

The Influence of Legislation on the Location of Chemical Industries



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Foreword

This report was commissioned to the Stockholm Environment Institute (SEI) by the Swedish Chemicals Agency (KemI) in order to research the links between chemicals management legislation and relocation decisions of the chemical industry. The responsibility for its content rests entirely with the authors. The views herein shall not necessarily be taken to reflect the official opinion of KemI.

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Summary

The aim of this report is to analyse if and how chemicals legislation influences companies in the chemicals industry in their relocation and establishment decisions. The focus has been on the type of legislation proposed in the *Guidance on the Development of Legal and Institutional Infrastructures for Sound Management of Chemicals and Measures for Recovering Costs of National Administration* in short the LIRA Guidance. This guidance has been developed by UNEP to assist developing countries and countries with economies in transition to improve the regulatory framework for national chemicals management.

The legislative environment in a specific country or region is only one of many factors that influence companies' relocation and establishment decisions. The academic literature distinguishes three types of factors affecting relocation decisions: 1. *Firm internal factors* (e.g. management structure, firm size and organisation), 2. *Location specific factors* (e.g. distance to suppliers and markets, local government policies and available space for expansion), and 3. *Firm external factors* (legislation and policies, labour market, general economic development). From the studies reviewed it is concluded that relocation factors are to a certain extent sector-specific, and that the chemicals sector is reported to be one of the sectors that are more prone than others to relocate. Suggested reasons for the relative mobility of the chemical industry include the fact that the sector consists largely of multinational firms that move their operations to access new markets or raw materials in other countries. Looking at the relative importance of different relocation factors, it seems that access to markets (location specific factor) and cost savings (location specific and firm external factors such as wage levels and taxes) are important drivers for relocation, whereas national regulation is seen as a minor factor.

Turning to effects of environmental regulations on relocation decisions, evidence on the Porter hypothesis, the pollution haven theory and the race to the bottom hypothesis was reviewed. The conclusion was that there is no scientific consensus on the validity of these hypotheses. Several researchers call for disaggregation into different categories of regulations and different sub-sectors of industry in order to attain unambiguous results. However, also in the more disaggregated studies, no clear evidence was found in the literature. When looking more specifically at legislation on chemicals management, the academic literature became scarcer, and had to be complemented with reports commissioned by governments and the private sector. Again, the literature emphasises the need to disaggregate and look at specific regulations and specific sub-sectors. Doing so, the studies reviewed show that regulations will always have an impact on the competitiveness of some sector or sub-sector, but the relative importance of this impact for relocation was not considered in these studies. The mid-term evaluation of the European REACH regulation add some information on the relative importance of regulations for relocation. Companies interviewed for the evaluation state that they found REACH burdensome, but not a driver for relocation for the chemical sector in general.

The conclusion that chemicals management legislation is of minor importance for decisions on location of companies in the chemical industry was supported by the set of interviews carried out for this report. The industry association representatives interviewed all stated access to markets and feedstock as the most important factors impacting relocation and new establishment. Production cost savings were stated as next in importance among the different factors affecting relocation. In addition, all interviewees claimed that a clear and predictive regulatory framework for chemicals management is an asset for business in any location and not a push factor for relocation.

Sammanfattning

Som ett led i genomförandet av SAICM (Strategic Approach to International Chemicals Management, en global kemikaliestrategi som antogs 2006) är många länder i färd med att bygga upp eller förbättra sina nationella system för kemikaliekontroll. För att bistå främst utvecklingsländer och länder med övergångsekonomier med detta har UNEP tagit fram en vägledning om utveckling av lagstiftning och institutionella strukturer för förebyggande kemikaliekontroll (LIRA Guidance, testversion 2012).

Syftet med denna rapport var att analysera om och hur kemikalielagstiftning i linje med UNEPs vägledning påverkar beslut om nyetablering och omlokalisering inom den kemiska industrin. Utifrån en litteraturstudie och intervjuer med företrädare för näringslivet drar författarna slutsatsen att införande av lagstiftning på kemikalieområdet inte driver omlokalisering eller hindrar nyetablering av företag inom den kemiska industrin. De faktorer som fanns vara av stor betydelse för omlokaliserings- och nyetableringsbeslut är närhet till marknader och råvaror.

1 Introduction

1.1 The chemicals industry and chemicals management legislation

The chemicals industry constitutes one of the largest industrial sectors with over 10 million employees worldwide (Jenck et al. 2004) and a global output valued at USD 4.12 trillion (UNEP 2012). There is rapid growth in the sector, which is characterized by increased volumes of chemical production and use, especially in developing countries (UNEP 2012). Within the chemicals sector, chemicals are sold directly to consumers, but also used in manufacturing of other products by downstream industry users. Chemicals become waste, both as chemical products and as part of products, and as such they present disposal challenges. The focus of this report is the part of the chemicals industry which produces or imports chemicals¹. These companies are in general large global actors with industrial activities in many countries.

Chemicals are an integral part of human society. Appropriate management in order to avoid risks associated with the production, use and waste of chemicals is essential. The socio-economic costs of an inappropriate chemicals management are significant, as are the benefits from creating sound chemicals management at national level (UNEP 2012). Although most countries in the world have some legislation in place to regulate chemicals management and to reduce the risks associated with the same, there are many cases of gaps in the legislation creating uncertainties for the market actors, and also a large general gap between legislation in developed versus developing countries and countries with economies in transition. This legislative gap was one of the drivers behind the development of the Strategic Approach to International Chemicals Management (SAICM), adopted in 2006. SAICM provides a framework to guide efforts to achieve the Johannesburg Plan of implementation goal that, by 2020, chemicals will be used and produced in a way that minimizes the risks for human health and the environment (SAICM 2006).

The SAICM policy framework includes the Dubai Declaration on International Chemicals Management and an Overarching Policy Strategy. The first expresses the high-level political commitment to SAICM and the latter sets out its scope, needs, objectives and implementation and review arrangements. SAICM also includes a Global Plan of Action with several hundred activities, also including actions that require changes in national legislation (SAICM 2006).

To assist countries in implementing SAICM the UNEP DTIE Chemicals Branch has developed guidance for national chemicals management legislation called *Guidance on the development of Legal and Institutional infrastructures and measures for Recovering costs of national Administration*, in short the LIRA Guidance (Test Version UNEP Chemicals 2012), with financial support from the Swedish International Development Cooperation Agency (Sida) and technical support from the Swedish Chemicals Agency (KemI). This guidance is now being tested in several countries. The LIRA Guidance emphasizes the importance of national regulations to ensure safe chemicals management, and describes how to put in place legislation and infrastructure that enables the sound management of chemicals at the national

¹ Apart from chemical producers and importers, the chemical industry also includes for instance distributors, retailers and down-stream users of chemicals. For an overview of the chemical sector, see UNEPs report Global Chemical Outlook (2012) or the ICIS Chemical Business analysis of the chemical markets with the top 100 chemical companies 2012 (ICIS 2012).

level with a focus on the placement of chemicals on the market, i.e. upstream in the life-cycle of chemical production and use.

