of war, civil disturbances and payment moratoriums. Economic risks can include insolvency or non-payment on the side of the customer. Another type of official support for export credits is the *mixed credit* in which governments combine export credits with development assistance loans. A related variation is *tied aid financing* in which any financial assistance loans or grants are conditioned to purchase goods and services from the donor country.

2.2.Information related promotion programmes -information asymmetry
In information asymmetry, the available information about key market entry decision factors such as prices, laws and regulations, market characteristics, export potential, counterparties in

business etc. are inadequate and/or biased between market players (Beltzér & Zetterqvist, 2008). In such a situation it becomes sub-optimal in making decisions or evaluating the risks

and possibilities of entering a foreign market. Trade might not occur or take place in lower volumes as players may under and or overestimate the benefits and risks involved.

With information asymmetry, governments usually employ communication channels to promote trade. This takes the form of information provision on the target country's laws, customs, regulations and market features etc. This could vary from general market characteristics to specific information regarding approaches to enter a particular foreign market with a particular technology.

Another important means through which firms gain information is through social networking. This often unfortunately does not extend overseas (DFID, undated). A trusted intermediary through which firms can enter into new networks abroad and source useful information is the government (ibid). Government diplomatic activities can facilitate entry into both public and private sector networks overseas which private sector service providers may struggle to achieve especially in new technology sectors.

2.3.Externalities in export

In foreign trade there exist externalities regarding gathering foreign market information related to consumer behaviour, business opportunities, quality and technical requirements etc. which private firms would hesitate to undertake knowing very well the cost involved and the findings which could be used by their competitors. Pace setters in export who make ground breaking investments to open foreign markets, establishing contacts, distributions links and other costly undertakings which can be beneficial to their rivals face a similar dilemma (Lederman et al, 2010). Government's role here is thus to diffuse such externalities by providing market information to export oriented firms either for free and/or at a fee.

By working with initiatives to promote export, government also aims to maximise the associated positive externalities. This could be through focused support for specific sectors where the country is competitive and or by encouraging a network export approach within which firms benefit from each other's activities. An exporting country benefits from an increase in knowledge and information about the country's products and the host market. The image built for the country could be enjoyed by other firms within the country.

2.4.Looking beyond economics-Sustainability

Global quest for sustainability could also be put forward as a justification or better still a demand for government intervention to promote ET diffusion through export. This argument takes a step beyond attempts to solely correct market failure associated with export of environmental technologies. To this effect achieving market efficiency does not guarantee sustainability (Padilla, 2002).

The case for sustainability is two-sided. Market failures associated with environmental pollution interact with market failures associated with the innovation and diffusion of environmental technologies (Jaffe at al., 2005). Market failure associated with environmental pollution is based on the trade-offs between the marginal cost of pollution control and its marginal social benefits (Aghion et al., 2009). The balance has rested on the ability to show that the benefits of correcting the existence of a negative externality such as pollution

outweigh the costs of correcting the institutional set-up that produces the harm (Bromley, 2007). If the benefits cannot be shown to exceed the costs of the change then it is said to be socially "optimal" and thus no need for change. Some school of thoughts further propose that in such an instance society must tolerate the pollution levels or better still the victims remove themselves from the vicinity of the polluter.

Sustainability is about the world to be inherited by future persons (Bromley, 2007). Unfortunately we cannot absolutely tell the world future generations will prefer. To add salt to injury, future generations neither have political power nor representatives (Padilla, 2002). Current approaches to green growth are taking place in an over simplified setting largely disregarding the innovation and commercialisation aspects (Aghion et al., 2009). Technologies to attain sustainability are treated as given or emerging spontaneously, ignoring the fact that the adoption and diffusion of such environmental technologies in the near future depends on actions taken in the present. Towards sustainability, directed policies to drive innovation and adoption of environmental technologies must be adopted. In this regard the obligation will be for government and present persons to create support systems that avoid technology lock-in but rather promote the continual innovation and commercialisation of environmentally better products and services throughout the world (Aghion et al., 2009; Bromley, 2007).

2.5.Previous research

Previous scientific studies on governmental initiatives to promote environmental technology export are scanty if non-existent. In a broader outlook much scientific studies rather exist on national export promotion programs for general goods (e.g. Beltzér and Zetterqvist, 2008; Lederman et al., 2010; Leonidou. et al, 2011). These have been from two major perspectives; that of the provider (government) and of the receiver (firm) (Leonidou et al., 2011). From the provider perspective, those which try to identify cross country initiatives and analyse both their framework and performance quantitatively for favourable adoptable characteristics are few (Beltzér & Zetterqvist, 2008). Lederman et al (2010) in their studies "Export promotion agencies: Do they work?" provides the most comprehensive studies on what characteristics an 'effective' export promotion agency should have (Beltzér and Zetterqvist, 2008).

Lederman et al (2010) employ a worldwide survey on Export Promotion Agencies (EXPAs) in 103 developing and developed countries to gather information on their objectives, activities and institutional structure with the overall aim of assessing their efficacy in promoting national export performance. The survey then applied standard statistical models to economic data in trying to assess the impacts of EXPAs on export performance quantitatively.

Their findings reflect that:

- 1. On average EXPAs activities have a statistically significance impact on export performance.
- 2. EXPAs operational budgets seem to be dominated by public sources.
- 3. In all regions studied, focus of EXPA activity was on small and medium size firms that are established exporters.
- 4. Regarding best practises that "work" their estimates suggest EXPAs with a large share of the executive board in the hands of the private sector combined with a large share of public funding are associated with higher national exports.
- 5. A single strong EXPA seems to be more effective than a proliferation of multiple agencies with overlapping responsibilities.
- 6. No statistically significant correlation was found between the allocation of EXPAs expenditure across different EP activities, type of firms (large versus small) or (exporters versus non-exporters), overall strategy (sectorial focus versus broad export objectives) and export performance.

Apart from the use of externalities (diffused benefits) as an explanation for the better performance of public funded EP programs compared to private sector funding, no practical explanation was given for the other findings especially (6).

Beltzér and Zetterqvist (2008) employ a qualitative approach to find an explanation for the loss in export shares by Sweden in recent years to its closest competitors Denmark and Finland. They explored the organisation of Swedish export promotion as a possible causative. They used Denmark and Finland as reference cases and studied how EP towards the Chinese market (where obstacles to and risks in trade are deemed high) is organised in these countries

in comparison to Sweden. They conducted a structured investigation employing documentation, archival records and interviews in three broad categories (1) organisational structure (2) resources and funding (3) strategies and activities in a similar manner to Lerderman et al (2010). Their findings were analysed with Lederman's 'what works' as a yardstick to explain the effectiveness or otherwise of the Swedish export promotion.

On the other hand, investigations aimed at identifying export promotion targeted at environmental technology and their effectiveness has mainly been conducted in non-academic fronts (government agencies). In a related study, the OECD (1994) attempt to identify various governmental initiatives to support environmental technologies export based on country examples. Their findings broadly classify governmental initiatives into two categories:

- a) Officially-supported export credits and
- b) General export promotion activities

Officially supported export credits were usually issued for the export of large scale capital goods and services such as power generating plants, steel plants, and pulp and paper mills among others. They also reiterate the lack of systematic data on export credits and support services going directly into environmental technology export. This they partly attributed to the lumped organisation of export promotion services which could be enjoyed by environmental technology exporters as well. General export promotion activities do not involve direct financing. They aim to encourage and or assist domestic firms sell their products abroad. These activities range from business awareness programs, advisory services, market information provision and trade fairs organisation which could be enjoyed by environmental technology firms as well as other general exporters.

However these institutional studies suffer from the absence of solid theoretical foundations providing justification for the interrelationships among constructs such as why governments intervene to promote environmental technology export and how such interventions are or should be organised. This study provides a pioneering bridge between existing scientific studies on general national export promotion initiatives and environmental technology export which is an important extension to scientific studies on environmental technology export development.

