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Resource efficient businesses in practice by applying the alternative business model Chemical Leasing

Summary

by

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Abstract

Chemical Leasing is an innovative business model in which the traditional unit of payment for chemicals shifts towards a service-oriented approach. This alters especially the motivation of the chemical suppliers as their profits increase when reduced amounts of chemicals are applied. Due to this change in motivation, chemical suppliers and industrial users work more closely together in order to optimise the processes with regard to the optimised consumption of chemicals. This leads not only to energy and resource savings, but also results in decreased risks attributed to the handling of chemicals as well as to reduced environmental burdens. In addition, the business model generates economic benefits for the partners. Chemical Leasing can thus contribute significantly to sustainability.

In order to estimate the potential contribution of Chemical Leasing to resource-efficient and sustainable production, the project team has quantified the economic, energetic and, to some extent, environmental potential of the Chemical Leasing business model in Germany. Overall, the full national-wide implementation of Chemical Leasing could lead to savings of 25 to 50 kt of chemicals in the German chemical industry accompanied by reductions in the corresponding risks, resources and emissions and can also lead to a decrease in the energy demand during the use and life cycle of a chemical of up to 50 %. The economic savings potential associated with application of the Chemical Leasing business model lies between 46 and 100 M€.

The project team has also investigated the inhibiting factors for the comprehensive dissemination of Chemical Leasing and has elaborated suggestions and recommendations to better overcome those factors in the future. In this context, the project team perceives the targeted communication of the business model's benefits and several political activities on the German and international level to be the most important measures.

Five sustainability criteria for Chemical Leasing, which contribute to the establishment of high standards for the business model, have already been developed in a previous project. The project team has analysed these criteria regarding their acceptance and practicability on the basis of existing Chemical Leasing projects. In this process, also the current status of the projects was determined.

The analysis revealed that all investigated cases applied and complied with two of the criteria (1: reduction of adverse impacts and 4: economic benefits). Likewise, criterion 3 (substitution) plays an important role in the context of process optimisation and has been fulfilled in all cases where the criterion is relevant. The criterion 2 (improved chemicals handling) is seen substantially less important in Germany and is often only marginally considered. The last criterion (5: monitoring of improvements) is usually fulfilled indirectly through agreements amongst the partners concerning the verification of resource consumption (raw materials and energy) and product quality; however, it is often not explicitly labelled as such. Generally, the criteria have proven to be very useful for the acquisition and initiation of new Chemical Leasing projects.

The project team has also been able to show that the involvement of chemical distributors in Chemical Leasing projects can still be improved. To work towards this target and to generally foster the dissemination of the business model, the project team – partially with support of different partners – has initiated or supported various initiatives: amongst others, these included workshops, presentations, national industry initiatives and international activities. Moreover, the German webpage www.chemikalienleasing.de has been updated continuously to support the mainstreaming of the Chemical Leasing business model in Germany.

Kurzbeschreibung

Chemikalienleasing ist ein innovatives Geschäftsmodell, bei dem die mengenmäßige Bezahlung von Chemikalien durch eine nutzenorientierte Bezahlung ersetzt wird. Dies führt insbesondere beim Chemikalienanbieter zu einer geänderten Motivation, da sein Gewinn steigt, wenn weniger Chemikalien eingesetzt werden. Chemikalienanbieter und –anwender arbeiten aufgrund der damit geänderten Interessenlage enger zusammen, um Prozesse im Hinblick auf einen verringerten Chemikalienverbrauch zu optimieren. Dies führt sowohl zu geringeren Risiken im Umgang mit der Chemikalie, als auch zu einer Reduktion der Umweltbelastung und zu Energie- und Ressourceneinsparungen. Zusätzlich werden bei den Partnern des Geschäftsmodells wirtschaftliche Vorteile generiert. Chemikalienleasing kann so einen wichtigen Beitrag zur Nachhaltigkeit liefern.

Um den potenziellen Beitrag von Chemikalienleasing zu ressourceneffizientem und nachhaltigem Wirtschaften zu analysieren, hat das Projektteam die wirtschaftlichen, energetischen und einige umweltbezogene Potenziale des Geschäftsmodells in Deutschland quantifiziert. In Summe könnten durch die flächendeckende Implementierung von Chemikalienleasing in der deutschen Chemischen Industrie zwischen 25 und 50 kt Chemikalien sowie die korrespondierenden Risiken, Ressourcen und Emissionen eingespart werden. Außerdem kann Chemikalienleasing den Energiebedarf im Laufe von Anwendung und Lebenszyklus einer Chemikalie um bis zu 50 % senken. Das ökonomische Einsparpotenzial liegt zwischen 46 und 100 Mio. €.

Das Projektteam hat weiterhin die Hemmfaktoren für eine flächendeckende Verbreitung von Chemikalienleasing untersucht und Vorschläge bzw. Empfehlungen erarbeitet, diese zukünftig besser zu überwinden. In diesem Zusammenhang sieht das Projektteam die zielgerichtete Kommunikation der Vorteile des Geschäftsmodells sowie verschiedene politische Aktivitäten auf deutscher und auch internationaler Ebene als die wichtigsten Maßnahmen an.

