Financing Models for Soil Remediation

Green Finance Approaches to Soil Remediation

International examples

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Published by the International Institute for Sustainable Development and the Norwegian Institute for Water Research.

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IISD Head Office

111 Lombard Avenue
Suite 325
Winnipeg, Manitoba
Canada R3B 0T4

Tel: +1 (204) 958-7700
Website: www.iisd.org
Twitter: @IISD_news

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NIVA Head Office

Gaustadalléen 21
0349 Oslo
Norway

Tel: (+47) 22 18 51 00
Website: www.niva.no

Green Finance Approaches To Soil Remediation: International examples

June 2018

Norwegian Institute for Water Research (NIVA)

Ingvild Skumlien Furuseth, Karl Jakob Kammler, Wenting Chen, Froukje Maria Platjouw, Yan Lin, Morten Jartun, Thorjørn Larssen, Mathias Lund Larsen

Cover design is based on soil symbols used in mapping soil types.

ABOUT THIS REPORT

This is a part of a series of outputs of a four-year project, Financing Models for Soil Remediation, carried out by the International Institute for Sustainable Development (IISD), the Norwegian Institute for Water Research (NIVA) and the Chinese Academy of Environmental Planning (CAEP), in association with the Centre for International Climate and Environmental Research (CICERO) and the International Institute of Green Finance (IIGF) of China Central University of Finance and Economics (CUFE) with support from the Norwegian Ministry of Foreign Affairs. The project aims to support the implementation of China's priorities and its policy development process through institutional partnerships; mutual learning and exchange; strengthening of capacity, especially in government institutions; and the effective demonstration of results on the ground in the implementation of China's environmental priorities. The overall objective of the project is to harness the full range of green finance approaches and vehicles in the task of funding and managing the associated risks in the remediation of contaminated soils in China.

This series of reports focuses on the financial vehicles available to attract investment to the environmental rehabilitation of degraded land and the financial reforms needed to make these vehicles a viable and desirable means of investing in land rehabilitation. We draw on best practices worldwide in funding environmental rehabilitation, with a special focus on the design and use of financial mechanisms to attract private investors, share the risks and offer a clear benefit for the rehabilitated land. This report was written by Ingvild Skumlien Furuseth, Karl Jakob Kammler, Wenting Chen, Froukje Maria Platjouw, Yan Lin, Morten Jartun and Thorjørn Larssen.

This report was edited by Lisa Muirhead and Tom Penner.

ACKNOWLEDGEMENT

In addition to the authors highlighted above, we would like to acknowledge the guidance and insights of a number of people.

The authors would like to thank all who shared information and insight about the cases: Terje Aamot from Flekkefjord municipality; Tor Øivind Solvik from Flekkefjord Motorbåtklubb; Erik Høygaard, Jeanette Bente Beckius and Harald Solberg from the Norwegian Environmental Agency (NEA); Chloé Annino from Ginkgo Advisor; Michael Mücke Jensen from the Danish Oil Industry Association (Energi- og olieforum); Preben Bruun from the Danish EPA (Miljøstyrelsen); and Jeff Hukill and Ronald Smedley from the Michigan Department of Environmental Quality.

We are grateful to the representatives from IISD, CAEP, CICERO and IIGF whose input has been an important contribution to this report: Joe Zhang, Nathalie Bernasconi, Oshani Perera, Elka Parveva-Kern, David Uzsoki, Laurin Wuennenberg, Andrés Cuéllar Illera, Flavia Thomé, Mark Halle and Fida Rana from IISD; Aiyu Qu, Zhanfeng Dong, Yunting Duan and Wu Qiong from CAEP; Knut Halvor Alfsen and Taoyuan Wei from CICERO; and Yao Wang and Mathias Lund Larsen from IIGF.

Findings and opinions expressed in this paper are not necessarily shared by those contributing to the work, and any errors and omissions are the responsibility of the authors and partner institutions.

Executive Summary

The scale of ecological degradation requires ever-greater natural resources to be repaired. With much of the degradation being the result of historic and cumulative environmental pressures for which traditional liability rules cannot generally work, new financial instruments and sources must be harnessed to fund restoration and remediation projects. Often environmental degradation will have direct, negative impacts on human well-being, most evidently on local communities living near affected areas. When degraded ecosystems pose an immediate threat to people's livelihoods and health, such as in the case of contaminated soil or sediments, the political imperative to undertake remediation will be particularly strong.

A remediation strategy intended to ameliorate contamination in a specific area can have different costs and different results when applied to the same ecosystem type in a different geographic area due to variations in regional or country-specific cost structures, such as workers' salaries and fuel costs. The size of the projects also is a material factor.

This report documents and analyzes how different financing instruments have been used to support soil remediation projects. We have chosen seven different cases with different financial measures used: the Superfund (United States), Clean Michigan Initiative bond (United States), the Danish Oil Industry's Remediation Fund (Denmark), the Ginkgo Fund 1 (France and Belgium), Bonfol Soil Remediation Project (Switzerland), and Flekkefjord and Hempel cases (Norway). The first four cases address programs for financing soil remediation projects, and the latter three cases address specific remediation projects. For the first four cases, we provide information on both the programs and chosen projects under each program.

In each case, we look at the background of the remediation program or project, including the level of development in the region or the nation at the time, and the type of land the remediation projects focus on. Then we identify financial actors, financial instruments used, financial sources and financial recipients, costs and various risks the project faces. Two types of costs that affect project return are discussed: transaction costs and information costs. The risks include legal, regulatory, social, political, technical and physical, and market risk. For each case, both success factors and weaknesses are discussed.

This report finds that the different financing approaches to soil remediation projects have different fields of application. In urban areas, it is easier to mobilize private funding, as remediation will increase possible revenue streams after remediation. Funds aimed for long-term soil remediation of a large quantity of sites rely on the continuity of funding. For instance, continuity may be ensured by a special tax on polluting industries or regular fixed grants from general fiscal revenue. As another example, the establishment of a remediation fund to provide loans, security and grants may ensure continuity and help mobilize private capital in the long term.

Many countries have legislation that follows the polluter pays principle. However, the polluter notion for cost liability may differ greatly. It may be defined broadly by including, for instance, landowners and leaseholders, or a narrower definition pointing directly the original polluter. This may affect the possibility to leverage private funding for remediation.

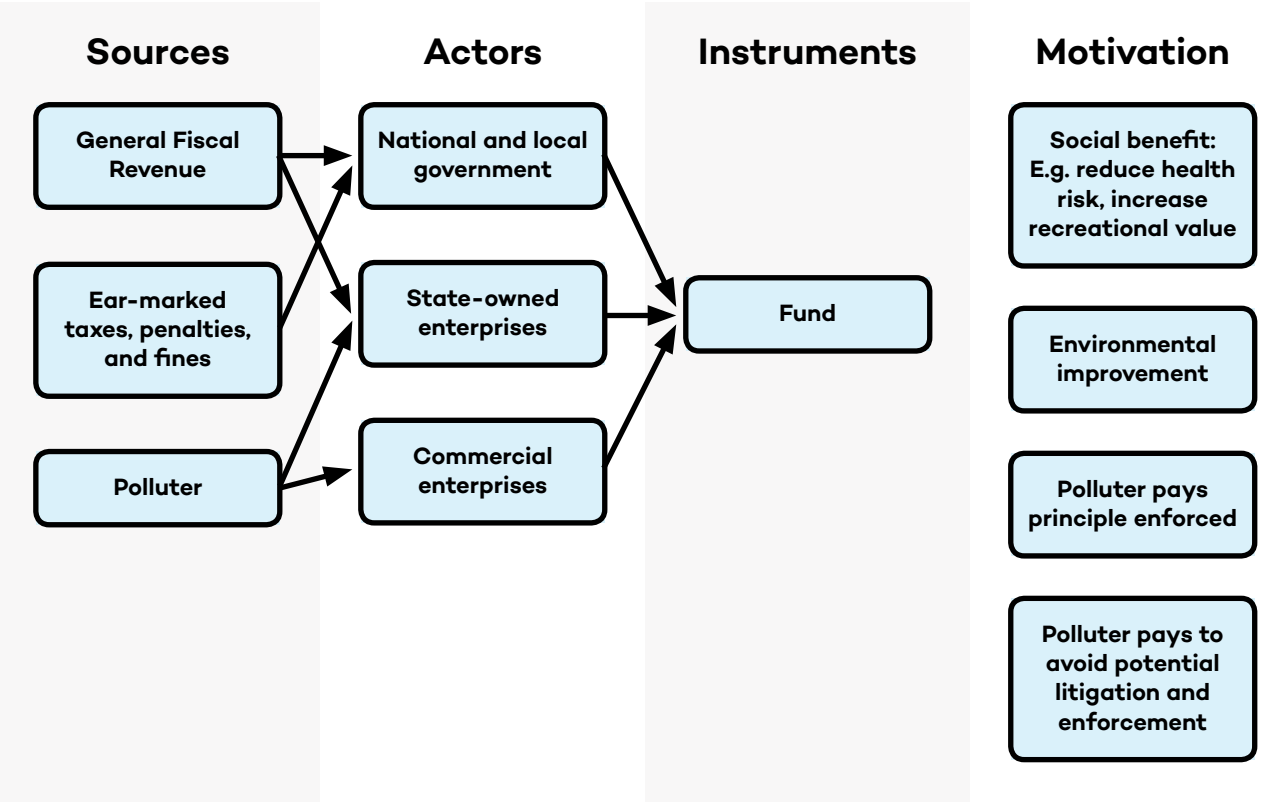
Each case is summarized in the following tables, where strengths and drawbacks of the financing instruments reviewed are summarized.