3. Methods

This section of the report describes concisely the methods employed to accomplish the objectives of this study. Input information mainly originated from peer reviewed scientific literature, institutional reports and websites, grey literature of relevance to the study context and also brainstorming sections among project group members.

3.1. Identifying ET export promotion initiatives-Structured survey

To identify environmental technology export promotion activities, a structured literature survey was employed for an overview. This covered governmental initiatives in the top three ET exporting countries by patents and market surplus (Germany, USA, and Japan); Scandinavian competitors to Sweden (Finland, Denmark, Norway); other European competitor (Austria) and China as an emerging exporter.

The literature survey was structured in a excel sheet matrix to cover the domestic industry characteristics and the activities of each country's Export Promotion Agency (ies) (EXPA) and Export Credit Agency (ies) (EXCA) towards ET export. The findings were categorised as financial aid, trade-mobility, information or education and training-related programs. Dedicated country initiatives for ET export were also identified if available. This gave insight into discussions among the project group members to purposively select Austria and Denmark for a deeper analysis on country 'action' plans.

3.2.In-depth analysis of ET "action" plans-Purposive sampling

For an in-depth analysis of "action" plans identified from the pre-assessment, two countries, Austria and Denmark were selected purposively. Purposive sampling is employed in special research situations where the objective is to explore a new phenomenon. It employs expert judgement to select cases which are particularly informative and not necessarily representative of the entire population characteristics (Neuman, 2006). These countries' initiatives do not necessarily represent "successful" programs but rather interesting cases from a Swedish learning perspective. These countries have largely similar industry characteristics as Sweden; small and potentially shrinking domestic markets, dependent on export for economic growth, and SME dominated ET sector. Thus these countries would perhaps face broadly similar barriers and drivers to promote the export of environmental technologies among other "psychic" similarities such as business culture. These country's action plans were investigated for similarities and difference for environmental technology export promotion.

3.3.Learning outcomes

When evaluating an export promotion system several measurement problems occur. Thus many studies depict this activity as typically complex. Hence more often than not, focus has been on rather modest objectives of whether exports have increased or new markets opened as a result of export promotion (Lederman et al., 2010).

This study in a modest attempt employed previous studies reviewed earlier on and brainstorming sections with the project group members to discuss environmental technology export promotion initiatives in general and highlight similarities and differences between specific country initiatives in Austria, Denmark and Sweden in particular. This was undertaken with the objective to provide some learning lessons for the Swedish case.

4. Environmental technology export promotion initiatives

Even though export promotion initiatives are unique in relation to the economic, cultural, legal and political idiosyncrasies of each country, their ultimate aim to improve the strategic performance and conduct of firms (both exporters and non-exporters) in overseas markets (Leonidou et al., 2011) remain similar. Governmental services to promote ET export are divided into four broad categories as either financial-aid; education and training; information; and trade and mobility related programs and discussed below.

4.1. Financial aid related programs

Financial aid-related programs represent the most common government initiative among surveyed countries. In each country at least one government agency concerned with only export financing existed. These organisations usually cover the political and economic risks of buyer non-payment in an export transaction. Their activities complement private commercial services at levels which the private sector is unwilling to cover because of the higher risks.

Table 1: Summary of financial aid related programs

Common EXCA se	rvices	Country specific Export Credit Agency ET so	ervices
Export credit		Export-Import bank mandated by law to support	USA
guarantees.		ET export.	
		"Environmental Export Financing" covers risks in	
2 Cover econor	mic	ET export.	
and political	risk of	Dedicated internal advisor on ET export.	
buyer default	•		
		"Cleantech guarantees" provided to assist	Denmark
Sustainability		companies which develop and export ET.	
assessment of		Export-Import Bank provides export credits,	China
exports projects.		international guarantees, loans for overseas	
		construction and investment, and official lines of	
		credit.	
General remarks	>	Financial aid-related programs represent the most con-	mmon
		export promotion among surveyed countries.	
	>	At least one EXCA dedicated to export financing exi	sted in each
		surveyed countries.	

Source: Author

In Germany there exists a portfolio of financial services offered to meet the varying needs of exporters. These initiatives which could also be accessed by environmental technology firms include export credit guarantees against political and commercial risks, investment guarantees to protect foreign direct investment and untied loan guarantees to back commodity supply to Germany. Sustainability aspects of the projects abroad are taken into account as an assessment of the eligibility of an export transaction for financial support. The case in Norway is similar; GEIK (The Norwegian Guarantee Institute for Export Credits) offers a variety of guarantee packages which could be accessed by ET firms as well. These guarantees

cover supplier credits, buyer credits, pre-shipment, investment and bond guarantees. GEIK offers only guarantees and not loans. In Finland, Finnvera provides financing for the start, growth and internationalization of enterprises and guarantees against risks arising from export. Finnvera strengthens the operating potential and competitiveness of Finnish enterprises by offering loans, domestic guarantees, venture capital investments, export credit guarantees.

In Japan, Nippon Export and Investment (NEXI) in addition to offering similar services discussed above provides financial support exclusively for SMEs. This has simple application procedures and prompt payments. To add to this NEXI offers investment and loan insurance for natural resources and energy development. This covers risks linked to overseas resource development projects within which Japanese firms are involved. Japan's bank for international cooperation (JBIC) has the priority to contribute to securing long-term and stable supplies of energy and mineral resources. A range of its financial schemes are utilised not only to finance oil, natural gas, iron ore and other resource of interest acquisition and development but also infrastructure projects directly linked to such projects in which Japanese firms are involved. JBIC is also strengthening ties with resource-endowed countries through business cooperation agreements with their governments. The Chinese Export-Import Bank represents one of the largest export credit agencies with primary operations greater than its counterpart in the US, Japan or the UK (Moss & Rose, 2006). Its main activities are export credits, international guarantees, loans for international construction and investment in official lines of credits. It has focused on loans to governments especially in Africa for hydropower dams which are not accompanied with transparent reporting as required by EXCAs in most developed countries (Moss & Rose, 2006).

Exceptions to the above trends are observed in the USA, Denmark, and Austria where the EXCAs have dedicated ET promotion services. The Export-Import Bank of the United States has been mandated by the Export Enhancement Act of 1992 to use its programs to support the export of goods and services that have environmental benefits. The bank has a dedicated internal officer offering advice on how to support ET export. Ex-Im Bank's 'Environmental Export Financing' helps mitigate risks for U.S. environmental companies and also offers competitive financing terms to international buyers interested in U.S. made environmental goods and services. In Denmark, (Eksport Kredit Fonden) EKF's "cleantech guarantees" are provided to assist Danish companies which develop and export climate, energy and environmental technologies. The guarantees provide insurance against loss and allow companies to offer long-term credit to their customers. Both Danish and international companies and financial institutions can apply for an EKF cleantech guarantee. No limit applies to the amount covered by the cleantech guarantee once the project meets the requirements of the scheme. EKF's package for ET exporters includes: standard credit guarantees, guarantees for export of new technologies, utility cost saving guarantees, guarantees for financing energy service companies, guarantee against failure to issue carbon credits among others. In Austria, Kommunalkredit Public Consultancy (KPC) manages support schemes for energy and climate protection programs and provides consultancy services for international projects on behalf of the Environment Ministry and other partners.

4.2.Information related programs

Most of the countries surveyed had a number of export promotion agencies (EXPAs) dedicated to general export promotion activities.