The LIRA Guidance emphasizes the importance of creating a clear division of responsibilities and obligations between the governments on the one hand, and chemical producers, importers and distributors on the other hand. A clear allocation of roles and responsibilities for the tasks involved in the chemical management legislation defines the distribution of the costs incurred. Example of responsibilities that can be given to the private sector actors are, for producers/manufacturers:

- Pre-marketing testing and classification
- Labelling and development of Safety Data Sheets
- Updating the information when required

For importers/distributors:

- Conveying information provided by producers/manufacturers to downstream actors
- Informing downstream actors in case of new information on chemical hazards and risks is identified.

The above mentioned responsibilities imply costs for companies. To further shift the public costs of managing chemicals from government budgets to private sources, LIRA includes advice on measures for recovering costs for national administration. Implementing such legislation will also result in positive effects to industries in terms of meeting international product standards and improved reputation together with reduced risks with chemical production and use.

1.2 Aim of the report

The aim of this report is to analyse if and how chemicals legislation that allocates certain responsibilities to the private sector influences companies in the chemicals industry in their location and relocation decisions. The legislative environment in a specific country is only one of many aspects that influence companies' relocation and establishment decisions. Among the many policy and regulatory frameworks that companies are facing, chemicals legislation constitutes only one part. This report tries to establish the relative importance of chemicals legislation versus other factors influencing relocation and establishment.

The main question discussed in this report is:

Which are the factors driving companies that produce or import chemicals to relocate their production or establish production in a new country, and in particular, to what extent are these companies affected by countries' legislation in the chemicals area, in particular linked to the legislation structure recommended in the LIRA Guidance?

1.3 Methodology

The report primarily builds on a review of the existing academic and grey literature, mainly consisting of firm relocation and location literature, with a particular focus on the chemicals industry. Additionally, interviews with four industry association representatives were carried out (Annex A). Industry associations rather than company representatives were chosen for interviews in order to collect the views representing more than single firms. The interviewees

were given the opportunity to comments on the draft section on the interview answers of this report.

The search for existing literature was made mainly through web search in Google, Google Scholar and Stockholm University library's database. The literature reviewed included journal articles, industry reports, country status reports, position papers, reviews, working papers and news. The search parameters used included the following search terms in different combinations:

- Firm/company relocation and location
- Chemical industry/sector
- Environmental regulations
- The pollution haven theory
- The Porter hypothesis
- The race to the bottom hypothesis
- REACH evaluation
- Offshoring/outsourcing
- Agglomeration

The main focus of the report is on *chemical producers and chemical importers*. These stakeholders are more than other parts of the chemical industry directly concerned by the upstream activities that are recommended for legislation by the LIRA Guidance.

The report looks at *relocation* and *new establishments* of companies. Relocation can either involve the movement of an entire company from one region to another, or affect only a segment of the production. It can also arise through agreements between partner firms, such as joint-ventures or subcontracting (Brouwer et al. 2004), and/or within multinational enterprises. Various authors use the concept differently. This report follows the approach used by several other researchers (e.g. Brouwer et al. 2004) and includes both movement of entire companies and relocation of parts of the production in the concept "relocation". New establishment refers to a company establishing new activities in a country without closing down business in an earlier location.

1.4 Outline of the report

The report starts with an overview of factors influencing the decisions of companies to relocate in general. Thereafter it reviews available research on the effects of environmental and chemical legislation on company relocations and new establishments. Lastly, the report presents views of industry on the effects of chemical legislation in line with the LIRA Guidance on the relocation and establishment decisions on the chemical industry.

2 General factors influencing company relocation

2.1 Overview of factors affecting relocation

Relocation and movement of companies have increased over time. Globalisation and competition are forcing companies to improve competitiveness through relocation (Sleuwaegen and Pennings 2006), and search for foreign inputs, partners and markets (Contractor et al. 2010). Consequently, countries are increasingly faced with the movement of companies (and thereby fluctuations in employment opportunities and tax income). Being an issue of political significance, firm relocation and location has also been subject to academic research at least since the 1950s (Pellenbarg et al. 2002).

The literature in the field lists and describes a range of factors that influence firms' decisions to relocate their production. The factors are sometimes referred to as Push, Keep and Pull factors, depending on the effect they have on companies' willingness to stay in a certain location. Relocation factors are also often grouped into three main categories (Van Dijk and Pellenbarg 2000):

- Firm internal factors (such as management, organization and size)
- Location specific factors (sub-national factors specific to the local context such as distance to suppliers and markets, local government policies and available space for expansion)
- Firm external factors (factors at national level, such as changes in market demand or supply, labour market, government policies including environmental and chemicals legislation, and general economic conditions)

These three categories will be used for the literature review below.

2.2 Firm internal factors

When it comes to firm internal factors, the *size of the company* is one of the recurring issues investigated in the literature. The findings linked to company size are somewhat contradicting. Brouwer et al. (2004) concludes that large and old firms are unlikely to relocate, whereas Sleuwaegen and Pennings (2000) and as well Potamianos (2000) argue that larger companies are more likely to relocate. Looking further into the different sources, we find that Brouwer et al (2004) refer to behavioural theory when first formulating their hypothesis that larger firms are more unlikely to relocate. Behavioural theory suggests that moving costs and organisational problems associated with relocation are considerable for large firms (van Dijk and Pellenbarg 2000).

Smaller firms are also thought to be more willing to relocate for several reasons as they have less demanding premise requirements and less capital investment to write off and because they make a series of small locational adjustment compared to large firms which instead make infrequent large locational changes (Brouwer et al. 2004).

The study by Brouwer et al. (2004) analyses the determinants of firm relocation behaviour in twenty-one countries during the period 1997-1999, resulting in the finding that firms with more than 1500 employees are most immobile, which is explained by high costs in site

relocation and high costs in engaging large number of new employees. The data set includes only firms with more than 200 employees, including private and public firms in different countries in Europe, Australia, New Zealand, Japan and the USA, among which the firms in Northern Europe had a somewhat higher response rate than those in Southern Europe.

Both the Pennings and Sleuwaegen (2000) and the Potamianos (2000) studies included only Belgian firms. It is possible that there may be higher representation of companies in certain industrial sectors in the Belgian samples, which also may affect the results. Other factors such as specific policies in Belgium may also have contributed.