Table ES1: A summary of the seven projects and programs explored in this report

Program: Superfund	**Instrument:** Fund **Location:** United States

Summary:

Superfund is a federal government program in the Unted States that funds the remediation of contaminated sites. The Environmental Protection Agency (EPA) may identify the responsible polluters and require them to clean up the sites or it may remediate the site itself using the Superfund. Historically, about 70 per cent of the Superfund cleanup activities have been paid for by the polluters. The Superfund was originally financed primarily through a tax on the petroleum and chemical industries. Since 2001, the fund has mostly been financed through the federal budget. Between 2000 and 2015, Congress allocated about USD 1.26 billion in general revenue annually to the Superfund program.



Strengths:

- Remediation of many sites
- Often exhaustive remediation
- Centralized EPA procedure

Weaknesses:

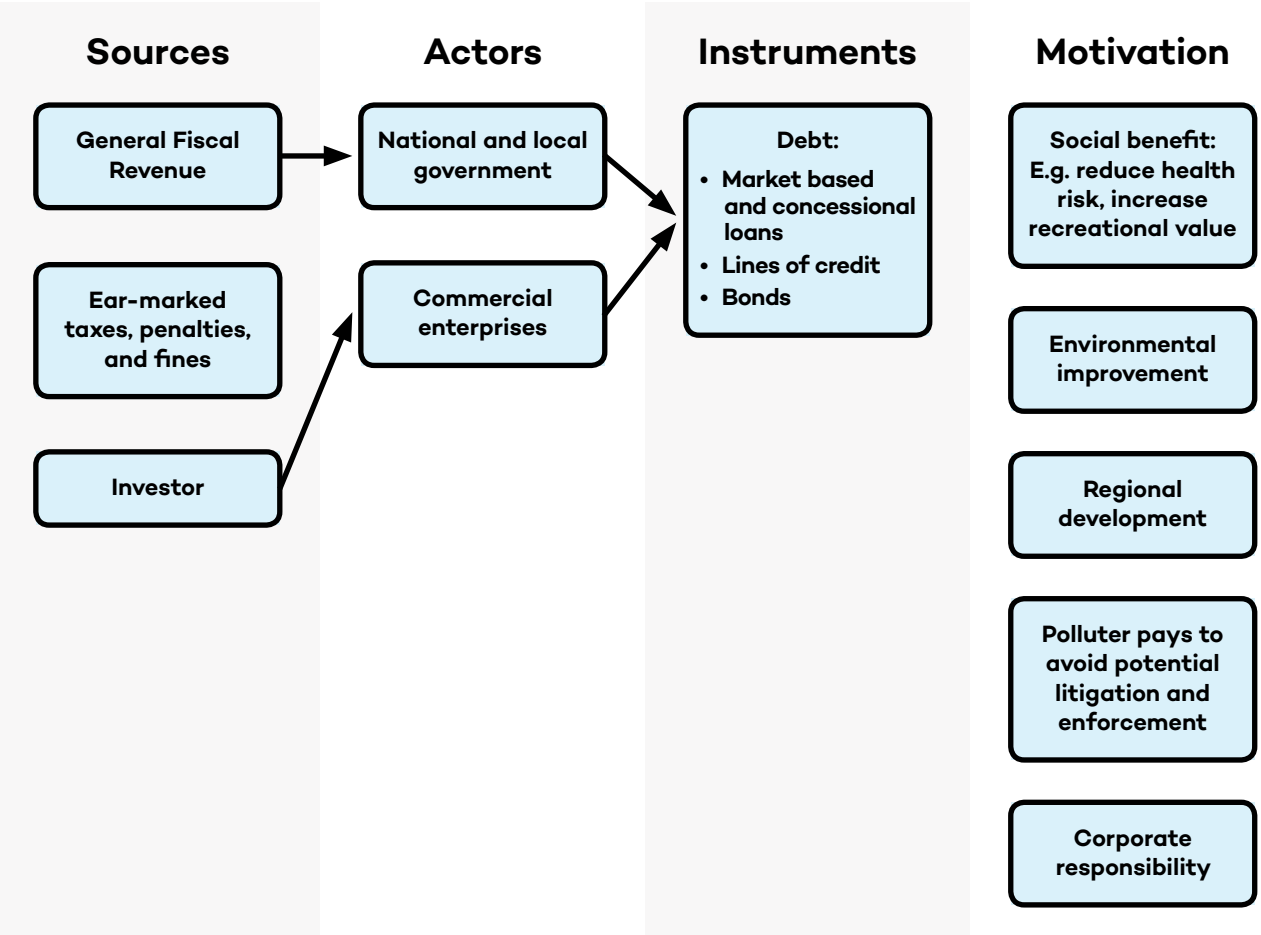
- Centralized, bureaucratic and inflexible
- Massive amount of litigation
- Slowdown in remediation startups

Program: Clean Michigan Initiative Bond

Instrument: Bond
Location: United States

Summary:

This program concerns a municipal bond, established in 1998, supporting activities relating to remediation and redevelopment of brownfields, redevelopment of waterfronts, remediation of contaminated lakes and sediments, and pollution prevention. Loans and grants are the main instruments used to finance the projects. Michigan voters approved USD 675 million to be spent on the bond. Financial actors are, for instance, the regional government and commercial enterprises.



Strengths:

- Medium-term solution for funding projects
- Avoids the need to approve each separate issue
- More comprehensive and forward-looking efforts towards improving the environment

Weaknesses:

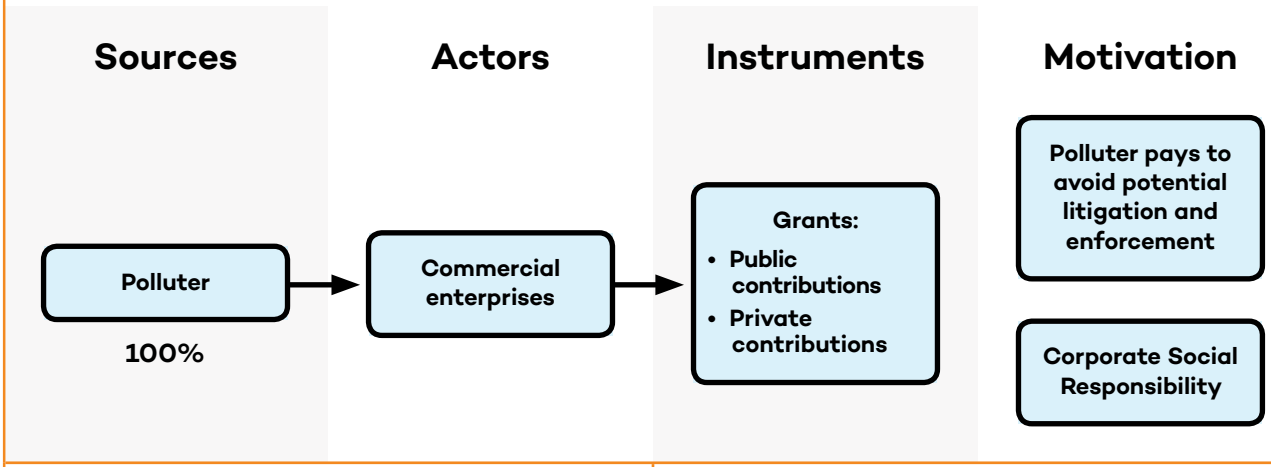
- No long-term solution, many non-remediated sites in 2017
- Expensive to finance projects through bonds
- Possibility of too-comprehensive projects, focusing too little on the remediation of contamination

Program: Bonfol

Instrument: Grants
Location: Switzerland

Summary:

This project concerns the remediation of 284,200 tonnes of contaminated soil, chemical waste and attached material in Switzerland, and the transportation of these masses to special treatment plants in the Netherlands and in Germany. The project is one of the most expensive undertaken in Europe. It is high risk because of the treatment of extremely toxic waste, which was transported over large distances. The total costs of about CHF 380 million were financed by the commercial entities BASF, Clariant, Novartis, Syngenta, Roche, Rohner, CABB and Henkel, which are identified as the polluters.