Table 2: Summary of information related programs

Common activities		Country specific Export Promotion Agency ET activity(ies)	
0	Provision of general	Virtual market place for ET business matchmaking.	Germany
	market	ET news publication online and in brochures	Japan,
	information.		Denmark,
			Austria
0	Promotion of	Export information sharing networks.	Finland,
	national trade		China
	fairs.	Country image building as model for environmental	Denmark,
		protection and ET innovator.	Austria
€	Promoting		
	country as a		
	fertile hub for		
	business.		
Gener	al remarks	Most surveyed countries have a number of official agence of general export promotion activities.	cies in charge

Source: Author

In Germany the central organisation for export is the Federal Office of Economics and Export Control (BAFA) which is a subordinate to the Federal Ministry of Economics and Technology (BMWi). BAFA's contribution is to put government initiatives into practice. One of its important responsibilities is the promotion of national trade fairs. Small and medium-sized companies get grants for exhibition space at selected international and national fairs both home and abroad. Another agency Germany Trade & Invest (GTAI) is the foreign trade and inward investment agency of the Federal Republic of Germany. GTAI markets Germany as a prime location to do business and supports companies based in Germany with international market information. This is through marketing campaigns abroad, events for journalists and seminars for foreign buyers. The German chamber network (AHK) also provides a virtual market place "renewables B2B" which offers a direct online opportunity to establish and conduct new business transactions. Comprehensive information on international renewable energy sector, trade fairs, conferences, training seminars around the world is also offered on this web platform.

The Japan External Trade Organisation (JETRO) also promotes Japan as a fertile hub for business. It supports Japanese exports by hosting an online business matchmaking service. Information on trade fairs in Japan and abroad is also available through an online trade fair database. JETRO also lists Japanese environmental technology in two publications, "New Technology Japan" and "Manufacturing Technology Guide series". In Denmark the Trade council also publishes quarterly in English "Focus Denmark" which features articles and news about Danish competences, research, innovation and new products, as well as

opportunities to invest in Denmark. A comprehensive catalogue of products and services of the Austrian environmental and energy technology industry is published in the form of brochures and also online.

The Finish Environmental Cluster Research Programme (2003-05; 2006-09) employed collaborative networks between researchers, the business sector, public authorities and funding organisations to share useful information aimed at strengthening innovation capacity as well as exports. In China a similar approach within industrial associations is employed to promote export by sharing useful information among members. Austrian environmental technology information is promoted on foreign fronts with a comprehensive market strategy jointly by federal ministries and 106 foreign trade offices located throughout the world (Austrian Master Plan Environmental Technology, 2005). Branding also plays paramount in internationalisation. In China there are rebranding attempts from "Made in China" to "Designed in China". Austria is also promoting a country image as a model for environmental protection and a provider of environmental products and services in parallel with a common umbrella brand "Environmental technology made in Austria". Achieving economic growth with environmental welfare in Denmark is employed to promote ET export in emerging economies.

4.3. Education and training related programs

International marketing is more complicated than marketing in a domestic market (Fillis, 2002). To guide ET firms in the journey of internationalisation some countries provide education and training. Workshops, conferences and seminars are used to educate on a variety of export operations including export planning, foreign market identification and export logistics (Leonidou et al., 2011). Representatives of exporting firms as well as foreign businessmen and government officials may be provided with this training to increase their familiarity (and ultimately their demand) for environmental goods and services from the host country.

Table 3: Summary of education and training related programs

Common activities	Country specific Export Promotion Agency ET activity	v(ies)
Training on genera foreign trade operations.	Environmental fellowships, exchanges and training for Asian businessmen and government executives.	USA
	Problem specific environmental training for executives, regulators and policy-makers in developing countries.	
	Training workshops for businessmen and government officials from developing countries with focus on Japanese ET application in problem solving.	Japan
General remarks	 Education and training is provided to guide firms through the much more complicated process of internationalisation. Education and training may be provided to exporting firms as well as foreign businessmen and government officials. 	

Source: Author

In Germany, marketing promotion programmes run by the foreign chambers of commerce is to support small and medium-sized companies from the start in their foreign trade activities to opening up new markets. Apart from country-specific trade consultations, the assistance measures focus on deliberate acquisition of foreign business partners. The Federal Office of Economics and Export Control (BAFA) also provide advisory services and training. Financial aid is granted for start-up counselling and general advisory services, e.g. issues of business management, adjustment to new competitive conditions and environmental protection.

The United States-Asia Environmental Partnership Program (US-AEP) initiated in 1992 aims to promote the application of US environmental technology goods and services to solve environmental problems in Asia. One of its main activities is the provision of environmental fellowships, exchanges and training for Asian businesses and government executives. Through the EXPA's Environmental Training Institute, the US government participates in a joint venture with the environment industry to provide problem-specific environmental training to executives, regulators and policy-makers in developing countries. A major activity of Japan's International Center for Environmental Technology Transfer (ICETT) is to organise symposia focused on effective means for transferring ET to developing countries. This includes workshops to train officials, company executives, managers, engineers and workers from developing countries with a focus on applying environmental technologies from Japan in problem solving.

To strengthen Danish innovation and growth opportunities, there is attraction of foreign investment and cooperation through the trade council's three innovation centres in Silicon Valley, Shanghai and Munich. These forms part of a crucial strategic partnership with business organisations, regional actors, knowledge institutions and private consultancies for education and training purposes. In Austria subsidies are available in the framework of research promotion and the national support scheme of Kommunalkredit Public Consultancy (KPC) for financing demonstration projects in so far as the political and economic risks are compounded by the technical risks.

4.4.Trade and mobility related programs

Trade mobility related programs to a large extent interact with initiatives on information provision. In specific, they deal with assistance offered by government to environmental technology firms to assist them organise and participate in trade fairs and exhibitions.

Table 4: Summary of trade and mobility related programs

Common activity	Country specific Export Credit Agency ET act	ivity
Assist exporters to rent and decorate space; logistics involved in trade fairs. Assist exporters to establish first contact with potential customers and prepare	Financial assistance to enable firms exhibit their products and conceptual models in international energy and environmental summits and cover other trade show related needs.	Japan
foreign personnel visit.		
General remarks	Trade and mobility related programs interact extent with information provision.	to a large

Source: Author

The "Renewable Energies" export initiative offers the needed assistance to German companies to enable them exhibit their goods and services both home and abroad. This includes helping exporters to rent and decorate a space to display their products and services and organising transport logistics to and from the fairs. The Japan External trade Organisation (JETRO), partakes in international energy and environmental summits. This is intended to support the overseas expansion of Japan's alternate energy technology and environmental related technology. In these summits companies are assisted to display products and conceptual models to the international community by providing finance for renting space among meeting other trade show related needs. The global representation of the Ministry of Foreign Affairs of Denmark provides assistance with market information as well as establishing initial contacts with customers and preparing personnel visit to foreign markets.

5. Action plans in Austria, Sweden and Denmark

This section of the report focuses on specific "action" plans in Austria, Denmark and Sweden to promote environmental technology export.

5.1. Austria-"Master Plan Environmental Technology"

Table 5: A Summary of Austria's Action Plan

	,
Title	The Master Plan Environmental Technology
Responsible	Collaborative effort between government and public
	administration, private sector and scientific institutions.
Vision	For Austria to become the leading supplier of environmental
	technology and services in the EU.
Year	Launched in 2005 and laid out for 10 years.
Initiatives	Content
Promoting exports	Information and Communication:
	• Gathering information and intelligence for foreign
	market entry.
	✓ Current and forthcoming environmental policies and
	developments.
	Focus on emerging markets:
	New EU member states
	✓ Technical cooperation with public authorities
	responsible for environmental protection and energy
	issues.
	✓ Staff foreign trade offices with ET product managers.
	2 Above average growth markets Arab, Asia regions and
	Russia.
	✓ Scale up foreign trade office operations.
	Actual needs of priority markets:
	Pooling together existing ET market information.
	Detailed market evaluation by individual technology
	sector.
	Comprehensive marketing strategy:
	• Country image building as a model for environmental
	protection and technology innovation.
	Provision of information ET products and services
	(online, catalogues; trade fairs and exhibitions;
	incoming and outgoing political delegations)
	Common umbrella brand 'Environmental technologies
	made in Austria'.
	 Definition of priority export destinations by countries or
	regions.