Fünf Nachhaltigkeitskriterien für Chemikalienleasing, die zur Etablierung eines hohen Standards für das Geschäftsmodell beitragen, wurden bereits in Vorgängerprojekten entwickelt. Das Projektteam hat diese Kriterien hinsichtlich ihrer Akzeptanz und Praktikabilität anhand von bestehenden Chemikalienleasing-Projekten untersucht. Dabei wurde auch der aktuelle Stand der Projekte analysiert.

Die Untersuchungen haben gezeigt, dass zwei der Kriterien (1: Verringerung negativer Auswirkungen und 4: wirtschaftliche Vorteile) in allen untersuchten Fällen angewendet und eingehalten wurden. Auch das Kriterium 3 (Substitution) spielt in Zusammenhang mit Prozessoptimierungen eine große Rolle und wurde in allen relevanten Fällen eingehalten. Das Kriterium 2 (Verbessertes Handling der Chemikalie) wird von den Akteuren in Deutschland als wesentlich weniger wichtig angesehen und wird oft nur am Rande beachtet. Das letzte Kriterium (5: Monitoring der Verbesserungen) wird in der Regel indirekt über Vereinbarungen der Partner zur Überprüfung des Ressourcenverbrauchs (Rohstoffe und Energie) und der Produktqualität erfüllt, jedoch nicht explizit so benannt. Insgesamt erweisen sich die Kriterien als sehr hilfreich bei der Akquise und Initiierung neuer Chemikalienleasing-Vorhaben.

Das Projektteam hat auch zeigen können, dass die Einbindung von Chemikalienhändlern in Chemikalienleasing-Projekte noch verbessert werden kann. Um darauf hin zu wirken, und um generell die Verbreitung des Geschäftsmodells zu fördern, hat das Projektteam – teilweise mit Unterstützung verschiedener Partner – diverse Initiativen initiiert oder unterstützt. Dazu gehören u. a. Workshops, Präsentationen, nationale Industrieinitiativen und internationale Aktivitäten. Außerdem wurde die deutsche Internetseite www.chemikalienleasing.de fortlaufend aktualisiert, um Chemikalienleasing in Deutschland weiter zu verbreiten.

Summary

Background and approach

The chemical industry is an important and indispensable branch of the German industry that manufactures materials and basic products for almost every other economic sector. Despite several efforts for optimisation, the industry is characterised by high resource and energy consumption, thus significantly contributing to the scarcity and consumption of non-renewable resources. Moreover, the production and utilisation of hazardous chemicals involves risks for human health and ecosystems. The research, development and implementation of new substances, future-oriented technologies, and innovative concepts and business models that contribute to the chemical industry's sustainability are consequently a permanent task for all parties involved.

Chemical Leasing is an innovative business model that sturdily supports sustainable chemicals management. It contributes to the optimised use of chemicals through the improved transfer of know-how and redesigned economic incentives. This results in resource and energy savings, emission and waste reduction, a decrease in risks for humans and the environment as well as in the generation of economic benefits.

Chemical Leasing is based on the fact that the user of chemical substances or mixtures does not aim for the ownership of the chemical itself but requires and wants to obtain the service or function of the substance for a certain process or production step. In Chemical Leasing, chemical suppliers (manufacturers or distributors) no longer sell the chemical itself but its service. The manufacturers or distributors are more closely involved in the production processes using the chemicals and support the optimisation of the processes with their knowledge about the best possible application. The conventional quantity-based payment basis, for instance €/kg chemical, is replaced by a service-oriented unit of payment, such as €/m² cleaned surface. Thus, a common interest is generated among supplier and user to apply the chemicals most efficiently and to optimise the processes. The economic relations are altered especially for the supplier, as the chemicals quantity becomes a *cost factor* instead of a *revenue factor*. Normally, this does not only result in reduced amounts of chemicals but also in a lower energy demand, fewer emissions into the environment and therefore reduced risks related to the application of the chemical and improved occupational health and safety. The service-oriented optimisation of the chemical quantities combined with an unchanged quality entails economic benefits for the partners, which are equally distributed among the cooperating enterprises if appropriate contracts apply.

This generation of mutual economic benefits is also a component of the sustainability criteria for Chemical Leasing. They comprise five aspects that need to be fulfilled in order to ensure a proper operation and a high standard for the business model. Chapter 3.1 provides an overview of the sustainability criteria.

Successful Chemical Leasing projects in different countries and branches¹ have shown that the implementation of the business model enhances the resource efficiency and contributes to a sustainable chemistry.