Further, the Pennings and Sleuwaegen (2000) sample included companies with 20 or more employees, compared to the Brouwer et al. (2004) study which included firms with more than 200 employees. It is plausible that up to a certain size, larger companies are more willing to relocate compared to smaller ones – it may require a certain size for companies to even have the capacity or interest to relocate – whereas beyond a certain size, companies may be more unwilling to relocate due to the factors suggested by Brouwer et al. (2004). Further, relocating entire firms is likely easier and less costly for small firms, whereas relocating only parts of the production is likely easier for larger firms. A further observation by both Pennings and Sleuwaegen (2000) and Potamianos (2003) is that companies belonging to *multinational groups* are more likely to relocate than national companies. Placing parts of production in other countries than where the headquarters are based can be part of the business strategy for multinational companies, where production may either be placed in another country, in a subsidiary of the multinational companies or allocated to a foreign contract vendor (Contractor et al. 2010).

Chemical producers are in general both large and multinational. It can be concluded that even if the firm size literature shows contradicting results, *chemical producers, being multinational companies, belong to a group that would be expected to relocate more than firms that are not multinational.*

Pennings and Sleuwaegen (2000) also point out that *labour intensive firms* are more likely to relocate than capital intensive, which may partly explain their results that large firms are more likely to relocate. This is further confirmed by Potamianos (2000). Reducing costs, in particular for labour intensive firms by relocating parts of their production to countries with lower salary levels is one of the most important drivers behind relocation (Liemt 1992). In these situations, it is often certain segments of the value chain that are being relocated. *Previous migration* also seems to be important. Companies that have relocated earlier are more likely to do so again (van Dijk and Pellenbarg 2000).

The *development phase of a company* may also influence relocation decisions. It has been suggested that old firms are less likely to relocate (Brouwer et al. 2004) and that sectors with fixed, non-recoverable costs (such as production plants or laboratories) also are less likely to relocate (Potamianos 2000). Furthermore, relocations may often be a result of *acquisitions, mergers, and take-overs* (Brouwer et al. 2004). All of these factors are the consequences of *external growth*. As pointed out by Brouwer et al. (2004), the literature suggests that mergers or acquisitions can be alternatives to relocation but as they found in their own study, this can also trigger relocation. They further found that firms with increasing or decreasing number of employees are more likely to relocate than ones with a stable number of employees. Pellenbarg et al. (2002) point out that firm growth is the most important reason behind relocation, and Potamianos (2007) argue that profitable companies tend to be more likely to relocate.

In a review of studies of relocation of the EU industry, Györffi and Oren (2006) found that the following *sectors are particularly sensitive for relocation*: textiles, clothing and leather, electromechanical engineering, and the chemical/pharmaceutical sector. The Györffi and Oren (2006) study does not provide a thorough explanation for why these sectors would be more sensitive to relocations, but suggests that cost savings is a main reason why the companies have been choosing to relocate their production in the past. Van Dijk and Pellenbarg (2000) found that firms in food service industry and in retail show slow interest in moving, which makes sense since the closeness to customers is of importance to companies in this sector.

Historically, it was mainly *low end manufacturing* that was located to low cost countries, however, more lately, also *high value functions* like R&D, design and engineering are being placed in developing countries (Maskell et al. 2007, UNCTAD 2005a, UNCTAD 2005b). This is also supported by for example Györffi and Oren (2006). They point out that for example in the textile industry, it was originally mainly labour intensive production that was relocated, but in the beginning of the 21st century, relocation has been taken place also in more technological or more capital intensive production units. This trend may also affect the chemicals industry, but no specific studies on this were found.

2.3 Location specific factors

Location specific factors include aspects such as the distance to suppliers and markets and other conditions such as local infrastructure and availability of space for expansion. Cost savings has been a very important driver for companies to relocate their production in the past. But more recently, factors such as *access to new markets* have become a more important driver (Contractor et al. 2010, UNEP 2012). Relocation abroad helps companies better understand and exploit foreign markets (Contractor et al. 2010). Weterings and Knobén (2012) also support the argument that closeness to markets plays an important role for company relocations. Like many other factors, also this one is likely more important for certain industrial sectors than others. Brouwer et al (2004) point out that firms that serve larger markets tend to relocate more often. Again this links back to the earlier findings of multinational chemical industry being among those that relocate more easily than others.

Also for the location factors, authors have found different, and somewhat contradicting results. The study by van Dijk and Pellenbarg (2000) for example found that the characteristics of the present location play only a limited role. Van Dijk and Pellenbarg found that infrastructure variables such as closeness to roads and public transportation was not an important factor for companies to relocate, which is perhaps somewhat surprising since accessibility has been identified as an important location factor in many other studies.

Location factors may affect firms differently depending on where in the development phases they are for the moment. A newly started company may for instance be more dependent on a social network in the vicinity, whereas an older more established company may be more willing to relocate in order to save costs (Stam 2009).

Weterings and Knobén (2012) also suggest that *R&D expenditures* in the region make the region attractive for companies to stay. The knowledge motive is also a factor which is growing in importance for companies to relocate – with growing complexity of products and services, even the largest companies don't have all the knowledge required within their own organisation but need to reach for this knowledge elsewhere (Contractor et al. 2010). In a study (UNCTAD 2005a) analyzing the Chinese case, both as a recipient of investment and an investor in other countries, it was found that one of the strongest reasons for Chinese R&D

industry investment in developed countries is the availability of inputs such as technology and skilled staff, as well as the possibilities to observe and learn from the knowhow of R&D industries in these regions. Relocation to developing countries, such as Iran or Chile is carried out mainly to be able to access the market and raw materials (UNCTAD 2005a).

Another line of research looks at the “agglomeration mechanism”, which means that companies preferably relocate to areas where there are already other similar industry establishments. The reason for this could be for instance the availability of workers with specific skills (labour market pooling), customer-supplier relationships (input sharing) and the use of similar technologies (knowledge spill-over) (Jofre-Monseny et al. 2011, Rosenthal and Strange 2001). This seems to be an important factor for the chemicals sector, for instance the Petrochemical sector is reported to have a legacy of cluster-like linkages between companies and that these linkages are now being used to improve competitiveness (Ketels 2007). Another recent private sector report states that there are large gains for the chemical industry to be made through, not only agglomerating, but through deepened collaboration across the entire value chain (AtKearney 2012).

2.4 Firm external factors

Firm external factors include the general economic development in a country or a region as well as changes in demand and supply of products, materials or work force needed for the production. It also includes all government policies and regulations including their level of implementation. Among the policy fields of interest tax levels, labour market regulations, trade regulations and environmental legislation can be mentioned. The next sections of this report deals specifically with legislation in the field of environment and chemicals, therefore these aspects are not covered here.

Also issues of *corruption and poor governance* can be of importance. One study on governance and foreign investment conclude that poor governance has larger deterrent effect on small companies than on large, and their analysis is that this is because larger companies have higher bargaining power to make demands on the government of the country and thus look after its interests (Lskavyan and Spatareanu 2008).