Strengths:

- Successful environmental outcome: chemical waste and its risks appear to be removed
- The polluter pays principle has been fully implemented
- Materializing of some risks was avoided

Weaknesses:

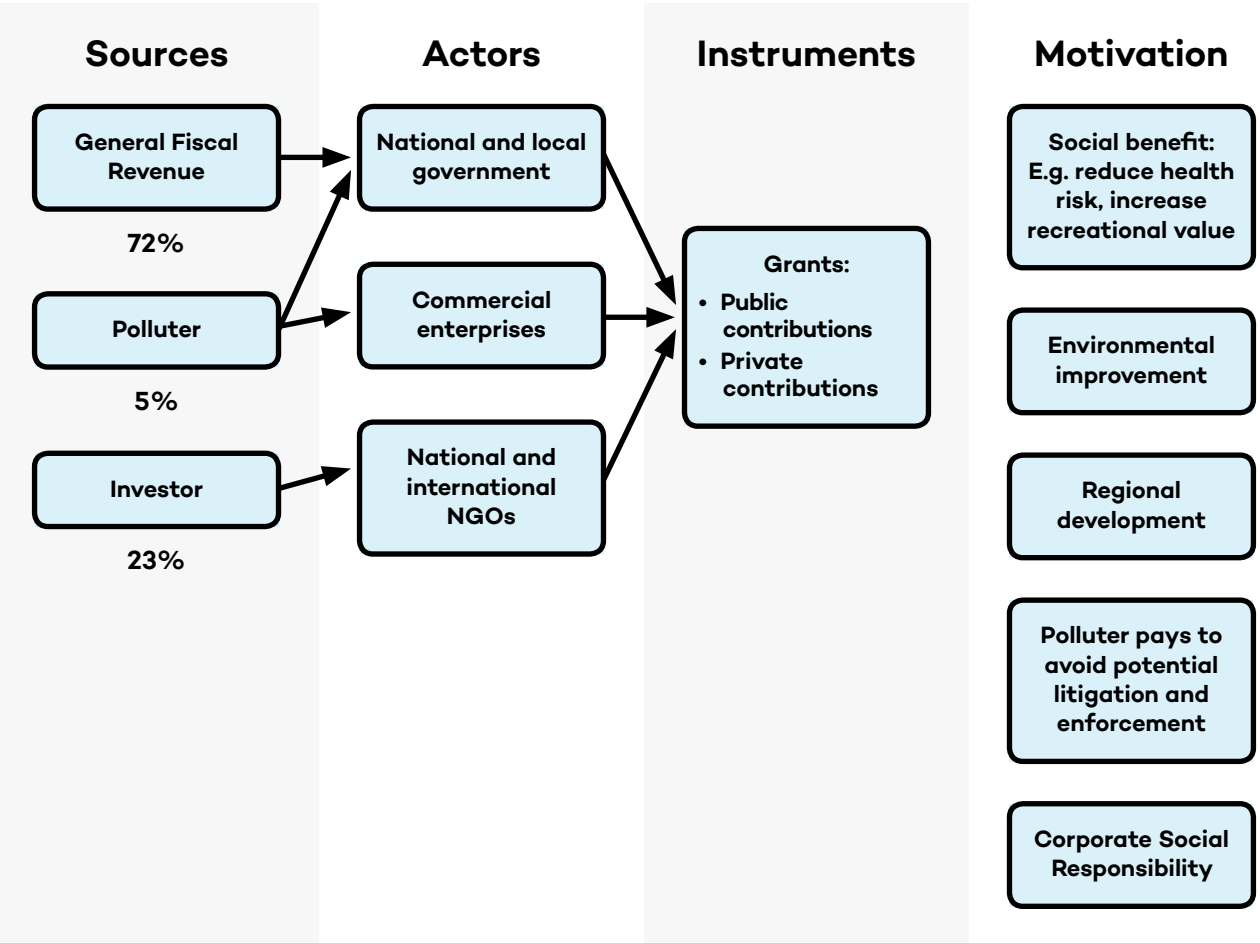
- Protracted process
- Lack of action
- Expensive
- Need for financial means and willingness to pay

Program: Flekkefjord

Instrument: Grants
Location: Norway

Summary:

The project concerns remediation of contaminated sediments in the fjords in Flekkefjord. The dredged material will be used to establish a waterside waste disposal site and a marina for small boats in the same municipality. The sources of funding were general fiscal revenue (NOK 3 million from the municipality and NOK 27.8 million from the Norwegian Environmental Agency [NEA]), polluters (NOK 2 million) and an investor (NOK 9.95 million). The NEA granted funding with the condition that the municipality, polluters and other entities also contributed. The pollution is mainly historic, and many of the polluting companies do not exist anymore. For that reason, the polluters' contribution to this project is only close to 5 per cent.



Strengths:

- Public funding encouraged private contribution
- Proper instrument utilized
- Prioritized areas for remediation
- Beneficial collaborations locally

Weaknesses:

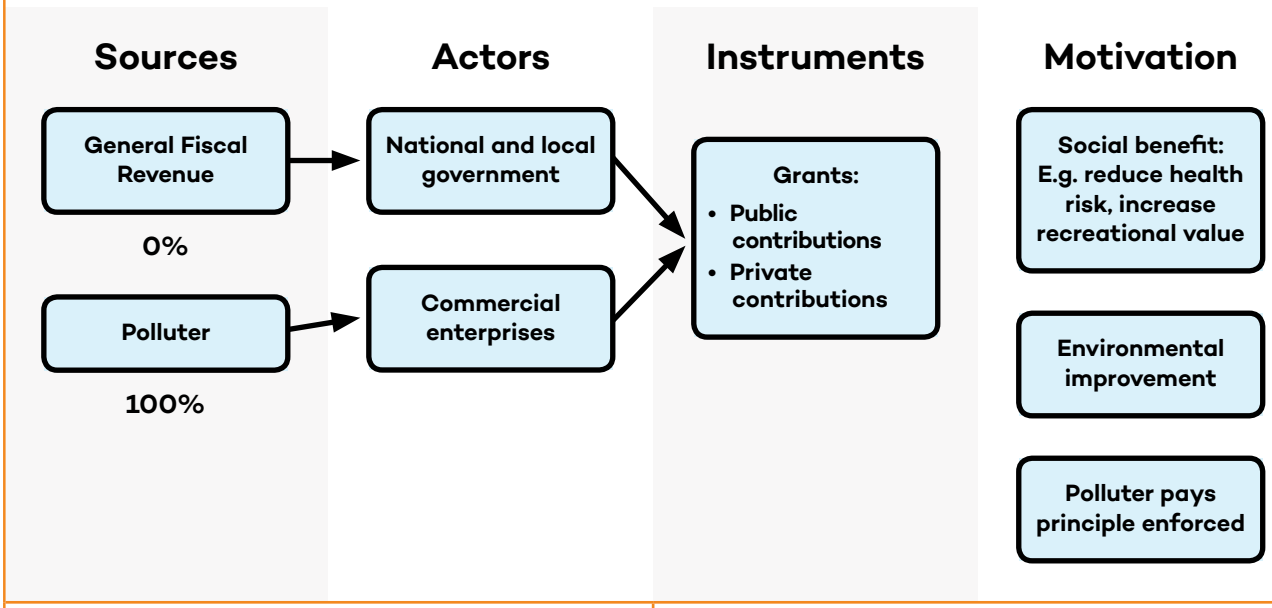
- Public authorities pay
- Lacks incentives to lower expenditure
- Need for action taken by the municipality

Program: Hempel

Instrument: Grants
Location: Norway

Summary:

The project concerns remediation of contaminated soil on the property of an abandoned paint and lacquer factory. The main motivation for the Norwegian Environmental Agency (NEA) was enhancing social benefits and improving the environment. This case, which includes a court dispute settlement procedure, set a precedent with regard to the liability question: the Norwegian Supreme Court transferred obligations from a daughter company to its parent company. The financial actors involved in the project are the private limited company Hempel A/S, the NEA and potentially the private limited company Byfjorden Business Park AS. The NEA contributed to the financing of the project through disbursements of the remediation in 2009 with NOK 2.38 million. All its costs were later recovered from Hempel A/S following court judgments. Hempel also funded the environmental assessment in 2008, amounting to NOK 756,321, and paid NEA's legal cost, amounting to NOK 670,772. Thus, the source of funding was a polluter through private grants.



Strengths:

- Polluters pay
- Clarified liability
- Public-funding-facilitated quick remediation startup

Weaknesses:

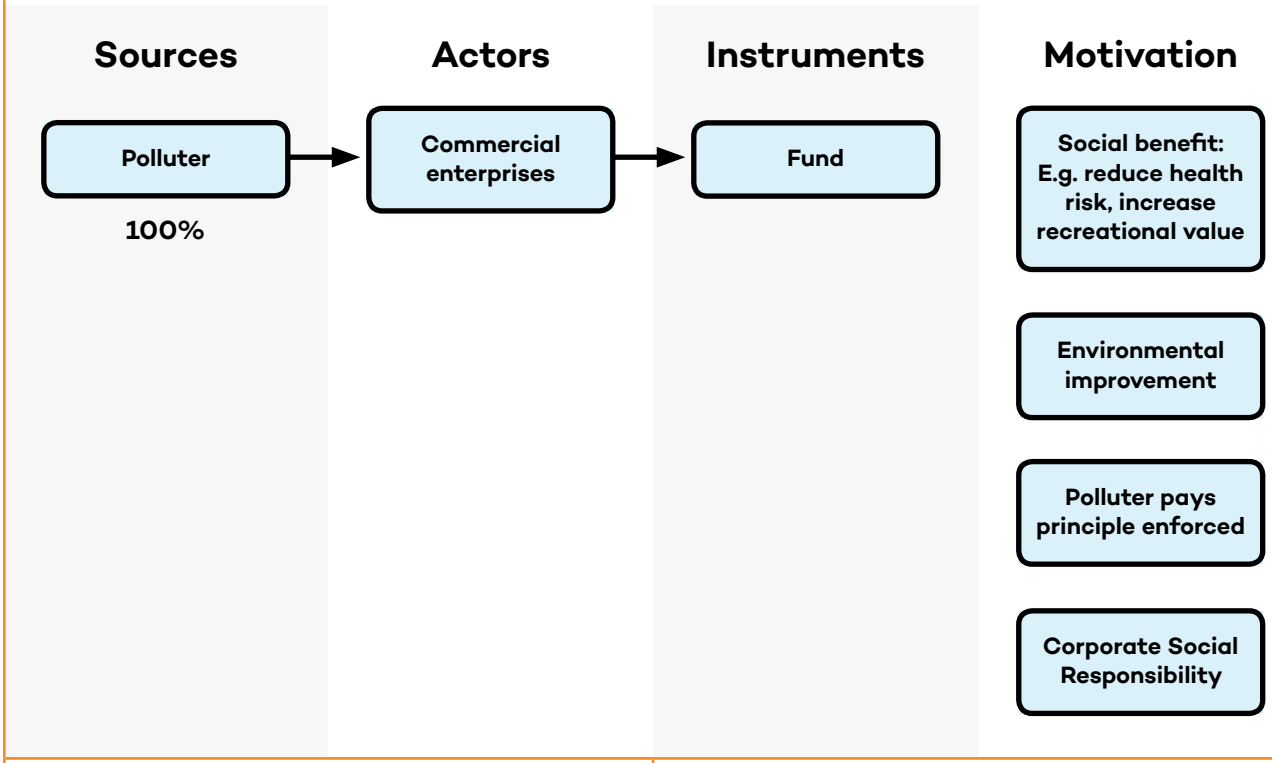
- Litigation was not avoided

Program: Oil and Petrol Sites Cleanup

Instrument: Fund
Location: Denmark

Summary:

This program concerns that Danish Oil Industry's Remediation Fund (OM), established in 1992 by nine oil companies operating petrol stations in Denmark. The fund financed investigations and remediation of sites previously used for petrol retail. The source of funding is the polluters, through a fee based on petrol sales. The oil companies were motivated by corporate social responsibility and the opportunity to create a cost-effective way to implement the polluter pays principle and avoid litigation.



Strengths:

- Voluntary agreement
- Proper instrument utilized
- Specialized procedures

Weaknesses:

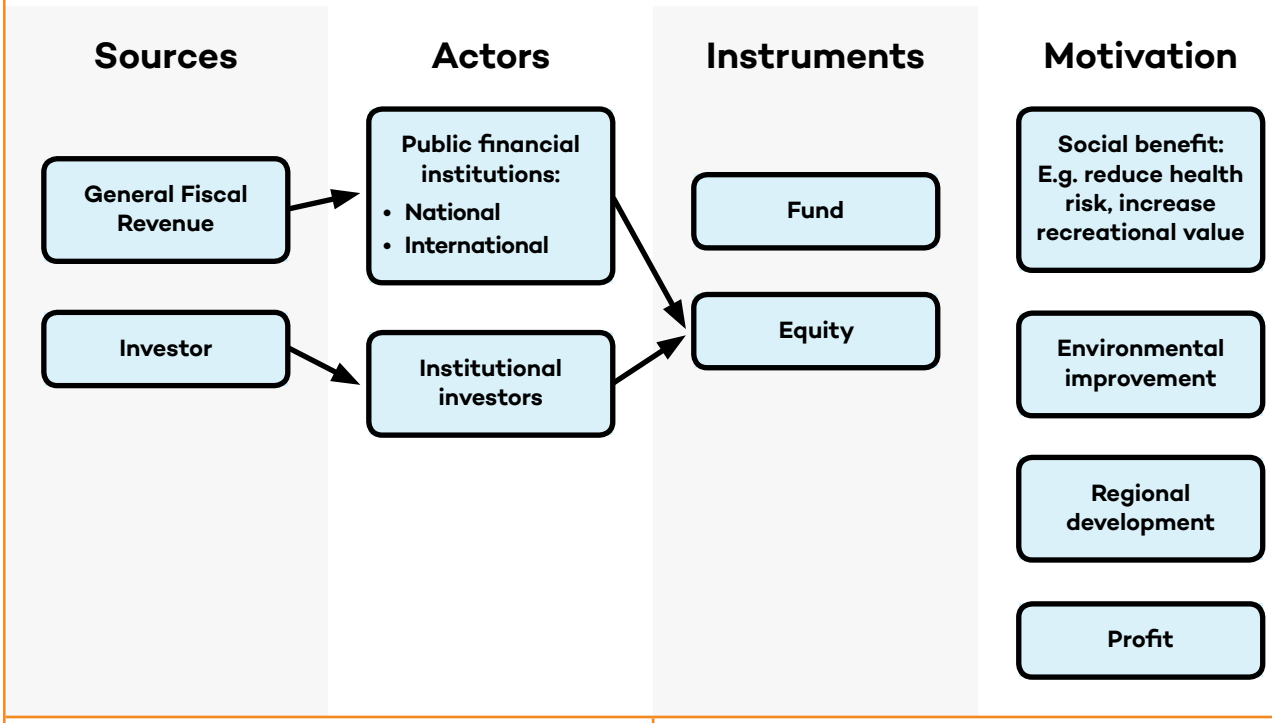
- Consumers pay
- The schemes depend on low remediation costs
- Limited to individual industries

Program: Ginkgo Fund I

Instrument: Equity investment
Location: France/Belgium

Summary:

This program concerns the Ginkgo Fund I, which was an eight-year for-profit fund managed by Ginkgo Management. The fund aimed to acquire a portfolio of environmentally impaired sites (brownfields) in France and Belgium, remediate the land using environmentally sound techniques and then sell the repositioned property to third parties at a premium. In certain cases, the fund maximized its value by participating in subsequent green real estate development projects on the sites.



Strengths:

- Profitability
- Public actors mobilized private capital
- Accumulation of specialized competence
- Risk diversification strategy to mitigate risks

Weaknesses:

- Large amount of initial capital required
- Limited field of application

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List of Abbreviations and Acronyms

BFPP	bona fide prospective purchaser
BCI	Basler Chemische Industrie (partnership of chemical corporations)
Brownfields Act	Small Business Liability and Brownfields Revitalization Act
CDC	Caisse des Dépôts et Consignations
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act
CMI	Clean Michigan Initiative bonds
CMIA	Clean Michigan Initiative Act
CHF	Swiss franc
DKK	Danish kroner
EIB	European Investment Bank
Environmental Pool	The Danish Oil Industry Association formed the Oil Industry's Environmental Pool
EPA	Environmental Protection Agency
EU	European Union
FOEN	Federal Office for the Environment (Switzerland)
GDP	Gross Domestic Product
Hg	mercury
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
Lender Protection Act	Asset Conservation, Lender Liability, and Deposit Insurance Protection Act
NEA	Norwegian Environmental Agency
NGO	non-governmental organization
NOK	Norwegian kroner
NPL	National Priority List
OM	Danish Oil Industry's Remediation Fund
OSites	Ordinance on Contaminated Sites
OCRCS–Contamination Fund	The Ordinance on the Charge for the Remediation of Contaminated Sites fund
OPEX	operating expenses
PAH	polycyclic aromatic hydrocarbon
Pb	lead
PCA	Pollution Control Act (Norwegian law)
PCB	polychlorinated biphenyl

PPPs	public–private partnerships
PRP	potential responsible party
SARA	The Superfund Amendments and Reauthorization Act
SFPI-FPIM	The Belgian Société Fédérale de Participation et d'Investissement
SOE	state-owned enterprise
SPV	special purpose vehicles
SRIW	Société Régionale d'Investissement de Wallonie
TBT	tributyltin
VAT	value-added tax

1 Introduction

Contaminated sites are recognized as a major global concern following the adverse effects these sites potentially have on human health and the environment. A contaminated site is often defined as an area of land that contains hazardous or potentially hazardous concentrations of substances that could cause adverse effects to human health or the environment, including surface waters and groundwater. In Europe, the European Commission has identified 1.2 million contaminated sites, and less than 5 per cent are currently remediated. Heavy metals are the biggest source of contamination, contributing approximately 37 per cent of the total European soil contamination (Panagos, Van Liedekerke, Yigini, & Montanarella, 2013). The Norwegian Environment Agency (NEA) reports that Norway has more than 5,000 locations of contaminated soil (including polluted sea bed) and that at least 10 per cent of these require immediate action (Miljøstatus, 2016). At the same time, China faces more serious environmental problems compared to its western counterparts due to vast contamination of river basins, coastal areas and soils following rapid industrialization, urbanization and intensive use of natural resources since the end of the last century. Approximately 16 per cent of Chinese soil is contaminated and 19.4 per cent of Chinese farmland is contaminated by heavy metals (Chen, De Sherbinin, Ye, & Shi, 2014). The environmental consequences of contaminated sites include deterioration of valuable resources like arable land and groundwater for human consumption, as well as ecotoxicological effects on terrestrial and aquatic ecosystems, resulting in both acute and long-term chronic effects on humans and the ecosystem (Fent, 2004).

Despite the global extent of contaminated sites and the adverse impacts, the sites potentially have on both human health and the environment, it has proven very difficult to achieve unified actions towards legally binding legislation for contaminated sites. The European Commission initiated a proposal for a Soil Framework Directive in 2006 (EU, 2006), which was withdrawn in 2014 due to resistance by several European Unnion (EU) member states who argued that "soil is a local rather than a global governance issue" (Montanarella, 2015). A similar situation occurred when the UN Environment's Minamata Convention on Mercury was negotiated, where the phrasing of Article 12 on contaminated sites became very vague, resulting in text that implies that no large efforts are needed in order to comply with the article (UNEP, 2014).

A key challenge associated with contaminated sites is the cost and financing of remediation. The cost of rehabilitating contaminated environments can be very high. Relying on public funds alone may not be sufficient to support all remediation actions needed. Hence, creative new financial mechanisms to remediation are needed, especially those mobilizing private capital.