So far, it has not been possible to disseminate Chemical Leasing nationwide and to establish a mainstream. Thus, it was the aim of the research project to contribute to the further dissemi-

¹ Examples include the utilisation of adhesives in the packaging industry in Serbia, the use of agrochemicals in Sri Lanka, the cleaning of bottles in the beverage industry in Uganda, and corrosion protection on vehicles in Colombia; for further examples see <http://www.chemicalleasing.com/sub/pilot.htm>

nation of the business model and hence to a sustainable chemistry and to analyse the potentials and existing Chemical Leasing projects. Emphasis has been put on the position of chemicals trade. To initiate new pilot projects in Germany, the project team has taken numerous initiatives, e.g. the introducing Chemical Leasing to interested company representatives of different branches². However, no new pilot project could be established, which can be ascribed especially to the following reasons:

- ▶ the potentials for the optimisation and reduction of the chemicals consumption are too low
- ▶ international chemicals trade: chemical distributors increasingly see potentials abroad, whereas the domestic situation is more challenging
- ▶ confidentiality of the business partners in new Chemical Leasing projects

In order to continue to encourage the targeted implementation of Chemical Leasing in Germany, the project team, partly with support of the contracting authority or, at larger events together with representatives of the industry and the National Cleaner Production Centers (NCPCs) of the United Nations Industrial Development Organization (UNIDO), has conducted several activities. From the project experience, the project team has deduced recommendations for further activities with regard to chemicals policy.

The following principal steps have been undertaken by BiPRO GmbH in the project:

- ▶ Evaluation of the potential for Chemical Leasing in Germany from an economic and environmental point of view, with an emphasis on the analysis of the position of chemicals distributors
- ▶ Analysis of the inhibiting factors for the nationwide dissemination of Chemical Leasing and development of recommendations for overcoming the existing barriers in the future
- ▶ Examination of the five sustainability criteria concerning their implementation and acceptance on the basis of already initiated Chemical Leasing projects
- ▶ Initiation of different initiatives and support for activities of national or international enterprises or organisations to foster the implementation of the business model (e.g. Global Chemical Leasing Award); these initiatives are summarised in this report and are analysed regarding their success or potential
- ▶ Conduction of continuous updates of the national German Chemical Leasing website in order to support the nationwide dissemination of the business model by improving information quality and availability; providing information about the Chemical Leasing concept as well as about current events or international developments

Chemical Leasing in Germany

Potentials for Chemical Leasing in the industrial location of Germany

The potential for Chemical Leasing has several dimensions from an environmental perspective:

- ▶ Reduction of raw material consumption (improved resource efficiency)
- ▶ Reduction of energy demand (climate protection, improved resource efficiency)
- ▶ Reduction of waste (waste prevention, improved resource efficiency)
- ▶ Reduction of emissions (climate protection, hazardous substances, pollution control of environmental media)

² e. g. drinking water treatment and treatment of water in swimming pools, wastewater treatment, chemicals trade, application of agrochemicals, cleaning and disinfection in hospitals

- Reduced risks through hazardous substances (risk reduction for man and the environment)

From an economic perspective, the potentials of Chemical Leasing can be attributed to reduced costs for the user as well as increased profits for the producer or distributor of chemicals. This involves positive effects on the competitiveness of both parties.

A precise quantification of the Chemical Leasing potentials would imply a significant effort and is subject to high uncertainties due to the variety of potential obstacles for implementation, which are described in more detail in the next paragraph and in chapter 2.2.1. Therefore, the project team has updated the already existing data and potentials from previous projects for the current study and differentiated the results regarding the environmental and economic dimensions.

The results obtained from these updated calculations are summarised in Table 1. The textbox below illustrates how Chemical Leasing leads to energy savings.

Table 1: Economic* and environmental potentials for Chemical Leasing in Germany.

Type of chemical	Quantity kt/a	Waste reduction (related to quantity)	Emissions reduction (related to quantity)	Risk reduction with respect to handling	Savings potential in Mio €
Solvents	10 – 20	10 %	90 %	medium**	20 – 40
Paints and varnishes	2 - 4	90 %	10 %	low***	6 – 12
Adhesives	1 - 2	90 %	10 %	medium**	3 – 6
Disinfectants and detergents	10 - 20	10 %	90 %	low***	15 – 30
Others	2 - 4	?	?	?	2 – 12
Sum	25 - 50	-	-	-	46 - 100

* without considering export possibilities

** „medium“ refers to the expected exposition reduction to hazardous (partially carcinogenic) substances, reduced risks from accidents

*** „low“ refers to the expected exposition reduction to non-hazardous substances, small number of risk from accidents

Energy savings induced by Chemical Leasing

All case studies analysed by the project team reveal direct and indirect energy savings due to the reduced chemicals quantities resulting from Chemical Leasing applications. Direct energy savings – but also higher energy demands - can be attributed to process adjustments, e.g. through altered temperatures or pressures. A by far greater reduction of energy consumption is due to the reduced chemicals quantities, as fewer chemicals have to be produced. Depending on the type of chemical, savings range between 20,000 and 100,000 MJ/t chemical³.

Obstacles to the implementation of Chemical Leasing in Germany and their overcoming

³ The basis for the estimations were values for the cumulative energy demand (CED) for selected chemicals (e. g. different solvents, single disinfectants and fertilizers, epoxy resin) from the ProBas- and ecoinvent databases.

An extensive nationwide dissemination of Chemical Leasing can contribute to the increase of Germany's resource efficiency in particular due to the business model's various advantages with regard to energy and raw material savings. Thus, Chemical Leasing can support the resource efficiency targets of the German Federal Government (UBA 2014). However, currently several obstacles exist that oppose the extensive nationwide dissemination.