Wages and market potential of the host region was found to be important for the relocation decision of enterprises in a Belgian study (Sleuwaegen and Pennings 2006) as well as in a US study of relocation between states (Campbell III 1996). In the US study the *wage rate and the tax rate* was the two most important push factors (Campbell III 1996). Also external factors such as *climate change* may be regarded as a push-factor for companies, forcing them to relocate (Linnenluecke et al. 2011).

No studies of aspects other than the legislative factors were found of importance for the chemicals industry. Effects of legislation on relocation are described in chapter 3.

2.5 Relative importance of different factors

Several studies have tried to assess the relative importance of the different factors. One study have for example found that *firm internal factors* are more important than *location factors* for decisions to relocate (Van Dijk and Pellenbarg 2000; Pellenbarg et al. 2002). This study concludes that no impact of government policy on relocation could be found, but that this finding needs further investigation to reach more conclusive results. Further, firm internal

factors seem to be of particular importance for small companies in their relocation decisions, compared to large companies.

However, Brouwer et al. (2004) suggest that the most important reason behind firm relocation is *the need for more suitable premises (i.e. a location factor)*. The second most important reason is suggested to be *cost savings* – firms take advantage of favourable cost conditions in other locations such as different wage levels, scale economies, energy prices and local incentives, and third, firms are also pushed to move by government policy through subsidies, a strategy which has according to Brouwer et al. (2004) been adopted in most industrialised countries since the 1950s.

It should be pointed out, that the different factors have different importance, depending on what type of relocation it is. Weterings and Knoeben (2012) for example conclude that *short distance relocations* – within municipalities and labour market regions, are highly influenced by company growth, whereas relocation choices for firms that look for new labour market regions are much more affected by regional conditions. They also conclude that these findings are likely due to short distance relocations are mainly driven by the need to find the room to accommodate the firm's growth, whereas long distance relocations are more linked to opportunities in the new regions. Here, they point out, that whereas several studies have found that high growth leads to relocations, long distance firm relocations are not caused by high growth but more related to regional characteristics.

The conclusions that cost savings are important and that the reviewed literature did not find proof for impact of legislation on relocation may be relevant for the chemicals industry too, although the level of evidence in these few studies have to be considered low.

2.6 Conclusions

In summary, the literature in the area points at some factors of importance for the propensity to relocate. Among the *firm internal factors*, certain sectors are more likely to relocate, e.g. chemicals, textile and ICT sectors. Multinational companies with established activities in several countries are more likely to relocate between countries than national firms. Looking at *location specific factors*, the access to markets and closeness to similar businesses seems to be a main factor driving relocation. For the *firm external factors*, for instance wage levels have been marked as important factors driving relocation.

In all, it can be concluded from the reviewed literature that:

- The relocation propensity is sector specific and the chemicals sector is found to be one of the more relocation prone sectors.
- Multinational firms are more prone to relocate than national firms. This applies to the chemical producers that are to large extent multinational companies.
- Location specific factors such as access to markets, closeness to similar business (agglomeration) and costs savings are important drivers for relocation. This conclusion is likely to apply for the chemicals industry.

3 Effects of environmental and chemicals legislation

3.1 An overview of the research field

Having reviewed literature on general relocation factors, the report now turns to one specific area, environmental and chemical legislation as a relocation and establishment factor. The research field includes various areas of study and has called upon researchers of different disciplines to contribute to the body of knowledge. In his book the “Competitive advantage of nations” (1990), Porter suggested that countries will provide their industries with competitive advantage by imposing strict environmental legislation. Companies will then have to develop and implement pollution prevention and greener technologies, which will be advantageous once other countries implement similar environmental policies. This has been called the “Porter hypothesis”. Oponents to this hypothesis, state that companies in developed countries are attracted by the laxity in environmental regulations of developing countries, and therefore relocate production to such countries. This is known as the “pollution haven” theory. Another concept that has been explored is the “race to the bottom”, suggesting that countries are driven to cut regulations, taxes and standards in order to accommodate the large companies’ perceived interest in lax regulations. This section first looks at the literature on these theories and concepts and thereafter some specific findings from the European experience are reviewed.

3.2 The Porter hypothesis

The Porter hypothesis suggests that strict environmental regulation triggers the discovery and introduction of cleaner technologies and environmental improvements, the innovation effect, making production processes and products more efficient. The cost savings thus achieved are supposed to be sufficient to overcompensate for both the compliance costs directly attributed to new regulations and the innovation costs. According to this hypothesis, investments in pollution prevention are better than investments in pollution control as means for cost saving and efficiency. Pollution prevention investments imply investments targeting earlier steps in the manufacturing process, investments that will avoid pollution to occur, as opposed to pollution control investments that are rather trying to decrease emissions just before they are emitted into the environment.

Different studies reach different conclusions regarding the Porter hypothesis. Broberg et al. (2010) for example, finds no support for the Porter hypothesis and suggests a number of reasons behind this: 1) there is no relation between firm efficiency and environmental protection investments; 2) the size of environmental protection investments is small compared to other investments and it can be difficult to isolate the effect of regulation from other effects of other much larger non-environmental investments; and 3) the effect of environmental protection investment may be visible only over a longer period of time than what was possible to include in the study.

Ambec and Barla (2005) conclude, after a review of literature discussing the Porter hypothesis, that there is “only scanty, weak evidence to date showing that environmental regulations stimulate innovation activity”. They also found that much evidence was pointing towards environmental regulations having a negative impact on productivity. Along the same line, Mulatu et al. (2004) find evidence for the hypothesis that stringency of environmental

regulation is a source of comparative disadvantage in dirty industries, when studying U.S, German and Dutch industries. For the Netherlands, no such link was found, except for on an industry level study, when they found a correlation for wood and fabricated metal industries. For a country where a specific production factor is scarce, and the industry intensively uses this factor, even a modestly stringent environmental regulation will evoke a decline in net exports. Industries that instead are intensive in production factors that are abundant in the countries studies show resilient export performances also with strict environmental regulation, which is the situation for example the food, chemical, and non-metallic mineral industries in the three countries studied.

Costantini and Mazzanti (2012) however, do find support for the Porter hypothesis when studying the export dynamics of the EU member states over the period 1996-2007, during which, they argue, environmental policies have seemed to foster export rather than undermine competitiveness of EU industries in international markets. However, they also point out that the Porter hypothesis is not to be taken for granted, and that it is both sector specific and policy instrument specific. The effect of environmental taxes, they find, does not stand in conflict with export performances and in some cases they even enhance exports. In particular, high tech industries seem to be particularly positively influenced. Export competitiveness seems to benefit most when the regulatory framework is followed by private sector innovation efforts.