Financing	New financial solutions tailored at customer needs (e.g.
	Public-private partnership models).
	New funding for market development consultancy.
	New financial models for demonstration projects
	abroad.
	 Development of a permanent platform between
	financing institutions and companies.

Source Author

The "Master Plan Environmental Technology" was launched in 2005 and laid out for 10 years. The strategic vision is for Austria to become the leading supplier of environmental technology and services in the European Union. To this effect the continuous growth of the environmental technology sector through opportunities in emerging global markets and establishing Austrian environmental technology as an internationally recognisable brand remain central. The plan is a result of the collaborative effort between private, public and academic stakeholders. Four strategic fields of action were defined: (1) Promoting exports (2) Research and education (3) Financing and (4) Strengthening the domestic market with a total of 30 implementation measures. The strategy contents directly linked with environmental technology export promotion will be discussed.

5.1.1. Promoting exports

The Austrian environmental technology sector is dominated by SMEs with little experience in and contribution to export performance. One pillar of the master plan is therefore to stimulate the export of environmental technologies with focus of small and medium enterprises. Specific measures to achieve this are highlighted below.

Information and communication: Gathering of information and intelligence for market entry will be anchored on an extensive network of around 106 foreign trade offices located worldwide (Master Plan Environmental Technology, 2005). In order to facilitate the identification of environmental technology needs, an active communication policy informing Austrian companies of current and forthcoming policy developments would be implemented. This would be anchored on more intensive cooperation with the public bodies responsible for environmental legislation in the export target countries.

Focus on emerging markets: The new EU member states face tough challenges concerning the effective incorporation of new EU laws into national legislation. With the required infrastructural investments in environmental technology sector the action plan suggests a focus on these markets as a prudent. In their endeavour to surmount these challenges, the public authorities responsible for environmental protection and energy issues in the new EU member states will receive technical assistance from Austrian institutions. This would employ Austrian environmental technologies in problem solving. In addition efforts to staff the foreign trade offices with product managers in environmental technologies in countries this region remain imminent recommendations. In addition foreign trade office services should be scaled up in markets with above-proportional growth potential (especially in the

Arab and Asian regions as well as Russia) as these carry strategic significance to export growth.

Actual needs of priority markets: The action plan stipulates as a first step the requirement to determine the actual needs of target markets by pooling together existing information gathered by various organisations. This encompasses in particular the individualization of existing information related to international tenders in the environmental technology sector, as well as the creation of a detailed address database of suppliers. This would facilitate specific market evaluation and entry steps while taking into account existing industry reports and market studies. In extension, the plan calls for existing market potential evaluations (e.g. for waste management sector) to be elaborated in more detail by focusing on individual technology sectors (e.g. potential for waste-to-energy incinerator of defined sizes). The implementation of subsequent steps for market development include in particular the extension of the above-mentioned marketing concept for individual regions, the use of a range of Austrian subsidy instruments (e.g. for demonstration plants abroad) and the development of customer-specific financing models.

Comprehensive marketing strategy: The development of a comprehensive marketing strategy for promoting Austrian environmental technology is also specified. The aim is to position Austria as an innovative centre for environmental technologies. This would promote Austria's image as a model country for environmental protection and provide information about suitable environmental technologies. In addition to this, the organisation of trade fairs and exhibitions with environmental technology remain central in the marketing strategy. The strategy also comprises the creation of a common umbrella brand "Environmental technology Made in Austria"; the definition of priority export destinations by country or region; the bundling of all information regarding outgoing and incoming delegations of federal and provincial-level politicians to do with environmental technology and a comprehensive catalogue Austrian environmental technology industry published in the form of brochures as well as online.

5.1.2. Financing

Export is exposed to the risk of political and commercial buyer non-payment. In Austria, particular attention is paid to financing exports to higher risk countries of Central, Eastern and South Eastern Europe. Financial service providers are called upon to develop financing solutions tailored to meet customer needs (e.g. public-private partnership models) backed by public subsidies. The action plan identifies an insufficiency in funding for foreign market development consultancy studies. Small- and medium-sized enterprises are not in a position to finance such services, since it does not benefit them alone but also the entire industry sector (including competitors and possibly foreign industry). This represents an externality (Lerderman et al., 2010). Thus the action plan calls for the creation of a new fund specifically for consulting services in the field of environmental technology abroad. To ensure the fund's high level of efficiency, it is essential to closely engage the specific interest of Austrian companies in the development of such a consultancy fund. Financing demonstration projects represents a special challenge as far as the commercial and political risks are compounded by

technical risks. Subsidies are available in the framework of research promotion and a national support scheme. Demonstration facilities abroad exhibit greater proximity to the customers and therefore have a stronger impact as references facilities, facilitating the development of more customised solutions. However, new financial models are to be developed for the promotion of such projects abroad. The importance of financing for the implementation of environmental technology projects stipulate for the development of a permanent platform between financing institutions and companies.

5.2. Sweden-"Action plan for Swedish Cleantech"

Table 6: A Summary of Sweden's Action Plan

Title	Action plan for Swedish Cleantech
Responsible	Collaborative effort between government and public
	administration, private sector and scientific institutions
Vision	For Sweden to take a driving role and supply world leading
	solutions for a sustainable future.
Year	Launched in 2008 and applicable to 2009 and 2010
Initiatives	Content
Commercialisation	Technology push
	✓ Stimulating the use of ideas with commercial potential
	and strong link to demand market.
	2 Market pull
	✓ Close attention to market signals by researchers and
	companies.
	More financing for demonstration projects and
	commercialisation of new technology and system
	solutions.
	All measures are to be targeted at clusters rather than individual
	companies.
Business models	• New business models that respond to different
	opportunities.
	✓ Domestic and international markets.
	✓ Products and services.
	✓ Companies and public actors.
	Business models that build on collaborative network to
	deliver systems solutions.
	✓ Enhanced channels for finding business partners abroad.
	✓ Stimulate large companies as leaders in
	internationalisation whiles pulling along smaller firms.
	✓ Collaborative sister city programs as door openers.
Collaboration	Enhanced coordination between ET promoters and their
	initiatives.
	✓ Based on mutual respect and clarified roles.
	✓ Dynamic and adaptable to changing market
	circumstances.

New strategy Launched for 2011 to 2014

Aim to facilitate the emergence and export of new Swedish green solutions

- > Intensity research and innovation
- Enhanced financing and business development at early commercial stages.
- > Support and assistance in market research for SMEs.

Enhanced coordination among government agencies promoting ET.

Source Author

The Swedish Environmental Technology Council (Swentec) was tasked by the government in March 2008 to develop a comprehensive strategy to strengthen the Swedish Cleantech sector. The action plan is well-anchored among Sweden's Cleantech actors; companies, industrial associations, representative from universities and state actors. The action plan proposed 82 measures within five strategic areas: (1) Political steering, (2) Competence for sustainable development, (3) Commercialisation, (4) Business models and (5) Collaboration. The vision is for Sweden to play a driving role and supply world-leading solutions for a sustainable future. Those initiatives directly related to export promotion are discussed.

5.2.1. Commercialisation

Sweden commits a lot of resources to research and development and thus maintains a top international position in innovation. Despite this success, Sweden has been less successful than many countries in obtaining results in the form of new and growing companies. Having the technology alone does not create wealth but rather its application through commercialization (Heslop et al., 2001). To increase commercialisation of innovations the action plan calls for measures to get new technology out (technology push) as well as to get research and companies to listen closely to signals from market (market pull). For an international outlook the measures suggest stimulating and utilising ideas with commercial potential, strong linkage to demand in the market and supporting the business through entrepreneurship. Consistent with export promotion the measures call for more financing for demonstration projects and commercialisation of new technology and systems solutions. These efforts as suggested should be directed at clusters rather than towards individual companies.