It should be noted that there is a multitude of cases, where Chemical Leasing is applied but named differently. Sometimes Chemical Leasing is referred to as "Chemical Management Service", "Single Source Supply", "Cost per Unit" or it is used under special brand names such as "COMPLEASE™". Therefore, the analysis also addresses inhibiting factors that relate to the term "Chemical Leasing".

Furthermore, a relatively large number of companies is applying Chemical Leasing but is not communicating it due to reasons of competition. The analysis therefore includes inhibiting factors regarding the communication about successful Chemical Leasing implementations.

In general, many of the inhibiting factors are due to insufficient information. In particular, the identified inhibiting factors can be summarised as follows:

Inhibiting factors for the nationwide implementation on the user's side

- ▶ reduction potentials are too low (normally, at least 15 - 20 % reduction potential must be given), thus the effort of changeover is considered as not justified
- ▶ other types of cooperation between the manufacturer and the user (especially joint research and development projects) for the reduction of the chemicals consumption

Inhibiting factors for the nationwide implementation on the manufacturer's side

- ▶ lack of application expertise and therefore no possibility to support the user in the reduction of consumption
- ▶ optimisation of the end application (improvement of profits) is overcompensated by losses in upstream products
- ▶ no willingness to invest in process optimisation due to a lack of human resources
- ▶ obstructionist attitude of the sales employees (commission linked to turnover and therefore to quantity)

Inhibiting factors with regard to the term "Chemical Leasing"

- ▶ Existing business models with a service-oriented payment are not called "Chemical Leasing" because the term is considered misleading.
- ▶ The established service-oriented payment has emerged independently of the national and international Chemical Leasing activities, so that a different term has been chosen.

Inhibiting factors with regard to the communication of successful projects

- ▶ Chemical Leasing as a business model embraces confidential information
- ▶ The application of Chemical Leasing generates competitive advantages (new benchmarks) whose communication to others would be counterproductive for the companies involved.
- ▶ The contract between manufacturer and user prohibits the passing on of information to third parties.

Essentials regarding the inhibiting factors and their overcoming

In summary, the project team could detect that often complex and usually contrasting interests make it difficult or impossible for companies or public institutions to overcome the aforementioned inhibiting factors. Nevertheless, several obstacles can be reduced by i. a. the following approaches:

- Many chemical applications entail larger reduction potentials regarding chemicals consumption than expected by the involved parties. The project team has worked out and communicated this fact.
- The dissemination of Chemical Leasing generates potentials and chances for German suppliers in emerging countries where companies have already started Chemical Leasing activities.
- Public relations work and targeted information (presentations, toolkit, etc.) essentially contribute to the dissemination of the business model and reduce doubts.
- Public procurement and the financial sector constitute new and promising channels for the dissemination of the business mode. Moreover, marketing-effective measures can increase the awareness and may serve as an incentive for the implementation.

Specifically, BiPRO has initiated the following activities to foster the overcoming of the inhibiting factors:

The project team has – also in parallel projects (e.g. VDI ZRE 2014) – identified and communicated the fact that in many cases greater reduction potentials concerning chemicals consumption exists than expected by the parties. An emphasis has been put on the fact that especially Chemical Leasing offers an opportunity to recognise these potentials, which are hardly visible for the individual company.

The dissemination of the business model Chemical Leasing generates, also increasingly for German manufacturers, potentials and opportunities in emerging countries, where companies (e.g. Henkel, BASF, SAFECHEM) already started Chemical Leasing activities. In this context, BiPRO has supported the introduction of Chemical Leasing on the German-Brazilian Economic Meeting in Rio de Janeiro⁴, amongst others.

Most of the identified inhibiting factors have proven to be difficult or impossible to be overcome for the participating companies as well as for public institutions such as the Federal Environment Agency or UNIDO, because complex and often conflicting interests exists in many cases. For instance, after the successful implementation of Chemical Leasing chemical users are often interested in not disseminating the results, as the confidential handling of the outcomes strengthens their competitive position. Public institutions have, however, the desire to communicate successful projects, as imitators should be motivated for a further dissemination. These relationships are explained in more detail in section 2.2.2. However, several options for solutions exist, amongst others good public relations work and the provision of information, the integration of Chemical Leasing into public procurement and the inclusion of the financial sector. These approaches are described in the following paragraphs:

The project team was able to reduce some of the information deficits within the present project. For example, BiPRO, supported by additional actors (contracting authority, companies, associations, etc.), has extended the documentation on the German website⁵ and has support-

⁴ implemented by partners of the NCPC Brazil, see Appendix for the event announcement flyer

⁵ www.chemikalienleasing.de

ed the targeted public relations work (e.g. brochure BMU and BDI 2013) as well as the information of relevant target groups.

The advancement of the UNIDO Chemical Leasing Toolkit is an additional measure to overcome the inhibiting factors. The toolkit, which is under revision until the beginning of 2015, aims at the processing of Chemical Leasing basics specifically for certain target groups. The toolkit communicates the information in such a way that the user is directly referenced to the relevant content of the toolkit according to his function and needs. The project team supports the revision of the toolkit by concrete content-related amendments as well as by reviewing the current and final version.