In a study of the effect of German environmental regulation on the competitiveness of the German manufacturing industries, Triebswetter and Hitchens (2005) find that the existing regulations did not prevent any firm from achieving internationally competitive performance. Rather, environmental policies seem to have led to positive employment and productivity effects together with environmental benefits.

Ashford and Heaton (1983) reviewed the effects of regulations on technological innovation in the chemical industry. One of the conclusions is that the large variety of different types of regulations as well as the heterogeneity of the chemical industry demands a certain disaggregation if we would like to understand the effects of regulations on innovation. The authors suggest that, from a US perspective, a distinction should be made for different types of regulations: 1. Government premarket approval of new chemical substances, 2. Process control (including workplace technologies and emission control), and 3. Existing products. Regulation under these three types will affect competition and innovation differently in different types of companies in the chemical industry. Strong regulations under the TSCA (Toxic Substances Control Act) in the first category did for instance negatively impact competitiveness in small, new or specialty companies in the US, partly because there was not a simultaneous regulatory effort directed at existing substances and products in the second and third category of regulations (Ashford and Heaton 1983). On the other hand, the authors also note that in general, the small, new and specialty firms are the ones that can respond quickly and achieve new market opportunities under new regulations.

Ahsford and Heaton also discuss the long term implications of regulating the chemical sector. They state that regulations will always affect the market conditions and may force some companies out of business, but that this is a part of the market economy functioning and that the long-term consequences maybe positive even if there are short term competitiveness problems for some types of companies. A long-term consequence could for instance be the effect on product evaluation if companies are driven by regulation to employ more toxicologists and analytical chemists than they had before (Ashford and Heaton 1983).

Broberg (2010) also found a positive dynamic effect on efficiency in the *chemical industry* linked to investments in waste pollution prevention. Lanoie et al. (2008) suggest that the Porter hypothesis is most relevant for sectors that are comparatively more exposed to international competition such as pulp and paper, *chemicals* and basic metals. Aldy and Pizer (2011) find negative effects on the most energy intensive industries in a study of competitiveness effects of climate change policies on energy intensive industries in the US.

Frohwein and Hansjurgan (2005) reviewed the Porter hypothesis and the chemicals regulation in a European context. Also they conclude that a regulation of the new REACH, see 3.5, character will have different impact on different segments of the chemical industry, of which some may experience negative impact on their competitiveness (Frohwein and Hansjurgans 2005). Ackerman and Massey, on the other hand, conclude in a pre-assessment of REACH that it will not harm the level of innovation in the chemical sector, but rather boost innovation and competitiveness (Ackerman and Massey 2004).

In summary, there is both support for and evidence against the existence of a Porter effects on the chemical industry. Considering the many authors that point out that the heterogeneity in the chemical sector makes aggregated conclusions difficult to draw, it seems appropriate to conclude that effects on the chemical industry by environmental and chemical legislation will differ between subsectors of the industry and between different policy instruments and parts of regulations.

3.3 The pollution haven theory

Regarding the pollution haven theory, stating that companies in developed countries are attracted by the laxity in environmental regulations of developing countries, and therefore relocate production to such countries, studies conducted from the early 1990s to the present have produced mixed results. Tobey (1990), Jaffe (1995) and Cole et al. (2005) find no evidence to suggest that the stringency of a country's environmental regulations influences investments in polluting industries. Manderson and Kneller (2011) studied multinational companies, focusing particularly on the heterogeneous firm behaviour and looking at FDI outflows. They found that UK firms that find it costly to comply with environmental regulation are not more likely to establish foreign subsidiaries than those with low environmental compliance costs. They also find that multinational companies with high environmental compliance cost do not have a greater tendency to locate subsidiaries in host countries with lax environmental policy, compared to low cost multinationals.

In a study of how environmental regulation affected trade pattern between China and EU, Marconi (2012) found no support for the pollution haven effect. She found that EU member countries had kept or improved their competitiveness with respect to China in both water polluting industries and air-polluting industries (such as basic metals and *chemicals*) but lost competitiveness in more mobile and clean industries (such as communication equipment and office-and computing machinery). She explains this latter result by labour cost differentials and higher capital accumulation in China. The *chemicals industry* was in this study one industry where the EU industry had improved its relative comparative advantage compared to the Chinese industry.

Authors who do not find support for the pollution haven hypothesis search for explanations as to why more widespread evidence of pollution havens has not been found despite the predictions of many theoretical studies (Pethig 1976, Chichilnisky 1994, Taylor and Copeland 1994). One such argument is that although environmental compliance costs appear large in

absolute terms, as a proportion of a firm's total costs they are often less than 2% (Walter 1982, Walter and Ugelow 1979, Tobey 1990, Dean 1992, Massey and Ackerman 2012). Hence the loss of competitiveness in developed countries associated with the implementation of more stringent regulations may be quite minimal. Other explanations of the limited evidence of the relocation of firms include the dependence of heavy industries on home markets; the fact that countries with lax regulations may have certain other characteristics which deter inward investment such as corruption, poor infrastructure and uncertain or unreliable legislation.

However, in contradiction with the above, there are a number of studies that do indeed find support for the pollution haven hypothesis. Taylor and Copeland (1994) find that both trade and investments are influenced by pollution regulations. Yet, they also conclude that while there is evidence of a pollution-haven effect, this is only one of many factors affecting trade patterns and there is no evidence suggesting it would be the dominant factor. Environmental policies, they point out, do have cost and competitiveness effects but so do all domestic policies. Along the same line, Poelhekke and Ploeg (2012) found evidence that in the sectors of natural resources extraction and refining, construction, retail, food processing, beverages and tobacco, a less stringent environmental policy in the host country significantly attracts Foreign Direct Investment (FDI). But they also conclude that it may not be legislation per se but the government's capacity to enforce it that contributes to this effect.

On the same line, Brunnermeier and Levinson (2004) concluded, after a review of the literature on the pollution haven hypothesis, that there are statistically significant pollution haven effects, regardless of whether the studies examine across countries, states, counties, or industries, or whether they examine plant locations, investment, or international trade patterns. In addition, a study of import–export ratios for dirty industries by Mani and Wheeler (1998) found evidence of temporary pollution havens, and Birdsall and Wheeler (1993) and Lucas et al. (1992) found that the growth in pollution intensity in developing countries was highest in periods when OECD environmental regulations were strengthened.

Antweiler et al. (1998) studied the impact of trade liberalization on city-level sulfur dioxide concentrations and found some evidence of pollution haven pressures, a result supported by a complementary study by Cole et al. (2006). Van Beers and Van den Bergh (1997) also found evidence to suggest that regulations influence trade patterns. Clapp warned that although companies the pollution haven hypothesis does not hold in general, it may be valid for the most hazardous industries where foreign investments in developing countries had increased at the time of that study (Clapp 1998).