5.2.2. New business models

The view that, Sweden has a small and potentially diminishing domestic market implies that international markets represent a unique opportunity for further growth and expansion. Nonetheless the domestic market is central to many companies in finding a platform to develop from (Swentec, 2008). The Swedish Cleantech business sector is dominated by small and medium sized companies with limited international sales experience. The action plan stipulates firms in the environmental technology sector to develop business models that respond to opportunities in different markets; both home and abroad to sell products and services to companies and as well as systems operated by public sector actors. The characteristics of the domestic industrial set-up stipulates for business models that build upon collaborative networks to deliver system solutions (ibid). The collaborations should be based

on the firms need to do so with clearly defined roles. Implementation measures coherent with export promotion include support channels for companies in finding collaboration partners abroad; enhancing the market analysis function of state actors; stimulating large companies that can act as leaders in the international markets whiles pulling along smaller firms; encouraging municipalities both home and abroad operating Swedish environmental technologies to show it off to foreign counterparts and also building collaborative sister city programs as door openers for firms.

5.2.3. Coordination among promoters

The action plan recognises the fact that there has been increased interest in the Swedish Cleantech business sector and an equal surge in agencies promoting its development and export. This has led to a myriad of agencies both private and public with different approaches which could be confusing for firms especially SMEs. In order to achieve a more effective support system, the action plan calls for efforts to enhance coordination between the different actors and their initiatives. Extended collaboration is required within the public sector and between the private sector actors based on mutual respect for and clarity in each other's role Swentec, 2008). This collaboration should be dynamic and easy to change in accordance to changing market circumstances. In addition the measures calls for an increase in transparency in the operations of environmental technology promoters in order to enable firms find which organisation to consult. In addition help should be among many others focused on companies that want to grow (ibid).

Recently, follow ups to the action plan have emerged. Among them is the Swedish government's environmental technology strategy presented for the period of 2011 to 2014. The strategy builds further on the investments in environmental technology and the promotion of Swedish exports in the field undertaken by the government in past years. The aim of the strategy among many is to facilitate the emergence and export of new Swedish green solutions. The strategy spans both the short and long term targeting from research and development to increased exports reinforcing the government's ambition to make Sweden a pioneer in the environmental technologies. The government will be investing SEK 400 million in environmental technology over the period. The strategy outlines 12 proposed initiatives to boost the Swedish environmental technology sector. These include steps to intensify research and innovation, initiatives aimed at facilitating financing and business development at an early commercial stage, support and assistance with market start-ups in export markets for small and medium enterprises, and measures to improve coordination among government agencies and other actors of relevance to development in the environment sector.

5.3.Denmark-Action Plan

Table 7: A Summary of Denmark's Action Plan

Title	Danish solutions for global environmental challenges – the
Title	government's action plan to promote eco-efficient technology
Responsible	Collaborative effort between government and public
Kesponsible	administration, private sector and scientific institutions
Vision	To ensure Danish leadership in the environmental technology
VISIOII	sector
Year	Launched 2007 and up to 2010
Initiatives	Content
Partnership for innovation	Strategic and binding cooperation between players in
arthership for hillovation	the innovation chain
	✓ Heighten public-private cooperation with common
	goals; opportunities and needs; and funding and
	strategies for market entry.
	✓ Build collaboration on existing networks, efforts and
	initiatives
	✓ Five starting points with strong Danish ET foothold-
	water; industrial biotechnology; mega wind turbines;
	biofuels and hydrogen cells
Targeted and enhanced	• Focus on emerging economies(BRIC)
export promotion	• Focus on energy efficiency; wind energy; biomass and
	waste; Aquatic environment.
	Strengthened market consultancy in target markets
	(present and future needs).
	Presenting ET solutions as synergistic infrastructure
	working with existing systems.
	Need for increased collaboration among ET promoters
Title	Environmental technology for the improvement of the
D 01	environment and growth
Responsible	Collaborative effort between government and public
¥7.* - *	administration, private sector and scientific institutions
Vision	To create an improved framework for Danish environmental
	technology companies-for the improvement of the environment,
Vacan	prosperity and employment.
Year	Launched 2010 and up to 2011
Initiatives Development testing	Content Official lines of collaboration for demonstration projects
Development, testing and demonstration	• Official lines of collaboration for demonstration projects.
anu utinonsuanon	• Danish economic growth and environmental welfare as door opener.
	Government grants to focus on clean water, air pollution
	and waste processing in India and China.
Information on statutory	Feeding Danish companies on existing and forthcoming
regulations	regulations that influence ET development and diffusion.
1050100110	✓ Mapping how future regulations could promote Danish
	ET development
	✓ Mapping barriers in regulations to ET development
	mapping current in regulations to L1 development

Source Author

The Danish government launched Denmark's first collective plan for environmental technology development and innovation in 2007. The action plan entitled 'Danish solutions for global environmental challenges – the Government's action plan to promote eco-efficient technology' is to ensure Danish leadership in the environmental technology sector. To this end creating new technologies that benefit the environment, exports, and Denmark's brand as a country with an innovative and knowledge-intensive business sector remain crucial.

The action plan presents nine specific initiatives: (1) Partnerships for innovation (2) Targeted and enhanced export promotion (3) Research and technology development in the interest of the environment (4) Strengthened efforts to promote eco-efficient technology at the Ministry of the Environment (5) Targeted promotion of eco-efficient technology in the EU (6) Climate and energy technology (7) Environmental impacts from livestock farms (8) A clean and unspoiled aquatic environment (9) A healthy environment. The initiatives most related to export promotion will be foregrounded.

5.3.1. Partnerships for innovation

The characteristics of the environmental technology sector, global competition and nature of challenges among many others dictate that individual players cannot act in isolation; they have varying degrees of dependencies on others (The Danish Government, 2007). These necessitate targeted efforts on strategic and binding cooperation between the players in the innovation processes (ibid). The action plan calls for increased governments efforts to heighten public-private cooperation between state, enterprises, research institutions, and venture capital with the aim to accelerate the development of innovative technologies targeted at specific environmental problems. This was to be channelled through deliberations with the relevant enterprises and institutions on establishing partnerships for innovation. These partnerships would set common visions, identify similar opportunities and needs and agree on funding and strategies from development to market entry and eventual export of environmental technologies. For example, joint development of demonstration projects abroad. The partnerships would build on existing initiatives and networks to avoid duplication and draw full resources and experience from existing cooperation. Initial proposals put the partnerships in five key starting areas with great potential for technology to solve environmental challenges combined with strong Danish enterprise foothold. The partnership areas are: (1) water, (2) industrial biotechnology, (3) mega wind turbines, (4) biofuels and (5) hydrogen/fuel cells.

5.3.2. Targeted and enhanced export promotion

There is increasing growth rates for environmental technologies with Danish stronghold particularly in emerging economies of the BRIC countries (The Danish Government, 2007). The action plan stipulates the employment of Danish success in decoupling economic growth from environmental pollution as a persuasive sales argument when entering such markets. Initial, efforts would target markets in the US, Brazil, Russia, India, and China with a focus on energy efficiency, wind energy, biomass and waste, as well as the aquatic environment. In response to the demand of enterprises it is the intention to strengthen the consultancy function within eco-efficient technology in the most important export markets. This would be through

bridge-building between national/international environmental policies, environmental technological innovation, entrepreneurship, and growth markets. The environmental technology solutions as well must be presented in context as a system solution working synergistically with existing administration, legislations, and technical systems. For effective export promotion, the government stipulates close collaboration between the promoters and their initiatives with the aim to improve the synergy between Danish national activities, participation in the global political scene, and exports of eco-efficient technologies.

In February 2010 the Danish government launched a second in the series of action plans to promote environmental technology development and export up to 2011. This action plan allocates DKK 90 million over two years to support the development and implementation of environmental technology focused for clean water, air pollution and waste recycling. Out of this allocation, DKK 10 million has been designated to promote international export.