The re-use and redevelopment of contaminated sites has become one of the major catalysts in development of residential housing and general city modernization in urban areas in industrialized countries. Redevelopment of contaminated sites supports the three pillars of sustainable development: i) economic (generating business and employment opportunities in often deprived areas); ii) environmental (removing contaminants and hazardous substances and saving potentially undeveloped green areas); iii) and social (improving the living environment in urban areas) (Pahlen & Glockner, 2004).

Recently, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) concluded that degradation of the Earth's lands and waters through human activities is negatively impacting the well-being of at least 3.2 billion people, pushing the planet towards a sixth mass species extinction and costing more than 10 per cent of the annual global gross product through loss of biodiversity and ecosystem services (IPBES, 2018, p. 2). The IPBES concluded that "investing in avoiding land degradation and the restoration of degraded land makes sound economic sense; the benefits generally by far exceed the cost. On average, the benefits of restoration are 10 times higher than the costs, estimated across nine different biomes" (IPBES, 2018, p. 3). The IPBES calls for acceleration of measures for ecological restoration of degraded land. To attain this, however, significant financial flows should be mobilized. Even though offsetting and cap-and-trade mechanisms might succeed through the trade in credits, the implementation of concrete restoration projects sometimes requires huge amounts of financial resources. The costs to be funded may include acquisition of private property, scientific research and environmental monitoring, removal of pollutants, translocation of species, and compensation to local resource users for any reduction in their existing economic rights such as for forestry and

farming. With many states functioning within substantial and protracted budget deficits and public opposition to higher taxes, the public sector has limited capacity to fund such expenses. Enhancing private parties' involvement is therefore essential for meeting the expectations of the IPBES.

This report presents examples from around the world where green financing mechanisms have been employed to remediate contaminated soil and/or sediments. The examples provide an insight into the background to the projects or programs, including the level of development in the particular country/region and the type of land. Moreover, the examples describe the financial actors; financial instruments; financial sources; financial recipients; costs affecting return; and risks for financing return including legal, regulatory, political and social risks. Each example concludes with a section on lessons learned.

2 Definitions and Terminology

2.1 Level of development

The level of development in a country or region affects financing of remediation projects in several ways. First, it affects the ability to fund such projects. In poor countries and regions, the basic needs (e.g., schools, health care and food) must be covered before financing potential costly remediation projects. Second, the possibilities to combine remediation and redevelopment, financed through future revenue streams, are affected by the purchasing power in the area, as well as the attractiveness of the site. Third, investors will assess the risks related to the financial recipients' ability to carry through the project.

2.2 Type of Land

Type of land refers to the population density in the area, landscape and subsoil structure. These factors may affect the severity of contamination, remediation techniques to be used, physical risks and allowed level of residual contamination.

2.3 Financial Sources

Public capital stems from general fiscal revenue and earmarked taxes, penalties and fines. Remediation projects could also be financed by polluters' capital or private capital.

GENERAL FISCAL REVENUE

General fiscal revenue refers to the general public budget. This ultimately originates from any government income, such as taxes, duties and income from state-owned assets. Depending on circumstances, this is collected and distributed between central and local government.

EARMARKED TAXES, PENALTIES AND FINES

This source of capital refers to taxes committed to a specific purpose at the time of collection. This can be distinguished from general fiscal revenue, which is allocated through the fiscal budget determined by the government. As an example, revenues from sales taxes on polluting products, emission taxes, or penalties or fines when pollution occurs could be directly committed to remediation projects.

POLLUTER

Remediation projects could also be financed by the polluters, either voluntarily or through enforcement. The polluter pays principle is implemented in legislation in several countries but could be difficult to enforce if: the pollution stems from firms that no longer exist, the causality is unclear, or the firm had permission to pollute. Public authorities, SOEs and private actors could be classified as polluters. Thus, both private and public capital could be the financial source for remediation projects financed by a polluter. It may take the form of grants, ownership of debt, funds and other mechanisms.

INVESTOR

This category covers both individuals' and organizations' resources. It may take the form of ownership of debt, equity and any other type of asset. For instance, investors hold private capital that could be used to remediate and develop an area.

2.4 Financial Actors

The financial actors are those who finance the remediation projects through different instruments. The financial actors can be categorized into seven groups: national and local government, public financial institutions, state-

owned enterprises, institutional investors, commercial enterprises, private citizens, national and international non-governmental organizations (NGOs).

NATIONAL AND LOCAL GOVERNMENT

This category is a public source of funding. At the national level, this includes funding from ministries, bureaus, authorities and other public institutions. Local government refers to public institutions at the subnational level, for instance municipalities, counties, administrative regions and provinces.

PUBLIC FINANCIAL INSTITUTIONS

These institutions could be either national or international. The national financial institutions operate by mandate of national governments and include primarily national development banks and funds. At the international level, a number of institutions provide funding for soil remediation. These include several multilateral development banks as well as various funds and facilities. Such institutions are publicly mandated and primarily publicly funded, and could aim to finance projects in certain types of countries or regions.

STATE-OWNED ENTERPRISES

State-owned enterprises often operate as profit-seeking organizations, but with softer budget constraints, different strategic goals, and closer relations to other state-owned enterprises (SOEs) and the government. This category includes both financial, such as state-owned banks, and non-financial, such as SOEs in strategic industries.

INSTITUTIONAL INVESTORS

Institutional investors include pension funds, insurance companies, endowments and funds. Such organizations are traditionally private but can, in the Chinese case, be partly or wholly publicly owned.

COMMERCIAL ENTERPRISES

This broad category includes all privately owned enterprises, from primary and secondary to service sectors of the economy.

PRIVATE CITIZENS

This category represents finance flows directly from private individuals without intermediate institutions. Private capital with an intermediary actor is labelled by the actor, with private capital at the level of the source, such as with private deposits channelled through banks.

NATIONAL AND INTERNATIONAL NGOS

As private non-profit actors, NGOs can, in many cases, provide financing for soil remediation. NGOs can be both of national and international origin and vary between small-scale local NGOs and large-scale international NGOs.

2.5 Financial Instruments

Remediation projects could be financed by employing financial instruments such as grants, debt, funds, equity, crowdfunding, public–private partnerships (PPPs) and instruments that could enhance credit or reduce the cost of debt.

Capital from public or philanthropic sources could mobilize private capital for remediation projects with high development impact, through their choice of financial instruments and criteria. First-loss capital or guarantees, tax incentives, interest rate subsidies and PPPs could be suitable for such means. Thus, the private investors benefit from lower risk and/or enhanced returns on their investments, while public investors magnify the impact of their funding by attracting private capital to the projects. Such projects might not be possible to carry out if left to the private or public sector alone.

GRANTS

Grants could be given by both private and public actors. Public contributions can take the form of direct payments such as cash grants or gap grants and subsidies by performance indicators. Private contributions can come from a number of actors and take the form of grants at various stages of a project. Payments due to enforcement of the polluter pays principle are also categorized as grants in this report.

FUNDS

Some of the cases could be best described as a fund for financing remediation projects. A fund receives capital from general fiscal revenue, earmarked taxes or fines, equity investments or polluters.

DEBT

Remediation projects could also be financed by debt instruments such as market-based loans, concessional loans, lines of credit and bonds. Market-based loans refer to loans given to projects based on the terms of the market. Creditors will set the interest rate and maturities based on their own estimates. In contrast to this, concessional loans intentionally offer better conditions than market-based loans in order to incentivize certain behaviour.

Another debt instrument is lines of credit. A line of credit is the promise of a loan in case of a creditor's shortage of liquidity. For example, if a special purpose vehicle (SPV) runs short of financial resources to operate, rather than selling assets, declaring bankruptcy or seeking new loans, a line of credit is a promise of a loan from a financial institution beforehand to be used for such a case. This includes a maximum amount, certain interest rate and maturity.

BONDS

Bonds are also used to finance remediation projects. Such bonds could be issued through an SPV, public authorities or proceeds dedicated to the project by a related actor. A bond could be earmarked to finance remediation projects, or it could finance other kinds of projects as well. Some bonds could be labelled as green bonds, meaning that proceeds are earmarked for projects with environmental benefits. In the Chinese case, green bonds include those earmarked for soil remediation projects, as soil remediation is listed in the China Green Bond Endorsed Catalogue (China Society of Finance and Banking, 2015). The proceeds of those bonds have to be used for remediation and not for a given usage of the land subsequently, unless this purpose is also listed in the catalogue.

CREDIT ENHANCEMENT AND COST-OF-DEBT REDUCTION

Credit enhancement and cost-of-debt reduction instruments include interest rate subsidies, tax incentives, securitization, guarantees and insurance.

Interest rate subsidies provide submarket interest rates to a specified scope of projects when lending in certain financial institutions. The subsidies allow for a lower interest rate than usual for loans with similar risk profiles. National and local governments commonly pay the subsidy. This tool allows the government to use a market-based and scalable mechanism to meet policy objectives, making it possible to realize projects that are feasible only with artificially low interest rates. This can be contrasted to concessional loans, which are directly provided to specific projects.

Public authorities can structure tax incentives in several ways. A reduction in the amount of tax to be paid by a project logically reduces its costs. Such a reduction in the costs allows for project holders to borrow at cheaper rates, as creditors estimate that more projects are bankable and as costs are lowered while all other variables remain constant. This ultimately results in more projects being realized. Other kinds of tax incentive schemes also exist. For instance, in countries with a capital gains tax, a tax relief on income from green funds or bonds could provide incentives for investors to invest in remediation projects and other green projects. Tax Increment Finance is another instrument employed to finance remediation projects. The logic behind such a scheme is that the property value is expected to increase when a contaminated property is remediated (World Bank, 2014). The improved property value will cause an enlarged tax revenue in areas with property taxes. The difference in tax revenue could fund additional remediation projects.