In response to the contradicting results, Manderson and Kneller (2011) point at the importance of studying within-sector differences in firm characteristics when trying to study the pollution haven effect. Others have also tried to disaggregate sectors and sub-sectors. Yet, also studies on a sectoral level reach different results. Kellenberg (2009), for example, concluded in a study about the pollution haven hypothesis that although one might expect that mining, utilities, *chemicals* or primary and fabricated metals would be driven to pollution havens, he finds that it is rather the sectors food, machinery, and electrical equipment, appliances and components that are negatively influenced by environmental policy. As an explanation, he suggests that capital intensive industries, industries with large fixed costs or industries with high trade costs are not very willing to move for environmental cost that are small compared to overall costs of operations.

Poelhekke and van der Ploeg (2012) find quite different results. In their study, it is rather the capital intensive and pollution intensive industries with high setup and trade costs that avoid countries with stringent environmental policies and instead turn to countries with less stringent environmental policies, while footloose and CSR-minded industries are attracted to countries with tougher environmental regulation. They call this latter phenomenon “green havens”.

Poelhekke and van der Ploeg (2012) explain these differences partly by mentioning that their study includes more countries, sectors and years than that of Kellenberg (2009). They found the strongest pollution haven effects for the sectors agriculture, food processing, natural resources, and utilities. But also construction and installation, retail, and “chemicals, rubber and plastic” have pollution haven tendencies, although not as strong as the former industries. The reason why some industries avoid investing in countries with bad environmental policy they suggest is that companies in these industries are particularly concerned about their reputation. Mulatu et al. (2010) find that highly polluting industries, including for example *industrial chemicals* and drugs and medicines, are indeed attracted to countries which have lax environmental standards. They also point out that for industries with low levels of pollution, the effect of lax environmental standards is very low.

Others discuss the role of geography. Ben Kheder and Zugravu (2008) find that the pollution haven hypothesis does not work similarly for all groups of countries. Although they do indeed find support for the pollution haven hypothesis, they also point out that for some countries, for example the CIS countries (i.e. countries formerly part of the Soviet Union), stricter regulation generally attracts foreign investment. For CEEC (Central and Eastern European Countries) and OECD countries however, they find that the impact of environmental regulation is significantly negative. The strongest effect they find for emerging countries, which have the strongest pollution haven tendency.

In summary, the evidence for the existence of pollution havens is mixed and it is likely that the contradicting results correspond to a reality where a pollution haven effect has indeed been seen for some cases for some industries, but that other sectors or subsectors have not seen the effects of this type. It is also possible that the contradicting results in the literature reflect methodological difficulties and bias created by value based assumptions in the research design. For the chemicals industry the results on pollution haven are not less contradicting. One possible conclusion is that highly polluting chemical industries with high costs of compliance in a regulated environment would be more likely to act according to the pollution haven hypothesis than less polluting industries.

3.4 The race to the bottom hypothesis

The race to the bottom hypothesis states that as an outcome of globalization and free trade, governments are given increased incentive to cut business regulations, labor standards, environmental laws and business taxes (Konisky 2007). There are several studies exploring the race to the bottom hypothesis in the case of environmental regulations. As the two previous concepts, there are mixed results and there is no conclusive evidence of lax legislation attracting companies.

In one study, Douglas (in Bhagwati et al. 1996, page 393) found no evidence of a race to the bottom in the case of capital mobility in the US. They point at other factors of environmental protection that may affect companies’ decisions to invest or relocate, rather than legislation on itself; enforcement problems such as government inability to implement the regulations,

mismatches in local and federal legislation and uncertainties in impacts of pollution versus the costs of compliance.

Dong et al. (2012) analyzed the decision of firms to expand to a foreign market, either in the form of a local investment or in the form of exports. They found that in developing countries with limited access to technology but with large markets, governments tend to be reluctant to tighten its emission standard, i.e., the race to the bottom may hold. However, small countries with a small lag in technology tend instead to improve their environmental standards (Dong, Gong, and Zhao 2012).

Graham (1998) points out that although the race to the bottom is a powerful idea dealing with sudden changes in environmental requirements, it is a concept that was more applicable during the 1970s than now. At present, she argues, it is proven that environmental costs constitute a relatively small portion of business expenses, state governments are more open to include environmental interests, and public awareness has improved. “After nearly 30 years, environmental protection has been assimilated into the political system, where it will continue to evolve in thousands of separate national, state, local, and private actions”.

In summary, there seems to be no further lessons to be drawn from the literature on the “race to the bottom hypothesis” regarding current relocation and establishment decisions of the chemical industry.

3.5 Effects of REACH on European chemicals industry

There is not a vast literature on the effects on relocation of chemicals related legislation. The majority of the literature available is dealing with the effects on the European chemical sector from the introduction of REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) (EC No 1907/2006) and effects of the US Toxic Substances Control Act (TSCA 1976). The REACH legislation allocates significant responsibilities to chemical producers and importers.

During 2012, the REACH legislation mid-term evaluation was published. There are several components of the evaluation. One study looked at the functioning of the European chemical market after the REACH introduction. It concluded that one of the main concerns from the industry is the compliance and information exchange costs connected with REACH and the impact of this on the competitive capacity compared to companies outside EU. However, most industry representatives interviewed for the evaluation was of the opinion that REACH related costs are small in comparison with other variables such as costs of energy, raw materials and labor (CSES 2012, page 63). Also, when looking at the data on volume of import and export during 2001-2010, there is no apparent drop in trade levels that could be attributed to the REACH introduction (CSES 2012, page 66). Furthermore, respondents to the evaluation interviews claimed that the introduction of REACH has not been relevant for decisions on relocation (*ibid*, page 74).

In a press release regarding the mid-term review of REACH from one of the largest European Chemical producers, the company states, in line with what was reported in the study mentioned above that the costs of implementing REACH have been large for the company, but that they can also see the advantages with the new framework. Furthermore they state that so far, the small and medium sized companies have been able to draw on the work carried out by larger firms taking the lead on the registration dossiers (BASF 2012).

It has been noted that there is an influence of the EU REACH legislation on the legislative development in other countries and regions, for example Japan (Naiki 2010), Asian region (Park 2009) and the US (Salutz 2012; “Chemicals Policy Reform” 2012).

In summary, there are strong indications that the REACH introduction has not forced chemical producers and importers to relocate European parts of their business. This can be seen as an argument that regulations in line with the LIRA Guidance would not be an important relocation factor either. Furthermore, it can be noted that if in fact there is an influence by European policy and the REACH regulation on legislation in other countries and regions, this will reduce the possible locations to choose from if a company wishes to relocate in order to avoid chemical legislation.