Elements in the strategy are in three broad areas (1) Development, testing and demonstration of new environmental technologies (2) Partnerships and regulations that promote innovation (3) Public sector demand. Initiative content most related to export promotion will be played up.

5.3.3. Development, testing and demonstration

For most Danish companies involved in environmental technologies, the domestic market is too small to create the economy of scale for technology development and or competitive production (The Danish Government, 2010). Thus for the most part, Danish companies with tested and demonstrated environmental technologies have resorted to export. For international markets, environmental technologies need to be tested under local field conditions with the aim to demonstrate their suitability in-situ with close dialogue with the potential customers (ibid). The action plan stipulates the need for a clear interest in the recipient countries to invest in and in continue the demonstrated projects. Official lines of bilateral collaboration and partnerships between local actors and authorities can in many cases prove paramount for establishing such projects abroad. Denmark's image as a country with economic growth combined with environmental welfare would serve as key instruments in opening such collaboration doors abroad. For companies, this could provide basis for further collaborative opportunities with local partners on major projects involving system solutions. Government grants were to focus on clean water, air pollution and waste processing technologies as priority areas for development, testing and demonstration especially in collaborative country agreements with India and China.

5.3.4. Information on statutory regulations

Policy and legislation has a significant influence on the development and adoption of environmental technologies (The Danish Government, 2010; Jänicke and Zieschank, 2008). Ambitious and far-sighted legislation can thus crate a fertile platform for new markets and demand for environmental technology solutions. A large part of the environmental regulation that is significant for Danish environmental technology companies is laid down at EU and international level (The Danish Government, 2010). Knowledge of both existing and

forthcoming regulations will be significant in assessing their impact on technological development and adoption and potential markets for new eco-efficient solutions. The sooner companies are aware of a new market, the greater their chances of developing the best technology before their competitors (ibid). The government would compile and present information to Danish environmental technology companies early enough about forthcoming regulations to enable them get head start with technological development and thus security future investments.

6. Discussions

6.1. Gaps between theory and current practices

More market information provision: As has already been discussed in the theoretical framework, the economic justification for government involvement in export promotion is based on the theory of market failure (Lederman et al., 2010). Externalities, information asymmetry and market structure lead to situations in which actual diffusion paths of environmental technologies differ from that which may be optimal for society (Institute for Prospective Technological Studies, 2004). Moreover, the market may not yield a geographically satisfactory distribution of environmental technologies and hence government intervention for faster diffusion of such technologies across borders becomes necessary (ibid). From the empirical findings presented in earlier chapters, there is evidence of at least one government agency dedicated to providing financial aid related assistance to firms in the form of export credits and/or guarantees in each of the surveyed countries. Reconciliation the theory with current practise, the lack of finances for environmental technology development and diffusion is more likely a result of information asymmetry and other sources of externalities between market players. Thus governmental focus on the provision of financial aid related programs in various countries may not necessarily be coherent with the theory of information asymmetry and externalities. It is argued that information asymmetry and other externalities lead to lack of financing and not the other way round. It is therefore augmented that there should rather be increased efforts in the provision of relevant information to market players in the sector which will ease the flow of financial investments for the development and diffusion of technologies as such. Similar deductions have been drawn by Andersson & Newell, (2003) in their study in which they recognise that information provision to firms has not received much attention despite its relevant role in environmental technology adoption. In a report on support systems for SMEs, the EU (2007) also recommends the need to raise awareness on the need to internationalise and for long term effectiveness focus on developing SME capabilities rather than the provision of grants and subsidies. Externalities associated with gathering foreign market information has been rooted in its potential spill over effect, benefiting competitors (Lederman, et al., 2010) and thus government support in the form of market information provision among others would potentially be very much welcome by export oriented firms. In the situation of information asymmetry between market players, policy interventions in terms of information provision is desirable up to the point where the marginal social benefits is equal to the marginal social cost of such intervention (Institute for Prospective Technological Studies, 2004). As has already been discussed a wide range of information provision programs are available which need to be strengthened up and widespread. These include among many, demonstration projects, trade fairs programs, advertising programs, etc. Other school of thoughts have also raised arguments about laggards who after being well informed about the market conditions (including potential cost and benefits) would prefer to wait and see the results from competitor's initiatives. There remains no clear cut distinction in favour of taking immediate advantage of public information provision to export (e.g. first mover advantage) or waiting to see how others perform before (e.g. gain more information). The overarching agreement however remains the usefulness of foreign market information provision by the public sector to both early

starters and laggards in view of the cost and externalities involved in gathering such export data privately.

Sustainability, moving beyond economic market failure: In explaining government involvement in export promotion, theories of economic market failure have mainly been applied (e.g. Lederman et al., 2010). These theories have mainly come from the macroperspective of government intervention in a free market without much distinctive consideration for the characteristics of the technology type being promoted. It is our argument in this report that the economic market failure does not integrate fully all aspects especially with regards to the characteristics of environmental technologies and the objective for which they are developed. The quest for sustainability (with emphasis on environmental and social benefits) could (should) perhaps be put forward as a theoretical justification for government intervention to promote the diffusion of environmental technologies across borders in addition to economic gains. To buttress this, environmental technologies are developed (especially end of pipe) to internalise the externalities from organizations and individuals activities. This may not necessarily refer to economic growth but rather to social and environmental welfare. This argument takes a step beyond attempts solely to correct market failure. This is rooted in the fact that achieving market efficiency does not guarantee sustainability; it only leads to export growth. In a world with finite resources, a second look has to be taken at government objectives in promoting environmental technology diffusion. Technology change (towards cleaner technology) is usually considered a necessity albeit not a sufficient condition for a transition towards sustainability (González, 2009). In extension observations from the empirical findings in selected countries indicate spots of cases in which environment technology export promotion programs have been evaluated with other indicators (e.g. energy and material savings) in addition to economic basis. These arguments cumulatively point to the fact that economic market failure does not cover in entirety the characteristics of environmental technology and government intentions as such to promote its diffusion through exports. A similar argument has been raised by Aghion et al., (2009) in a policy brief in which they reckon that economists have not tackled the debate on the transition towards green growth and climate change mitigation very well. They argue that technologies to mitigate climate change (environmental technologies) are treated as emerging spontaneously, ignoring the fact that the portfolio of technologies available tomorrow (and their geographical distribution) depends on policy interventions today. This points to the fact that, so far the market has not inherently proven to be capable of stimulating the innovation and diffusion of environmental technologies to the 'optimal' societal (Aghion et al., 2009; Jänicke & Zieschank, 2008). This intervention if directed towards only economic market failure does not guarantee sustainability for which environmental technologies are developed.

What about government intervention for environmental technology export promotion being justified (in addition to neo-classical economic market failure) by issues such as globalized economy and increased interdependence, globalized environmental challenges, natural resource depletion, equity (technology sharing, open source innovation), prosperity (things going well for us-the human race in general) (Jackson, 2009), among others?