Public procurement can help to further implement Chemical Leasing; either by increasingly requesting innovative service-oriented solutions or by making Chemical Leasing mandatory. Since public procurement comprises about 13 % of the German gross domestic product (BMUB 2014), it can significantly influence the use of sustainable business models in industry. This would not only lead to an increasing publicity of Chemical Leasing but could also motivate or oblige companies to apply the model. In this context, an exchange with public procurement experts has been initiated. Specifically, conversations between the project team and experts from public drinking water supply, public wastewater treatment and the procurement departments of hospitals have taken place.

The project team has seen an additional opportunity for communication channels and the dissemination of Chemical Leasing in the integration of the financial sector. Similar efforts have been conducted in the past by UNIDO and the Austrian Environment Ministry. In order to introduce Chemical Leasing to leasing institutions and savings banks and to inform about the business model, a meeting with representatives of some institutions has taken place.

The event participants have identified the following approaches for the integration of the financial sector:

1. Financing of particularly expensive chemicals which are not consumed (e.g. noble metal catalysts)
2. Financing of plants required in Chemical Leasing business models via a "classical leasing"
3. Utilising the contacts of classical plant leasing in order to draw attention to the enhanced possibilities of an additional Chemical Leasing to a variety of clients

However, a concrete integration of the financial sector in Chemicals Leasing projects has not yet taken place. The main reason is the lack of collateral for financial institution in case of insolvency of the involved partners, as chemicals are consumer goods and thus do not present sufficient hedge.

Analysis of already initiated Chemical Leasing projects and review of the sustainability criteria based on these projects

Within a previous project⁶ for the Federal Environment Agency, the project team has developed sustainability criteria for Chemical Leasing. Subsequently, the Members of the national working group on Chemical Leasing have revised these criteria with assistance of UNIDO. This resulted in the following current version of the criteria for Chemical Leasing that is used

⁶ "Chemical Leasing as a model for sustainable development with test procedures and quality criteria on the basis of pilot projects in Germany" (German title: "Chemikalienleasing als Modell zur nachhaltigen Entwicklung mit Prüfprozeduren und Qualitätskriterien anhand von Pilotprojekten in Deutschland" - FKZ 3707 67 407)

by Germany, Austria, and UNIDO and that is also documented on the German and international websites⁷:

1. Reduction of adverse impacts for environment, health, energy and resource consumption caused by chemicals and their application and production processes
2. Improved handling and storage of chemicals to prevent and minimize risks
3. No substitution of chemicals by substances with a higher risk
4. Economic and social benefits are generated; a contract should contain the objective of continuous improvements and should enable a fair and transparent sharing of the benefits between the partners
5. Monitoring of the improvements needs to be possible

BiPRO has examined the feasibility and acceptability of the sustainability criteria in the context of the current project based on the existing case studies. In this context, an assessment of the existing Chemical Leasing projects in terms of their status and effectiveness has also taken place. Furthermore, the project team has conducted an analysis of the cooperation between the business partners and has examined in each case whether the pilot project has led to further projects.

Summary of the findings of the review and evaluation of the sustainability criteria on the basis of the project experience

The review of the sustainability criteria on the basis of the existing Chemicals Leasing projects has shown a mixed picture in terms of practical implementation and acceptance of the criteria. The project team's experiences with national but also international Chemical Leasing projects (amongst others through participating in the international expert group) have shown that the sustainability criteria for Chemical Leasing contribute essentially to the implementation of the business model in many cases. This following textbox summarises the relevance of the sustainability criteria for Chemical Leasing:

Relevance of the sustainability criteria

The sustainability criteria fulfil a central role in the acquisition for various suppliers of Chemical Leasing business models, as providers of chemicals can better work out the advantages of the business model and can emphasise their commitment with regard to sustainability from the beginning.

The criteria effectively prevent the substitution of chemicals with substances with a higher risk. Such concerns may arise among users of chemicals, when Chemical Leasing is communicated only in terms of process optimisation and a reduction in the chemicals quantities that could theoretically be achieved by using a more efficient, but also more hazardous chemical. In this case, chemical suppliers use the criteria to address the concerns of the users in terms of higher risks in their processes, as the criteria prohibit a substitution with substances of higher risk.

In contract negotiations between potential partners the sustainability criteria have also proven to be useful as they serve as a quality assurance instrument in case the partners have concerns about the project's success. The progress and quality of the project can be verified by the integration of the criteria and the success of the Chemical Leasing project becomes measurable and controllable (UNIDO 2011c; p. 4).

⁷ www.chemicalleasing.org

Relevance of the sustainability criteria

The criteria are explicitly included in Chemicals Leasing contracts. Not all criteria are used in every case, but the partner companies usually set individual priorities. For example, a fair distribution of economic benefits is covered by a contract or the companies ensure that the energy demand of the processes must not rise. Furthermore, the sustainability criteria are sometimes included in the envisaged measurement programmes for resource consumption.