Securitization is a bank-level financial tool pooling together a number of debt obligations into collateralized debt obligations. Being pooled together, collateralized debt obligations only carry the average default risk of the projects collateralized rather than the individual risk of a project. This consequently increases predictability, enhancing the stability of the portfolio. As banks can increase the stability of the default rate for lending, they are willing to issue more debt, ultimately increasing the number of projects being realized.

Guarantees and insurances increase a project's credit worthiness since risk is reduced. Guarantees are usually issued by governments and can cover an entire debt of a project or a portion of it. While the government does not have any direct initial cost, guarantees are carried as liabilities in the public budget. Insurance works in a similar fashion but is usually issued through insurance companies negotiating the terms directly with the project holder. Government institutions may in turn cover some of the cost of a market-based insurance, in a similar fashion to when governments provide an interest rate subsidy. As such, insurance and guarantees work in a similar fashion. As guarantees and insurance reduce the risk associated with a project, they work as a credit enhancement mechanism that ultimately reduces a project's cost of debt, making more projects realizable.

EQUITY

Equity in a project can be bought by several actors. When buying equity, the actor formally owns a portion of the project. This is only possible when the project is established as formally independent, such as with an SPV. From the perspective of the project holder, raising capital through equity is cheaper than debt as no interest is paid, but it simultaneously forces the project holder to give up authority and share future profits with other equity owners.

OTHER INSTRUMENTS

In addition to the instruments mentioned above, remediation projects could also be financed through PPPs or crowdfunding.

PPPs can be understood as a continuum between being completely public and completely private. At the level of low private party participation, PPP models such as management and operating contracts exist. This is based on public ownership with private operations, and the risk and expense are thus carried by the public sector, while taking advantage of competitive tendering for operation contracts. Leasing the facilities from the public owner provides this model with slightly greater private sector engagement. PPP arrangements using a mix of public and private finance include concessions, build-own-transfer and build-own-operate. The PPP arrangements with the greatest private involvement include joint ventures and partial divestiture of public assets. Through this mechanism, both public and private actors share risk and financing at a mutual benefit.

Crowdfunding is an innovative form of financing with great potential, as citizens become aware of environmental problems and are willing to contribute directly as individuals. It can be used through several the above financial instruments, such as grants, debt and equity. Crowdfunding is often operated through an online platform, where each project has their own site that could be shared through social media, friends and acquaintances. The project site includes a description of the project, total amount required to realize the project, pictures, etc. Then those interested in contributing could donate an amount of their own choice through the platform.

2.6 Financial Recipients

The nature of financing recipients, who are the recipients and users of the financed funds, determines the risk profile of the financing and as such the "bankability" of the proposed financing mechanism. Broadly, they can be categorized as sovereign recipients and non-sovereign recipients.

SOVEREIGN RECIPIENTS

In case the government body is the party responsible for receiving the financing and deploying that to remedy the contamination, the private financiers would look into the risk profile of the government, as they are taking on the risk of the governments for repayment. For national governments, except for a few seriously debt-ridden countries, it is comparatively easier for them to raise financing. For subnational governments, however, it could

be challenging, as their credit standing may not be as strong as that of a national government. In that case, the borrowing by the subnational governments can be credit-enhanced by backup from the central government.

NON-SOVEREIGN RECIPIENTS

If a private party, such as an SPV established to address soil remediation, is raising financing, then the financiers will be more focused on the commercial risks and their revenue profiles.

2.7 Costs Affecting Return

Costs incurred by an investment project can generally be categorized into one of the following three groups: costs affecting *rate* of return, transaction costs and information costs. In this report, we are interested in both project costs and costs incurred to the financing actor.

Transaction costs are incurred while buying or selling a good or service, relating to negotiations, communication, fees and enforcing of an agreement, among others. In the case of financing remediation projects, transaction costs could occur while negotiating with potential investors, polluters or other matters related to project financing. It could also occur when hiring remediation and construction companies. In the end, public authorities must approve the remediation efforts and remaining level of pollution, which also could be a subject causing transaction costs.

Information costs arise while exploring possible investments in projects or assets. Information costs arise in the process of identifying: potential sources of funding and investors, remediation and construction companies, development possibilities and so on. In cases where polluters are forced to fund remediation, information costs arise in the process of identifying polluters and gathering required information about causality, concessions to pollute and the status of the company in terms of their existence or resolution, mergers or slit-ups. The more complex the case, the higher the information costs. If polluters are not obliged to contribute, the project manager's knowledge about local polluters and their willingness to pay will be crucial to the level of information search and costs. Some of the instruments will not require as much financial or business information as others. However, a less complex information search may be less expensive, but also runs a higher risk of not detecting abuse such as attempts to cut corners, overestimate project costs or other unfavourable conditions.

Costs affecting rate of return could be commodity or service price, tax, financial costs and so on (Torvanger, Narbel, Pillay, & Clapp, 2016, p. 15). The latter is especially important for an investor, as it concerns the opportunity costs when financing this project.

2.8 Risks for Financing Remediation

LEGAL RISKS

The semantic use and definitions of legal risks are inconsistent. Indeed, there seems to be no generally accepted definition of legal risks (Mahler, 2007, p. 17). For this report, *legal risks in the wide sense* shall be understood as risks that have a legal issue as their source (Mahler, 2007, p. 10). A risk requires some form of uncertainty (Mahler, 2007, p. 20). The term "legal risks" shall include both legal and factual uncertainties.

The wide definition includes several types of legal risks. Thereunder, what we call legal risks in the narrow sense, include liability risks, contractual risks and regulatory risks. While the definitions of these types of legal risks are not mutually exclusive, they focus on different aspects of legal risks, thus representing useful analytical tools.

Legal risks, in the narrow sense, are the potential losses that may occur to an investment because of lacking, insufficient, vague or improperly applied legal rules (Harvey, 2011).

Liability risks are the potential losses that may occur to an investment due to fees, damage claims, and similar penalties and claims.

Contractual risks are the potential of losses that may occur to an investment as a result of breaches, invalidity, need of interpretation or further negotiation, litigation and similar costs related to a contract.

REGULATORY RISK

Regulatory risk is the risk that a change in laws and regulations will materially impact a security, business, sector or market. "A change in laws or regulations made by the government or a regulatory body can increase the costs of operating a business, reduce the attractiveness of investment and/or change the competitive landscape" (Investopedia, n.d.).

SOCIAL RISKS

Social issues affecting surrounding communities may also emerge during the cycle of a project. Some common examples could arise from land title and rights, displacement and resettlement, community engagement, etc. If left unmanaged, these risks can lead to injury to reputation, loss of revenue or costly dispute settlement proceedings.

POLITICAL RISKS

Political risks are related to policy changes or individual political decisions that affect the remediation project. There might occur policy changes as a result of political instability or scientific discoveries; differing priorities between political parties can also cause changes after an election. In addition, scientific discoveries could change the acceptable level of pollution, and therefore change the required remediation efforts.

These risks are generally difficult for investors to manage. According to the World Economic Forum (WEF, 2015), approximately 20 per cent of executives regard political risk as the greatest disincentive for any investments into emerging markets. Different political choices determine tolerable or acceptable levels of pollution, which in turn determine the goal of a remediation project.

MARKET AND COMMERCIAL RISKS

Market and commercial risks extend beyond the cost of completing the project. Market risks include the risk for negative changes in property value, revenue streams and demand for the outcome. Commercial risks arise when a company offers credit without any sort of security (Business Dictionary, n.d.).

For example, delays in the remediation process can jeopardize planned property transactions and decrease property value relative to buyer expectations. These risks could also arise from the reduction in the value of collateral associated with a remediation project.

3 Superfund

Superfund is a federal government program in the United States that funds the remediation of contaminated sites.

3.1 Background

In the United States, the issue of contaminated sites first came to the forefront in the late 1970s, following several catastrophic incidents in places such as the Love Canal, Times Beach and the Valley of the Drums. In response to these incidents, Washington passed the Comprehensive Environmental Response and Liabilities Act (CERCLA, 1980), commonly referred to as Superfund. The Superfund program enabled the Environmental Protection Agency (EPA) to establish a remediation fund that supports the remediation of contaminated sites. At the same time, CERCLA authorized the government to retroactively charge the polluters for contamination.

With the Superfund Amendments and Reauthorization Act (SARA) in 1986, the EPA's mandate was extended, and the size of the trust fund was increased (EPA, 2017e). Among many other activities, the mandate included conduct of research and remediation activities (EPA, 2011).

In short, Superfund aims to (EPA, n.d.e):

- "Protect human health and the environment by cleaning up polluted sites
- Involve communities in the Superfund process
- Make responsible parties pay for work performed at Superfund sites
- Return Superfund sites to productive use"

The EPA identifies the potential responsible parties (PRPs) and ensures that PRPs conduct remediation (EPA, n.d.a). If PRPs fail to clean up the sites or the PRPs cannot not be identified, the EPA finances cleanups through the Superfund trust fund. Later, the EPA may require that PRPs pay the costs of undertaken cleanups.

Until 1995, Superfund's main source of financing was a tax on crude oil and chemicals and by an environmental tax on companies (United States Government Accountability Office, 2008). After 1995, the fund was mainly financed by general fiscal revenue. The fund has also received financing from fines, penalties and cost recoveries from responsible parties as well as interest.