6.2. Coordination between actors and their initiatives

A proliferation of promoters and their initiatives: With the reality of climate change no longer a contentious issue, the debate has shifted towards climate change containment through support instruments for green innovation and diffusion (Aghion., 2009). On the governmental level, a myriad of support organisations have emerged along the value chain of environmental technology innovation through to diffusion within and across national borders. As has already been highlighted this has been buttressed by the pressing desire for economic growth and some spots on sustainability. With the issue of economic growth high up global government agenda in recent times, a proliferation of public agencies have either been given the responsibility or taken it upon themselves to promote environmental technology development and diffusion as it holds potentially significant stakes in national competitiveness. This surge in the number of promoters and their initiatives is large and diverse and can be problematic for targeted SMEs. When the efforts and activities of the private sector are brought into the equation, the field becomes a forest with no clear pathways. The Swentec report (2008) misses no words in highlighting this challenge "the diversity of organizations that are working in the cleantech area is confusingly large". What has been the outcome of such proliferation of support choices to the targeted SMEs? To the targeted SMEs there is a wide spectrum of choice as to which public export promotion agencies (including export credit agencies) to turn to for help. This undoubtedly is a good indicator of freedom of choice but over a certain threshold, reconciling this myriad of choice with the inherent characteristics (lack of financial capital and skilled personnel) of SMEs, the proliferation of such governmental support organisations becomes actually a limiting factor to accessing support. The cost in searching for the 'right' governmental support may perhaps surpass the potential benefits (especially in the immediate term). Firms might get confused and decide not to seek any such help at all. In a related study by Lederman et al (2010), they reiterate a similar call. Arguing on which organisational structures of national export promotion actually 'work' they conclude a proliferation of dedicated export promotion agencies in a country (degree of decentralisation of agencies) is negatively correlated to exports . "A single strong export promotion agency seems to be more effective than multiple agencies with overlapping responsibilities". Their argument comes from the government perspective, where a myriad of organisations with overlapping responsibilities seem to have diffused efficiency between input and output. Our argument is from the firm perspective. Swentec (2008) also advocates the need to simplify and precisely clarify which public actors should do what in the innovation and diffusion of environmental technologies. Similar calls have been raised in most of the countries reviewed. In fact the question therefore is not whether or not coordination among promoters and their initiatives is necessary and/or beneficial but rather how to effectively design such a 'web' of export promotion systems. There have been recommendations about government agencies serving in a capacity as anchors directing SMEs to the 'appropriate' support organisations and not necessarily one big umbrella body which could risk the benefits of flexibility and the complications of bureaucracy. Challenges with dented image towards firms which have failed with previous attempts could also emerge in subsequent search for support through the anchor. Collaborations are needed between the public and private promoters and their initiatives and this should be based on mutual respect for each other's clearly defined role (Swentec, 2008).

6.3. Similarities and differences between action plans

SME focused: Globalisation has brought a shift to the economic environment of SMEs (EU, 2007). Barriers which previously confined SMEs to domestic markets are progressively disappearing and thus exposing all companies (both small and large) to new markets and international competition (EU, 2007; Etemad et al., 2001). Internationalisation is no longer thus regarded as a choice but a must for long term strategic growth (Etemad et al., 2001). The cleantech sector is however dominated by small and medium size businesses in Sweden (Swentec, 2008), Austria (Austrian Government, 2005) and perhaps in many other developed countries. These SMEs present an inherent mix of challenges and opportunities. In addition to the main constraints of their size (lack of financial resources, lack of information and lack of skilled human capital to tackle internationalization), they also hold a potential to long term national competiveness through job creation and export growth. Governments in the reviewed countries (Austria, Sweden and Denmark) recognising the dominance of SMEs in the environmental technology sector and have targeted export promotion activities towards them to assist them overcome the barriers in internationalization. Questions for researchers thus look pass the benefits of supporting cleantech SMEs into how to organise such support systems. Among other issues, considerations for the peculiar needs of cleantech SMEs (sector characteristics) and more importantly the unique characteristics of environmental technologies in their export promotion remain inconclusive. On the general level however, recommendations include focusing export promotion efforts on increasing the number of internationalised companies rather than on those with the largest export potential (EU, 2007). This could be achieved by tackling the peculiar challenges of small size which have been highlighted earlier on. In addition, the most effective form of export promotion should be individualised SME support and should evolve according to the company needs as its gathers resources and grows in size through course of internationalization (EU, 2007).

Differences in focus: Synthesis emerging from the action plans in Austria, Sweden and Denmark to promote environmental technology export highlights key differences in approach. In summary, Swedish initiatives among many focus on domestic technology and business development whiles attention is given to role of target market's policy instruments in Austria and Denmark. The objectives to these different approaches remains rather clear; In Sweden, the aim is intended to use the domestic market as a growth platform (and also for customer reference) and as a launchpad into international markets. In Austria and Denmark the objective is to give domestic firms a fore start (in technology development and diffusion) ahead of competitors from other countries. The arguments on the effectiveness or otherwise of each approach is rather inconclusive; if they are even mutually exclusive. Reiterating the significant role environmental policy instruments play in the diffusion of environmental technologies (especially end-of-pipe technologies) (Gonzalez, 2009) it is critically important to keep export oriented firms up to speed with such forthcoming policies in target markets. However, within the walls of the SMEs being able to identify export opportunities and take advantage of them goes beyond access to policy information. To some extent (if not largely) it also depends on the internal resources of the firm and the managerial entrepreneurship through local and international networks (Andersson, 2003). Firms in competitive markets who want to capture customers should be able to satisfy variant customer requirements

(within and between markets) with tailored offerings (Sakao et al., 2007). Offering should be marketed by business models adaptable to both local and foreign conditions suitable for products and services (Swentec, 2008). To lighten up the intersection, there is a complex ecosystem of interactions between such market pull and technology push initiatives (Cleantech group, 2012). Therefore the focus approaches discussed in Sweden and Austria & Denmark should not be regarded as necessarily mutually exclusive but rather one and complementary parts of a whole. Shifting towards hybridisation of such export promotion focus could potentially produce better export performance than their current individual output. The discussions should not end there; there could be tradeoff of inherent benefits associated with each individual focus and how the characteristics of environmental technologies type would influence the structure of a hybridised approach.

7. Conclusion and further research

Environmental technology change remains a necessity albeit not enough for a transition towards sustainability. This change is usually characterised into three major phases as invention, innovation and diffusion. The first two phase i.e. invention and innovation has received much attention within academic circles. On the contrary, the diffusion and commercialisation of environmental technologies especially across geographic borders in now entering the limelight as desires for economic growth and consequences of climate change continue to bite of various governments. The various initiatives, objectives and role of government agencies in environmental technology export promotion are not particularly clear. Even though a handful of institutional studies have attempted to undertake this clarification, they lack solid theoretical background explaining interactions among constructs.

As a point of departure, this study employs the economic justification of market failure as lenses to identify and analyse both scientific and grey literature discussions concerning governmental initiatives for environmental technology export promotion. Empirical findings indicate environmental technology export promotion is organised by one or a combination of the following in the reviewed countries: prioritized environmental technologies; prioritized countries; alternative services (e.g. information, financial, education & training, trade mobility related programs); firm size (small vs. large) and/or firm's stage in internationalisation. Concluding remarks from the study highlight lapses between current theory and practises. Recommendations are thus made for increased detailed market information provision related programs recognising its significant role in the diffusion of environmental technologies and the issue of externalities in foreign market information gathering. A look beyond current theoretical constructs is brought forth to reconsider the objectives of governmental initiatives to promote environmental technologies export. This look extends to cover other aspects of sustainability especially social and environmental benefits. However strong empirical evidence is needed to substantiate such arguments. In regards to the proliferation of export promotion agencies and their initiatives, calls are made for cleaning up through effective collaboration between actors and their initiatives based on mutual respect and clearly defined roles. With the regards to the action plans, different focuses on business and technology development within Sweden and the target on market policy information provision to firms in Austria and Denmark are regarded as one and part of a whole and could potentially be hybridised with synergistic benefits.

For further research, this study is rather seminal in the role governmental agencies play in the export promotion of environmental technologies. It is intended to help readers see the forest of trees and lay hands on the low hanging fruits. Questions and discussions need to come up. Further research as to, when, what and how to measure the effectiveness of such public support programs for environmental technologies are required. How the characteristics of environmental technologies have (or should) influence governmental promotion programs need to be investigated not forgetting the general characteristics of the sector. The discussions are far from over; perhaps they just started!