Moreover, for the evaluations within the Global Chemical Leasing Award, the criteria have proven to be helpful, as projects are only admitted to the award if they meet the sustainability criteria (e.g. UNIDO 2012; pp. 31 and 37). However, it should be noted that there is a certain risk that the sustainability criteria are simply “ticked off” without ensuring a serious confrontation (chapter 3.2).

From the project team’s perspective, it is important to present the sustainability criteria when introducing the Chemical Leasing business model (e.g. at conferences and workshops) in order to remove all potential concerns about environmental benefits. This debilitates, for example, the accusation of “greenwashing”, which can arise when the economic success of the business model has too much priority.

Furthermore, the Chemical Leasing criteria are being incorporated into a current project on behalf of the German Federal Environment Agency about sustainable chemistry. Here, they serve as a basis for the development of criteria and indicators for a sustainable chemistry.

A brief individual evaluation of the criteria on the basis of the project experience is listed below:

The criterion 1 “Reduction of adverse impacts for environment, health, energy and resource consumption caused by chemicals and their application and production processes” is applied the most; besides criterion 4. It is used especially during the initial discussions as well as in the phases of “process optimisation” and “testing” and is, in almost all cases, also quantified (for internal use).

The criterion 2 “Improved handling and storage of chemicals to prevent and minimize risks” is much less important to the actors and is often assessed at the end of the project (or ignored). In Germany, the aspect of risk avoidance with regard to accidents is rather less important due to the high standards.

The criterion 3 “No substitution of chemicals by substances with a higher risk” plays no role whenever the same substance is used prior and after the process optimisation.

The criterion 4 “Economic and social benefits are generated; a contract should contain the objective of continuous improvements and should enable a fair and transparent sharing of the benefits between the partners” is usually examined at the beginning of a Chemical Leasing cooperation in relation to questions such as “Are economic benefits even possible?”. The criterion has again a high significance in the contract negotiations.

From the project team’s point of view, the criterion 5 “Monitoring of the improvements needs to be possible” is often not understood as a sustainability criterion. Only a few partners speak about monitoring. Generally it is agreed upon an inspection of the resource consumption (raw materials and energy) and of the archived product quality.

Chemical Leasing in chemicals trade

Analysis of the position of chemical distributors

In 2011 and 2012, more than 100 companies with a turnover of over 13 bn. € were working in chemicals trade in Germany. Moreover, a positive trend with regard to jobs and turnover can be observed in the branch. Between 2010 and 2011 alone, the chemical distributors could generate 12.7 % more turnover (VCH 2012, VCH 2011).

As the direct distribution of the chemical manufacturers and the online trade with chemicals are increasingly challenging the branch, it is essential for the chemical distributors to meet current market developments and trends. Current megatrends are:

- ▶ sustainability
- ▶ service orientation
- ▶ cooperation along the supply chain
- ▶ efficiency increase (regarding energy and material)

The Chemical Leasing business model enables companies to react to those trends. Via the intensified cooperation along the supply chain, the model leads to an increased efficiency of the chemicals use and thus reduces the material and energy consumption.

Requirements of chemical distributors for a successful implementation of Chemical Leasing

Due to the close proximity to the end consumer, chemical distributors carry with them the ideal preconditions for the implementation of the business model as long as they possess applied technical know-how in order to optimise the user's processes. Here, the educational level of the employees being in direct contact to the customer is a crucial factor. A long-term oriented relationship with the customer combined with the environmental and health related benefits eventually results in an increased ecologic as well as economic sustainability.

Successful examples of Chemical Leasing applications in the field of chemicals distribution, such as those of the companies Brenntag AG, SAFECHEM, and CSC JÄKLECHEMIE, confirm the described assumptions. The success of the individual Chemical Leasing projects was acknowledged in the frame of the Global Chemical Leasing Award presentations (SAFECHEM 2012: winner in category „Case Studies“; 2014: Conformity Declaration Certificate; CSC JÄKLECHEMIE 2012: Conformity Declaration Certificate).

However, a number of shortcomings exist and could be identified within this project using personal interviews with representatives of companies and the German association of chemical trade (VCH).

Important shortcomings are:

- ▶ The Chemical Leasing business model is not known or wrong ideas about the business model exist (the latter results from the often observable interpretation of the term “leasing” in the sense of a financing mechanism).
- ▶ There are existing service concepts in chemicals trade which make companies think that they are already practicing Chemical Leasing under a different name. However, those concepts are lacking essential components of the alternative business model, such as the user-oriented unit of payment, no substitution with substances with higher risks, and the compliance with the sustainability criteria for Chemical Leasing.
- ▶ Basic information about Chemical Leasing is available but companies do not have insights into the chances and opportunities as well as risks and limits of the application. Corresponding analyses of the improvement potentials of the company's market and earnings situation through the implementation of the Chemical Leasing business model do not exist.

- ▶ Information on the suitability of chemicals for the business model is not available.
- ▶ The companies do not have information about existing experiences.
- ▶ Companies that know and correctly interpret the business model usually lack information about applicable contracts and possibilities for the contract design.
- ▶ In general, knowledge gaps exist within the companies with respect to the authorisation under REACH; distributors have no or insufficient knowledge about the connection of REACH and Chemical Leasing.