In March 2018 there were 1,341 sites on the National Priority List (NPL), 399 deleted sites and 55 proposed sites (EPA, 2017b). Sites are deleted from the NPL if they no longer pose a threat to human health or environment, or if remediation is complete (EPA, n.d.b). Of those still listed on the NPL, 64 sites have been partially deleted and 1,194 sites are listed as "construction complete," which means that necessary construction for remediation is complete, construction is not needed, or the site qualifies for deletion (EPA, 2017b, n.d.d).

When remediation and monitoring activities are completed at a site, the Superfund Redevelopment Initiative provides support and helps communities reuse the formerly contaminated sites (EPA, n.d.c). The EPA can help assess reuse possibilities and offer opportunities through EPA's partnerships.

The CERCLA has been extensively criticized, especially with regard to its liability regime.

CRITICISM TOWARDS SUPERFUND

- **Liability**

  Liability under CERCLA can be joint and several or strict. Under the first alternative, any potentially responsible party may be held liable for the entire cleanup of the site (when the harm caused by multiple

parties cannot be separated). Strict liability implies that companies can become liable even if their actions were not illegal when they occurred, and even if no actual harm was done. Some see this as unfair.[1]

- **Special taxes**

  It has been argued that the polluter pays principle was violated by the special Superfund taxes, which lasted until 1995, because they harmed companies that may never have contaminated any waste site requiring cleanup (Stroup, 2001, p. 5). A firm that found a way to produce the same products with no pollution whatsoever would still pay the same amount of tax. Production, not pollution, was taxed. The paperwork costs were also very high. Stroup (2001) also criticizes that the accused parties "can do little to challenge the EPA's decisions, except at the very end of the remediation process, after many years" (p. 6).

- **Unrealistic and unnecessary costly outcome goals**

  As an example, SARA required stringent drinking water standards to be applied as cleanup standards, even when the water is not expected to be drunk. Stroup (2001) argues that, despite USD 20 billion spent by 1992, the program created few human health benefits, as per a study by Hamilton and Viscusi called *Are Risk Regulators Rational? Evidence from Hazardous Waste Cleanup Decisions*, which showed that the cost per averted cancer case exceeded USD 100 million.

- **Slow and expensive process**

  The Superfund has also been criticized for being too slow and expensive (Pruitt, 2017). Rausser, Simon and Zho (1998) states that because of "informational asymmetry, as well as the huge cost of cleanups and the strict, joint and several liability rule, the process of apportioning the liability shares among PRPs has been characterized by prolonged negotiation and extensive litigation. As a result, the cleanup of Superfund sites has proceeded at an unexpectedly slow pace. Dower estimated that, on average, it takes 12 years or more for a site to be completely cleaned up from the date of EPA awareness" (Dower, 1990 in Rausser, Simon & Zhao, 1998, p. 48).

Due to the criticism, some of which is discussed above, the CERLA has been changed and supplemented through several major and minor reforms. Some of the most important reforms as listed in Table 1.

Table 1: Superfund reforms from 1986 to 2017

Superfund Reforms	
1986	Congress enhanced the "innocent landowner" defence in CERCLA, a rule that limited landowner's liability if they "did not know or have reason to know" that any hazardous substances had been or were being released on it (Slutzky & Frey, 2010, p. 90).
1996	Congress passed the Asset Conservation, Lender Liability, and Deposit Insurance Protection Act (Lender Protection Act),[a] intending to limit the liability of lenders who financed brownfield developments that were later foreclosed on (Slutzky & Frey, 2010, p. 89).

[1] See for instance Stroup (2001), who argues that the connection between the company and the contamination in some cases is so remote that "the polluter pays principle, properly understood, is routinely violated" (p. 5). Slutzky and Frey (2010) goes a step further by stating that many would argue that CERCLA's liability regime is the greatest impediment to the redevelopment of brownfield sites states (referring to Davis, 2002; Rubenstein, 1997; Anderson, 1996). Slutzky and Frey argue: "Private developers, who might otherwise provide the resources needed for redeveloping brownfields into vital community assets, are driven away from purchasing or investing in brownfield sites by the potential for catastrophic federal and state regulatory and tort liability. As a result, many brownfields continue to sit vacant or underutilized" (p. 85–87).

Superfund Reforms	
2002	Congress passed the Small Business Liability and Brownfields Revitalization Act (Brownfields Act).[b] The act "further clarified the standard of due diligence required for the innocent-purchaser defence, introduced the concept of the bona fide prospective purchaser (BFPP)[c], and clarified also the situations in which liability applies to owners of properties contiguous to a Superfund site" (Slutzky & Frey, 2010, p. 90).[d]
2017	A task force was established to accommodate some of the critique (Pruitt, 2017). The Superfund Task Force Report from July 25, 2017 listed 42 recommendations that can be initiated without legislative changes during the next year (EPA, 2017d). The recommendations are organized into five goals: Expediting Cleanup and Remediation; Re-invigorating Responsible Party Cleanup and Reuse; Encouraging Private Investment; Promoting Redevelopment and Community Revitalization; and Engaging Partners and Stakeholders. The report directly addressed some of the criticism mentioned above: • **Recommendation 6** addresses the unnecessary costly and sometimes unrealistic cleanup goals. One of the specific actions suggested is to evaluate the groundwater beneficial use policy, so that the remediation goals to a larger degree relate to the anticipated use. • **Recommendation 16** addresses time and costs related to implementing the polluter pays principle. One of the specific actions suggested is developing a plan to provide financial incentives in the form of reduced oversight to PRPs who perform timely, quality work under an agreement by reducing the costs associated with EPA's oversight, including adjustments to indirect costs. • **Recommendation 21 and 33** address the lack of redevelopment of Superfund sites. A specific action suggested in 21 is to issue an Agency Directive to encourage integration of reuse outcomes into PRP-led cleanups. A specific action suggested in 33 is to focus redevelopment efforts on 20 NPL sites with redevelopment potential and identify 20 sites with greatest potential reuse. • **Recommendations 22 and 27** seek to increase private investment. A specific action suggested in 22 is to establish a national work group to identify creative uses for insurance, annuities, indemnification and other tools for third parties. A specific action suggested in 27 is to conduct outreach to third-party investors who may provide private financing or otherwise become involved in transactions involving contaminated or previously contaminated property to identify specific liability concerns acting as a barrier to investment or other opportunities in such transactions.

[a] 42 U.S.C. § 9601(a)(1).

[b] 42 U.S.C. § 9601(40).

[c] Bona fide means in good faith. In accordance with the concept of bona fide prospective purchaser (BFPP) a subject may purchase contaminated land with knowledge of the contamination without becoming liable for response costs, if certain requirements are met. The contiguous property owners (CPO) defence protects landowners who own property that is or may be contaminated, but is not the original source of the hazardous substance contamination. For more on this, go to https://www.epa.gov/enforcement/innocent-landowners.

[d] Slutzky and Frey (2010) state that the innocent-prospective purchaser defence, and the contiguous-property-holder defence, marked "the most significant step yet toward eliminating liability barriers to brownfield redevelopment" (p. 90).

3.2 Level of Development

Superfund is a federal program operating all over the United States, and it clusters in some areas (Figure 1). The level of development between different states and regions varies significantly. The following numbers give an impression of the differences by comparing the real Gross Domestic Product (GDP) per capita in 2016 in chained 2009 U.S. dollars by states and unemployment rate. Massachusetts had the highest per capita real GDP at USD 65,545 and the Mississippi the lowest with USD 31,881. The U.S. average was USD 50,577 (Statista, 2018a). The unemployment rate in 2016 varied between South Dakota with only 2.8 per cent unemployment and New Mexico with 6.7 per cent (Statista, 2018c).

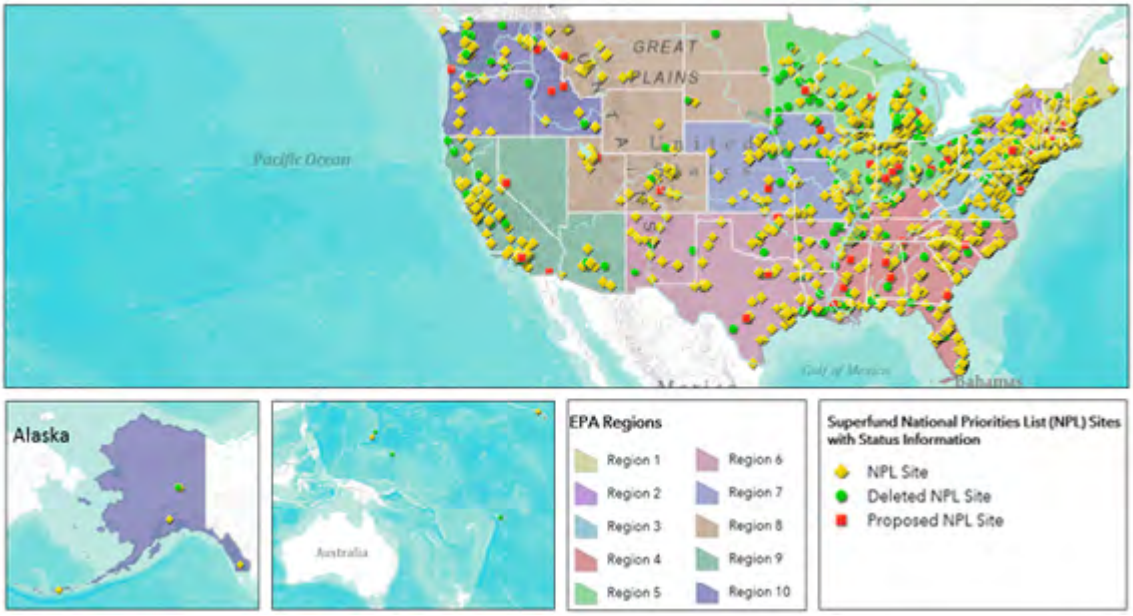


Figure 1. Map viewing proposed, deleted and active sites on Superfund National Priorities List.