3.6 Conclusions

It can be concluded that there is a lack of scientific studies looking at the effects of chemicals management legislation on the relocation of companies. Based on our review of literature studying the Porter hypothesis, the pollution haven hypothesis and race to the bottom hypotheses, no consensus regarding their validity at the aggregated level was found that could give evidence on relocation effects of chemical and environmental regulations for the chemical industry. However, one possible conclusion is that highly polluting chemical industries with high costs of compliance in a regulated environment would be more likely to act according to the pollution haven hypothesis than less polluting industries. Regarding the Porter hypothesis, many authors that point out that the heterogeneity in the chemical sector makes aggregated conclusions difficult to draw. It thus seems appropriate to conclude that effects in line with those suggested by Porter on the chemical industry by environmental and chemical legislation will differ between subsectors of the industry and between different policy instruments and parts of regulations.

In addition, there were some studies looking at the relation between regulations in the chemical sector and innovation. These studies conclude that it is necessary to disaggregate different types of regulations and different types of companies in order to understand the effects of regulation on innovation. Furthermore they conclude that regulations will always affect competitiveness in the regulated sector or subsector, but that this effect may be in-line with the intention of the regulator and serve the purpose of the long-term competitiveness of the sector as a whole. The relative importance of this impact on competitiveness in relation to other relocation factors is not assessed in these studies.

Turning to the recent mid-term evaluation of the REACH regulation, this can be seen as an example of a chemicals management legislation that is far more comprehensive than the for instance the one proposed in the LIRA Guidance. It seems that the general conclusion is that for the European chemical industry sector as a whole, REACH implementation has been possible without major distortions of the sector’s competitiveness. Companies that have been interviewed for the evaluation state that REACH implementation has been burdensome, especially for small and medium-sized companies, but also for the larger firms that have often been taking the lead on the registration dossier production. Interestingly companies also state that they see the long-term benefits in now having a system in place for the risk assessments and safety procedures that will make these aspects of their activities easier to follow-up in the future.

In summary it can be concluded that:

- There is no scientific consensus on the validity of the Porter, pollution haven and race to the bottom hypotheses, and no clear evidence that these are mechanisms affecting the chemicals industry today in their relocation and establishment decisions.
- Some general conclusions can however be drawn; factors other than environmental regulations are more important such as a government's capacity to implement the legislation, and external factors such as the availability of skilled work force and cost saving opportunities.
- The European experience with the REACH regulation suggests that also a more comprehensive and costly legislative framework for chemicals management than proposed in the LIRA Guidance, has not caused chemical producers to relocate.

4 Views of some industry association representatives

In order to complement the literature review, a set of interviews was carried out with representatives of selected industry organisations; two international organisations, the International Council of Chemical Associations (ICCA) and the European Chemical Industry Council (Cefic), and one national organisation, the Swedish Plastics and Chemicals Federation (Plast- och Kemiföretagen). Interviewees were asked about their views on the role of chemicals legislation, specifically the type of legislation proposed in the LIRA Guidance. This section summarises the results of the interviews.

4.1 The most important relocation factors

When asked in general about the most important factors contributing to relocation decisions of chemical producing companies, all interviewees mentioned *closeness to markets and opportunities of winning new market shares* as a key factors. One interviewee mentioned the high growth markets in Asia, Latin America and other emerging economies as a key “pull factors”. Secondly, *closeness to feedstock* was stated as important by all. One interviewee gave the examples of availability of oil in the Middle East and the bio-feedstock in Latin America as drivers of relocation for some parts of the industry. South Africa with feedstock availability for bio-based products (soy and sugar cane) attracts a lot of business, said another interviewee. In addition one interviewee pointed out that for some part of the industry the feedstock is a more crucial issue than for others, for example, for paint production it is less crucial, whereas in the case of aluminium products, feedstock availability is a big incentive for new establishments. Interviewees mentioned that other factors such as the tax base, the cost of labour and other costs are also important for companies, but less so than market and feedstock proximity.

4.2 Relocation and firm size

When asked about the importance of firm size, interviewees gave the example of the REACH implementation, and stated that it has been more burdensome with the registration costs for the small and medium sized companies than for the large companies. In Eastern Germany, for example, REACH has pushed the threshold for being in business, it was said. One interviewee also concluded that for large European chemical companies that have fixed assets in Europe (plants and laboratories), it is not an option to move these facilities, but rather invest in new possibilities elsewhere in addition to the European locations.

4.3 Relocation to developed versus developing countries

The interviewees were asked if there is a difference in factors pushing for relocation to developed compared to developing countries. In response, all interviewees mentioned that locating to a country with an unclear legal framework is considered risky. One interviewee gave an example from earlier experiences of working with the recycling industry. In this case the company had to assist the host country with creating a regulatory framework before they could start their business there. It was also stated that Multinational companies do business according to their own code of ethics and their own procedures, independent of which country they operate in. But again, it was said that also in these cases there is a need for a basic framework that can be complemented with a voluntary program.

4.4 Relative importance of relocation factors

Interviewees were asked to rank the relative importance of different relocation factors in a given list (Table 1). The interviewees were unanimous in their ranking of the first three most important factors. In addition, one interviewee said that he was not aware of any investment *not* taking place because of legislation, but many cases where costs of operation have been a hinder.

Factor	Ranking (1 is most important)
Production cost savings	2, 2, 2
Transport/logistic savings	3, 3
Potential of new market share	1, 1, 1
Access to expertise/skilled staff	4
The components of the chemicals management legislation and infrastructure at the location	5
Level of corruption	6

Table 1: Ranking of factors. Each number represents a ranking of one interviewee (not all interviewees did the ranking for all factors).

4.5 The role of chemicals legislation as proposed by the LIRA Guidance

Interviewees were asked about their view on chemicals legislation as proposed in the LIRA Guidance (i.e. a regulatory framework that defines clear roles and responsibilities for the private sector and the government, respectively). They were asked if they consider such a legislation to have a positive or a negative impact on decisions of chemical producing companies to relocate or make investments in new establishments.

The interviewees were all of the opinion that in general, legislation plays a very small role, if any, on decisions to invest or relocate. But once a company is established somewhere, there is a positive effect of an appropriate legislation in the country. A legislation that clarifies rules and conditions for competition makes it easier for companies to operate in the region or country. Uncertainty of *enforcement* of legislation, on the other hand, may be a disadvantage in the view of the industry. One interviewee also stated that from the experience with REACH we know that this regulatory reform was burdensome for the companies and that the EU commission had underestimated the costs, but still, REACH has not driven the companies away.

4.6 Chemical legislation aspects considered important by industry

Interviewees were also asked to indicate aspects of a chemical legislation that they find important from their perspective of industry representatives. Here there were more divergence among the answers and various points were raised. Among the aspects mentioned were, that regulations should be predictive, transparent, clear and easy to understand and follow up, that regulations do not discriminate between local and international companies. Furthermore, the division of responsibilities between the government and the private sector should be clear.