The shortcomings can be summarised with a lack of information among the right recipients in the companies. To overcome these shortcomings, the project team has identified and implemented measures for the reduction of the knowledge deficits during the course of the project.

Build-up of know-how and strategies for the reduction of shortcomings

A suitable measure for the reduction of shortcomings with regard to Chemical Leasing in chemicals trade is a targeted public relations work. Here, in particular managers of distributing companies shall be informed about Chemical Leasing via presentations and newsletters. The information should underline the strategic importance of the business model.

To implement this measure, the project team has introduced the Chemical Leasing business model to approximately 200 representatives of the management and executive board of chemical distributors during the annual conference of the European Association of Chemical Distributors (Fecc). The presentation was initiated by the project team together with VCH and several selected companies. In addition, the association regularly sends out announcements and news in the field of Chemical Leasing in its newsletters.

In this way, the attention of the companies and the association has been drawn also towards the national and international Chemical Leasing homepages. Meanwhile, the former includes a separate subpage presenting specific information about Chemical Leasing in chemicals trade.

As additional measures to reduce the general information deficit in chemicals trade, several actors (the project team, the German Federal Environment Agency, UNIDO, the German Federal Foundation for the Environment) have implemented the following measures:

- ▶ presentation of the Global Chemical Leasing Award 2012 in Frankfurt/Main by the president of Fecc
- ▶ site visit of the international working group on Chemical Leasing at the world market leader for chemicals trade (Brenntag AG)
- ▶ participation of chemical distributors on the national working group Chemical Leasing
- ▶ individual visits of single companies (e.g. Brenntag, CSC JÄKLECHEMIE)

Initiatives for the extensive nationwide dissemination of Chemical Leasing

Within the course of the project the team, as well as companies and associations, initiated different measures for the dissemination of Chemical Leasing in Germany. These measures are in parts closely connected to the activities aiming at the reduction of the obstacles, which have already been listed in the beginning. They are conducive for the increase in the level of awareness for Chemical Leasing and for the improved information regarding the functioning of the business model.

Workshops and keynote speeches

During the project duration, the project team has hosted workshops or has given keynote speeches that particularly serve the information flow about Chemical Leasing and its level of awareness. The following activities took place within the project:

- ▶ industry workshop in Berlin
- ▶ meetings of the national working group
- ▶ European Forum Alpbach
- ▶ conference in Vienna
- ▶ different Chemical Leasing keynote speeches

International activities

Chemical Leasing and REACH

The European Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) facilitates and harmonises the European chemicals legislation and risk management.

An important aspect of REACH is the cooperation and communication of the involved actors along the value chain. This exchange and the shared use of the existing knowledge are also key elements of Chemical Leasing.

Annex XIV of the REACH regulation lists the substances that require authorisation for their manufacture or use. The applicant has to guarantee the adherence of certain boundary conditions when the chemical enters the market in order to receive a successful authorisation. For instance, specific exposure levels must not be exceeded. In case of an authorisation by the manufacturer, a synergy with Chemical Leasing can develop through the manufacturer's decision to combine the market launch with a Chemical Leasing business model. Thus, the manufacturer retains the control over the authorisation-compliant application of his chemical during the entire use phase of the chemical, which involves also the control over the risks and the exposure at work.

Introducing Chemical Leasing into the guidance documents is recommended in order to better link the business model with REACH. This placement of Chemical Leasing has raised great interest also in Austria.

Initiatives in cooperation with UNIDO

UNIDO has been promoting the development and dissemination of Chemical Leasing for more than one decade. Several initiatives and activities, such as the development of a Chemical Leasing Toolkit, the international expert group or the National Cleaner Production Centers (NCPCs) have been and are supervised and supported by the project team. Amongst others, the sustainability criteria have been advanced in cooperation with UNIDO. Meanwhile, the criteria are adduced as quality characteristics for the evaluation of the applications for the Global Chemical Leasing Award.

Chemical Leasing in the agricultural sector

Worldwide, substantial amounts of plant protection products and fertilisers are applied in agriculture. German manufacturers play an important role in this market: Bayer and BASF rank among the three manufacturers of agrochemicals with the highest turnover (Statista 2015c). In particular in emerging and developing countries, it can be observed that a growing amount of plant protection products is deployed due to the increasing industrialisation. This involves an interesting application potential for Chemical Leasing, which so far has been used only in a few projects in corn, wheat, and tea cultivation in Serbia and Sri Lanka. Contrary to

Chemical Leasing in industry, some particularities exist for the agricultural sector as e.g. the quality of the result is not only influenced by the business partners but also by external factors. In particular the general weather conditions or the occurrence of extreme weather events (e.g. droughts, floods) but also the infestation with pests and the soil conditions affect the harvest and the yield. Another difference is the provision of know-how which is obtained mainly by local service providers in the agricultural sector. The payment also differs from that common in industry as the farmer continues to pay for and buy the pesticide or fertiliser and he retains the risk of harvest losses. The optimisation due to the know-how transfer under Chemical Leasing can for instance be proven via a reference field. Subsequently, additional revenues are allocated to the business partners according to the contractual arrangements.