8. Bibliography

- AdvantageAustria. (u.d.). Available online at http://www.advantageaustria.org/se/ [Accessed November 2011].
- Aghion, P., Hemous, D., & Veugelers, R. (2009). No green growth without innovation. *Bruegel policy brief*. Available online at http://www.bruegel.org/publications/publication-detail/publication/353-no-greengrowth-without-innovation/ [Accessed August 21,2012].
- Andersson, S. (2003). Innovative Internationalisation in New firms: Born Globals-the Swedish Case. *Journal of International Entreprenuership*, 249-276.
- Andersson, S., & Newell, A. (2003). Information programs for technology adoption: the case of energy-efficiency audits. *Resource and Energy Economics*, 26(1), 27-50.
- Beltzér, C., & Zetterqvist, M. (2008). *An Evaluation of Swedish Export Promotion*. Master's Thesis. Stockholm School of Economics Institute of International Economics. Available online at arc.hhs.se/download.aspx?MediumId=544 [Accessed August 21,2012].
- Borooah, V. K. (2003). *Market failure An Economic Analysis of its Causes and Consequences*. Available online at http://www.borooah.com/Teaching/Microeconomics/Market_%20Failure.pdf [Accessed August 21, 2012].
- Bromley, D. W. (2007). Environmental regulations and the problems of sustainability: Moving beyond "market failure". *Ecological Economic*(63), 676-683.
- Cleantech Group. (2012). Coming Clean: The Global Cleantech Innovation Index 2012.

 Available online at http://www.wwf.se/source.php/1461631/Cleantech%20innovation%20report%202012.pdf [Accessed August 21, 2012].
- DFID. (u.d.). *Trade and Investment Analytical Papers*. Available online at http://webarchive.nationalarchives.gov.uk/+/http://www.bis.gov.uk/assets/biscore/international-trade-investment-and-development/docs/t/11-858-trade-promotion [Accessed August 21, 2012].
- Eksport Kredit Fonden. (u.d.). *EKF Cleantech Guarantee*. Available online at http://www.ekf.dk/en/WhatWeDo/Products/Pages/EKF-cleantech-guarantee.aspx [Accessed November 2011].
- Etemad, H., Wright, R. W., Dana, & Leo, P. (2001). Symbiotic International Business Networks: Collaboration between Small and Large Firms. *Thunderbird International Business Review*, 43(4), 481-499.

- EU. (2007). Supporting the Internationalisation of SMEs. Final report of the expert group. Available online at ec.europa.eu/enterprise/newsroom/cf/_getdocument.cfm?doc_id=3433 [Accessed August 21, 2012].
- Euler Hermes. (u.d.). Available online at http://www.eulerhermes.de/en//index.html [Accessed November 2011].
- Export-Import Bank of the United States . (u.d.). Available online at http://www.exim.gov/ [Accessed November 2011].
- Exportrådet. (u.d.). *Exportrådet-Swedish Trade Council*. Available online at http://www.swedishtrade.se/sv/om-exportradet/in-english/ [Accessed November 2011].
- Federal Ministry of Economics and Tehcnology. (u.d.). Available online at http://www.agaportal.de/en/portal/unsere_partner.html [Accessed November 2011].
- Fillis, I. (2002). Barriers to internationalisation-An investigation of the craft microenterprise. *European Journal of Marketing*, 912-927.
- Garanti-instituttet for eksportkredit. (u.d.). Available online at http://www.giek.no/ [Accessed November 2011].
- González, P. d. (2009). The empirical analysis of the determinants of technological change: A research agenda. *Journal of ecological economics*, 861-878.
- Heslop, L. A., McGregor, E., & Griffith. (2001). Development of a Technology Readiness Assessment Measure: The Cloverleaf Model of Technology Transfer. *Journal of Technology Transfer*, 369-384.
- Hoekman, B. M., Maskus, K. E., & Kamal, S. (2005). Transfer of Technology to Developing Countries: Unilateral and Multilateral Policy Options. *World Development*, 1587-1602.
- Institute for Prospective Technological Studies. (2004). *Promoting environmental technologies: Sectoral analyses, barriers and measures.* Technical report series. Report EUR 21002 EN. Available online at ec.europa.eu/environment/etap/pdfs/spc_finalreport_ipts.pdf [Accessed August 21, 2012].
- Jackson, T. (2009). Prosperity without growth: Economics for a finite planet. London: Earthscan.
- Jaffe, A. B., Newell, R. G., & Stavins, R. N. (2005). A tale of two market failures: Technology and environmental policy. *Ecological Economics*(54), 164-174.
- Jänicke, M., & Zieschank, R. 2008. Structure and Function of the Environmental Industry The hidden contribution to sustainable growth in Europe. Environmental Policy Research Centre. Available online at www.petre.org.uk/pdf/Janicke_Zieschank.pdf [Accessed August 21, 2012].

- Japan Bank for International Cooperation. (u.d.). Available online at http://www.jbic.go.jp/en/ [Accessed November 2011].
- Lederman, D., Olarreaga, M., & Payton, L. (2010). Export promotion agencies: Do they work? *Journal of Development Economics*(91), 257-265.
- Leonidou, L. C., Palihawadana, D., & Theodosiou, M. (2011). National Export-Promotion Programs as Drivers of Organizational Resources and Capabilities: Effects on Strategy, Competitive Advantage, and Performance. *Journal of International Marketing*.
- Moss, T., & Rose, S. (2006). *ChinaExIm Bank and Africa: New Lending, New Challenges*. Washington DC: Center for Global Development.
- Neuman, L. W. (2006). *Social research methods: quantitative and qualitative approaches.* Pearson Education, Inc.
- Nippon Export and Investment Insurance. (u.d.). Available online at://nexi.go.jp/en/[Accessed November 2011].
- OECD. (1994). *Export Promotion and environmental technologies*. OECD Environment Monographs No. 87. OCDE/GD(94)9. Available online at www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=OCDE/GD(94)9&docLanguage= En [Accessed August 21, 2012].
- OECD. (u.d.). *Official Export Credits Agencies Websites Links*. Available online at http://www.oecd.org/countrylist/0,3349,en_2649_34169_1783635_1_1_1_1_1,00.html . [Accessed November 2011].
- Oesterreichische Kontrollbank Aktiengesellschaft. (u.d.). Available online at http://www.oekb.at/en/Pages/default.aspx. [Accessed November 2011].
- Padilla, E. (2002). Intergenerational equity and sustainability. *Ecological Economics*(41), 69-83.
- Sakao, T., Shimomura, Y., Comstock, M., & Sundin, E. (2007). A method of Value Customization. *Strojarstvo*, 49(2), 99-108.
- Swedish Environmental Protection Agency. (2004). Local Investment Programmes-Environmental Technology for Export. A summary of local investment programme projects with potential for transfer to Eastern Europe and developing countries. Swedish Environmental Protection Agency. Available online at http://www.naturvardsverket.se/Documents/publikationer/620-5424-4.pdf. [Accessed August 21, 2012].
- Swentec. (2008). Action Plan for Swedish Cleantech.

- Swentec. (2008). Swedish strategies and initiatives for promotion of environmental technology-A national roadmap for the implementation of the EU Action Plan for Environmental Technology, ETAP.
- The Austrian Government. (2005). Master Plan Environmental Technology-The future of Austrian Environmental Technology.
- The Danish Government. (2007). Danish solutions to global environmental challenges: The government's action plan for promoting eco-efficient technology. Copenhagen: The Danish Environmental Protection Agency. Available online at http://ec.europa.eu/environment/ecoap/pdfs/roadmaps/denmark_en.pdf [Accessed August 21, 2012].
- The Danish Government. (2010). Environmental technology for improvement of the environment and growth: Action plan to promote eco-efficient technology 2010-2011.

 Available online at http://www.ecoinnovation.dk/NR/rdonlyres/BBD1582D-DF55-4799-94B2-FBE4BDBB8053/0/Miljoeteknologi_plan_2010_engelsk.pdf [Acessed August 21, 2012].