Other issues brought up were the importance of legal protection of your investments in case of political instability and that that intellectual property rights are protected. In addition there were comments about the need for improved control of illegal production and use of chemicals since it was considered a significant problem today, as well as the need for incentives for innovation of safer alternatives.

4.7 Summary and discussion of interview results

Overall, there was a high degree of consistency between the answers of the interviewees from the different organisations. Chemicals legislation is clearly not seen as a factor of importance for relocation or new investment by the industry representatives interviewed for this report. Location factors such as the proximity to markets and feedstock was seen as most important by all interviewees. With the experience of the REACH implementation in mind, industry representatives concluded that even though REACH has been costly for the companies, it has forced companies to introduce a framework for their risk and safety procedures that companies consider an asset for the future. In all, the input from the industry representatives can be summarized by the quote “In a global market, I don’t see [chemicals] legislation scaring away investment”.

The answer to the question of this report on the role of chemicals legislation for relocation decisions thus had much more coherent answer from the industry representative than from the academic literature in the field, which in many instances offered contradicting results. One of the interviewees pointed out that the academic literature in the field may in fact be suffering from a back-log of old data being mixed with new. He stated that only during the last 10 years, there has been a rapid development within industry, with companies realising the value in both environmental protection and in predictable and stable regulatory frameworks for their businesses. His advice to science was to go back and ask industry today about their views on environmental regulations, and the answers will be different, and maybe more coherent than they would have been 10 years ago. This is definitely something for the academic field to take on. One interesting aspect would be to distinguish between “deep” changes in the perceptions of companies on the role of legislation, versus changes in the rhetoric choices of firms and industry associations in relation to governance and sustainability issues.

In addition to the already mentioned, one aspect noted in the interviews was the importance of having industry associations in place to facilitate the communication between the industry and the government. In Europe, one interviewee said, the implementation of REACH was helped by the existence of mature industry and umbrella organisations.

Summing up the interviews carried out for this report, they are convergent in views and clearly point at some general conclusions:

- Proximity to markets and feedstock is the main driver for relocation and new establishments.
- Possibilities to reduce costs on labour, taxes and transport is also important.
- Chemicals management legislation (as proposed in the LIRA Guidance) is not considered to be a factor driving relocation or hindering new establishments of chemical industries.
- Predictive and transparent regulations are seen as an advantage for business.

When asked for a “wish-list” for chemical regulation, the industry representatives all ask for predictive and transparent regulations that are easy to understand and follow. This raises a

point that was not specifically dealt with earlier in the report, i.e. the issue of *how* legislation is designed and implemented, rather than *what* its components are. For instance, the time lag given in new legislation may be important in order to create a predictive regulatory environment. If the private sector is given a number of years to prepare for a coming new legislation this is likely to cause lower costs of implementation for the firms than sudden changes in regulatory requirements. Stakeholder involvement during the design process of new legislation may also influence the perception of industry of the regulation in question. In relation to this, it is also worth noting again that industry representatives interviewed also talked about the importance of having industry associations in place that can serve as a communication link between a government and an industry sector, for instance in a dialogue in new regulatory perspectives.

5 Discussion and conclusions

This report has reviewed the evidence on the relative importance of chemicals management regulations in relation to other relocation and establishments factors for the chemical industry. In spite of scattered data and disagreeing results, the literature still points to the general conclusion that legislation per se is not on the top of the list of factors of concern for companies making their relocation and establishment decisions. Both in the studies of general factors and the studies on environmental legislation, there is no evidence to suggest that regulations in the environmental field would be a major push factor for companies to relocate to other countries or regions. To the contrary, looking at the answers from the interviews in this study, it seems that a clear and predictive legislation on chemicals management could be considered as a pull factor.

Looking at the recent mid-term evaluations of the REACH legislation on European chemicals industry, it seems that the general conclusion is that for the chemical industry sector as a whole, REACH implementation has been possible without major distortions of the sector's competitiveness. Considering that this regulatory framework is by large more comprehensive than the basic chemicals management legislation that is the focus of this report, we conclude that from the case of European context and REACH, chemicals legislation cannot be considered a major factor for company relocation. There is literature arguing that REACH is and will be a major driver for the development of similar legislation in other countries and given the small costs of compliance in comparison with the industry's profits at a global scale, legislation is not expected to play a significant role in companies' decisions (Massey and Ackerman 2012, Park 2009).

This conclusion is further strengthened by the interviews carried out for this study with a set of industry association representatives. They all stated that the most important factors for relocation and new establishment is proximity to markets and feedstock. Chemicals management regulations have a small significance for relocation decisions in relation to other factors. Predictive and clear regulations in the field of chemicals are seen as positive for business.

This study has focused on the company perspective, how a company may be influenced by chemicals legislation in its decisions on relocation and new establishments. We have argued based on the literature review and industry interviews that this type of legislation is not a main factor influencing relocation decisions.

It should be pointed out that from a government perspective, there are of course many other aspects to consider when designing the national chemicals legislation. Lack of appropriate chemical risk management is expensive. It results in significant costs both in terms of human health and ecosystem degradation and as lost business opportunities, for example in the case of exported goods failing to adhere to international standards on chemical residues in products. Furthermore, the advantages of a clear regulatory framework for the whole life-cycle of chemicals may have various positive effects on society (UNEP 2012).

From an academic point of view it is interesting to note that from the general factors of relocation, through the effects of environmental legislation, to the more specific effects of chemicals management regulations, the literature contains contradicting evidence at every stage. In the first parts of the report where the more general factors were covered, views and results diverged on the relative importance of the different relocation factors as well as on the

validity of for instance the Porter hypotheses. A scientific response to these disagreements would be to improve the methods for evaluating relocation and environmental regulations, to make them less sensitive to predetermined views dominating different disciplines. Studies have also concluded that methodological differences may explain some of the discrepancies of results in studies on environmental regulations and new plant location decisions (Jeppesen et al. 2002) (Cole et al. 2005).

Some of the studies cited in this report call for disaggregation of the problems at stake, pointing at the heterogeneity of the chemicals sector as well as the great variation of different types of policies that may or may not affect the industry. This complexity is most probably one additional contributing factor behind the difficulties for academic studies in reaching unambiguous results on the relocation factors.

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7 Annex A: Interviewees

Interviewee	Organization	Date of Interview
Magnus Huss Executive Director	The Swedish Plastics and Chemicals Federation (Plast- och Kemiföretagen)	5th November 2012
Lena Perenius Executive Director of the International Chemicals Management Department	International Council of Chemical Associations (ICCA)	13th November 2012
René van Sloten Executive Director of the Trade Department	International Council of Chemical Associations (ICCA)	13th November 2012
Hubert Mandery Director General	The European Chemical Industry Council (Cefic)	19th November 2012

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