Overall, a rather reluctant attitude on the agrochemical manufacturer side did exist in the past, which now increasingly seems to change due to the interest shown by the Food and Agriculture Organization of the United Nations (FAO), different activities of UNIDO, and of the Austrian environment ministry.

Although no agricultural Chemical Leasing pilot project could yet be implemented in Germany, German companies are involved in the existing projects due to their presence on the global market. This results in a great potential regarding German projects. At the same time it cannot be assumed that large amounts of agrochemicals can be saved in Germany.

Possibilities to strengthen Chemical Leasing in the agricultural sector

The German chemical policy could take a leading role by fostering and supporting Chemical Leasing in agriculture on a global level more strongly. In this way, not only agrochemicals from German manufacturers could be exported to emerging and developing countries in the future but also the German knowledge for the optimal application of the chemical could be embedded and applied by the farmers. Additionally, this strategy would help mainstreaming the Chemical Leasing business model - in the agricultural sector as well as in general.

This can be achieved by the initiation of a pilot project on 'Chemical Leasing in agriculture' in Germany. The same is currently planned in Austria by its Environment Ministry. In addition, existing service models in agriculture should be compared to Chemical Leasing in order to exploit existing synergies or to add important aspects of Chemical Leasing to existing models.

Furthermore, the German policy can integrate Chemical Leasing into international bodies, especially into the activities and initiatives of the FAO. Moreover, the establishment of a German consulting system is conceivable that globally supports Chemical Leasing projects in agriculture by know-how provision.

Publications, media presence, and research activities in the field of Chemical Leasing

Chemical Leasing has been described in a number of national and international articles or has been disseminated via other media throughout the project duration. Some examples include online articles on the website of the "Deutsche Welle", the VDI news or Ensia, several YouTube videos and scientific publications e.g. in the journal Resources, Conservation and Recycling. A detailed overview is presented in Table 7 in chapter 5.3.

Furthermore, Chemical Leasing has led to the initiation of several research activities in the past years. For instance, the established cooperation between supplier and user can result in joint research for the substitution of hazardous chemicals with less hazardous alternatives or the continuous technological advancement and optimisation of processes induces user oriented research. Another area of research affects the economic analysis of the course of the business model and of the types of funding with methods of economics and business administration.

Research activities that are stimulated by Chemical Leasing but have continued without the business model exist in the field of battery production and fertilisers and plant protection products.

Revision of the national Chemical Leasing website

To provide easily accessible information on the German activities within the field of Chemical Leasing to all interested parties, the national website (www.chemikalienleasing.de) was regularly revised and improved during the project duration. Besides in-depth background information about the business model the website refers to former projects as well as to the activities of the national working group. Events, such as the Chemical Leasing workshop in Berlin or the presentation of the Global Chemical Leasing Award, are announced on the webpage and, following the events, information regarding the results and outcomes is provided.

Conclusions and recommendations

During the course of the project it has become apparent that all actors should strive for the further improvement of the targeted communication of the benefits induced by Chemical Leasing in order to contribute to the reduction of the inhibiting factors. Findings from international experiences and concepts can be transferred to the German chemical industry and initiatives and programmes can be combined more effectively.

The project team has elaborated activities for the implementation of incentive systems and communicative measures. They are summarised in the following textbox and described in more detail in chapter 7.

Recommendations of activities for the further implementation of incentive systems and communicative measures

1. Strengthen or establish linkages and synergies to similar programmes of the chemical industry, such as Responsible Production, Global Product Strategy (GPS) and the Guide on sustainable chemicals.
2. Integrate Chemical Leasing into the political activities for a sustainable chemistry, in particular at the conference to be held in September 2015 “Sustainable Chemistry Conference 2015: the way forward”.
3. Further support of the international Chemical Leasing initiatives by Germany through intensive exchange and continuous collaboration with UNIDO.
4. BMUB, UBA and UNIDO commonly working towards more transparency of existing Chemical Leasing projects and disclosure obligations in return for the support provided.
5. Support the integration of Chemical Leasing (and similar service-oriented business models) into public procurement, e.g. via the integration into handbooks such as the German ‘Handbuch Umweltfreundliche Beschaffung’ (Federal Environment Agency) or ‘Buying Green!’ (European Commission).
6. Governmental support of Chemical Leasing via marketing-effective measures, e.g. in the form of awards or prizes.
7. Improved examination of the fulfilment of the sustainability criteria for Chemical Leasing at the

Recommendations of activities for the further implementation of incentive systems and communicative measures

Global Chemical Leasing Award.

8. Expanded research in the field of Chemical Leasing in chemicals trade, including estimations of economic potentials and different chemicals and their application regarding the suitability for the business model.

9. Promote Chemical Leasing as an element of the REACH authorisation process (e.g. via the targeted information through European Chemicals Agency (ECHA), the Committee for Risk Assessment (RAC), and the Committee for Socio-economic Analysis (SEAC)).

10. Adaptation of the UNIDO Toolkit to the German circumstances, e.g. by including additional contract examples.

11. Support of the further development of Chemical Leasing in the agricultural sector and integration of the business model into international debates and guidelines on sustainable chemicals management in agriculture.