Source: EPA, 2018b

3.3 Type of Land

The United States is the third largest country in the world and has an enormous variety of land types. Superfund projects have addressed sites from rural areas like the Pantex Plant near Pantex village in Texas (EPA, 2018f), to central urban areas such as the Omaha Lead Superfund Site in Nebraska (EPA, 2018e). It has remediated land with all kinds of pollutants such as chemical contamination at the Kerr-McGee Chemical Corporation site in Mississippi (EPA, 2018c) and contamination from historical mining activity at the Eureka Mills site in Utah (EPA, 2018d), to radioactive material such as at the Savannah River Site in South Carolina (EPA, 2017c). Further, the sites contain soil, sediments and water.

3.4 Financial Sources

The Superfund program's financial sources are earmarked taxes, general fiscal revenue and PRPs. PRPs include both public and private actors.

One of the Superfund program's major sources of financing was tax on crude oil and chemicals, plus a company environmental tax until the taxes expired in 1995 (United States Government Accountability Office, 2008). General fiscal revenue has been an important source of funding since the taxes expired. The fund received increasing amounts of funding from general fiscal revenue until 2009 (United States Government

Accountability Office, 2008; EPA, 2018a). Since 2009, the funding received from general fiscal revenue has declined each year. The fund has also received funding from fines, penalties and cost recoveries from PRPs, as well as interest earned on the accrued on the fund's balance. The EPA has also secured funding through settlements with PRPs.

Table 2: Received funding for the Superfund program from 1981 to 2016 (expressed in 2016 USD)

Financial Source	1981–1995	1996–2016	1981–2016
General fiscal revenue	5.3 billion	21.4 billion	26.7 billion
Taxes	20.7 billion	1.1 billion	21.8 billion
Fines, penalties and cost recoveries	1.9 billion	5.7 billion	7.5 billion
Interests	2.8 billion	3.3 billion	6.1 billion
PRP settlements			35.1 billion[a]

[a] Note: PRP settlements are PRPs' commitments to do cleanup work under the Superfund program from 1980-2015

Sources: EPA, 2017a, 2018a; United States Government Accountability Office, 2009

3.5 Financial Actors

There are three principle methods to finance remediation projects through Superfund (EPA, 2017a):

1. The EPA enters into an agreement with PRPs, stating that PRPs would conduct or pay for environmental assessments, remediation activities and monitoring at the site, or the EPA could compel PRPs to conduct these activities.
2. The trust fund grants funding for the remediation project, which is relevant when PRPs cannot be identified, lack resources to pay for remediation, or the polluting company does not exist anymore.
3. The EPA conducts the environmental assessments, remediation activities and monitoring, and then recovers their cost from the PRP(s).

The EPA is a financial actor through the management of the trust fund.

PRPs are also financial actors if they are enforced to fund remediation of the contaminated site. PRPs could be many types of financial actors, such as state-owned or commercial enterprises, municipalities, private citizens, U.S. departments (e.g. U.S. Department of Defense) and other public institutions.

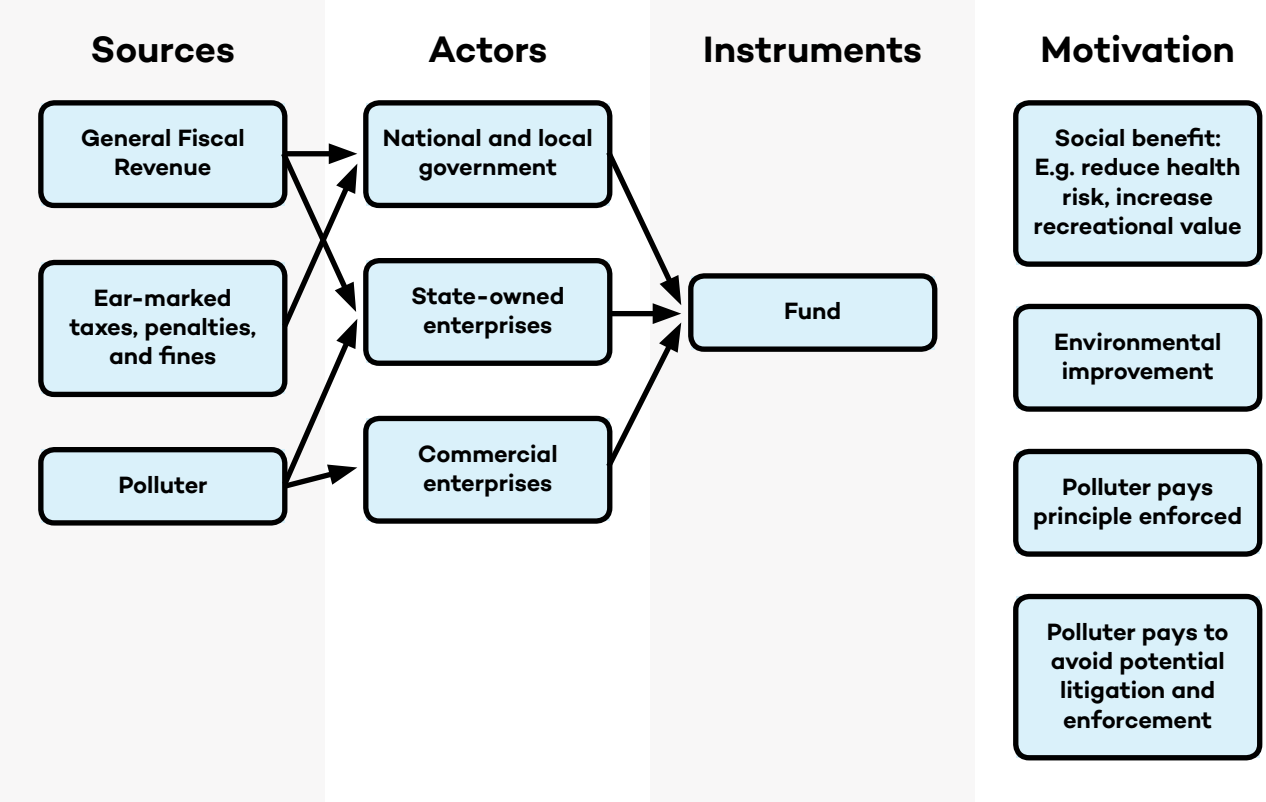


Figure 2. Marked in blue are the types of sources, financial actors and instruments in use in the Superfund program, as well as the financial actors' motivation to contribute to the project.

3.6 Financial Instruments Utilized

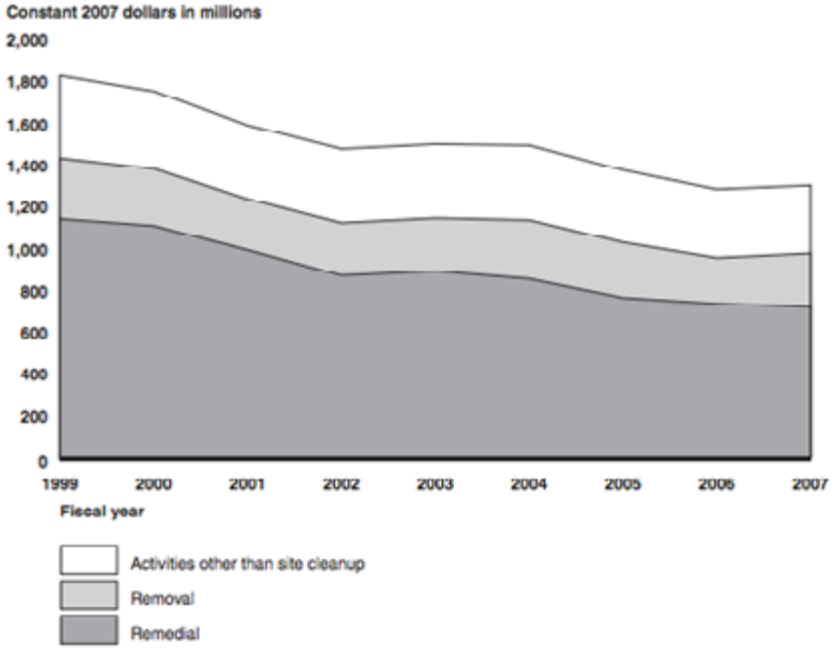
The financial instrument in use is a fund. If the PRP no longer exists or is unable to pay, the trust fund grants necessary resources to conduct remediation of the contaminated site (EPA, 2017a).

The EPA must in some cases rely on the trust fund to conduct assessments and remediation activities, if they retrieve funding from the PRPs afterwards or if the project is funded entirely by the trust fund. The initial assessment for each site and search for PRPs also requires funding in advance. Thus, there is need for a substantial amount of money in the trust fund at all times. For the successful implementation of a trust fund as a financing tool, appropriate sources of income must be a part of the scheme.

3.7 Financial Recipients

The EPA administers the Superfund trust fund, which makes the EPA the financial recipient. These funds provide funding for sites that do not have a PRP or disbursements in cases where the EPA conducts remediation and then receives cost recoveries from the PRPs.

The EPA has the legal mandate to require polluters to carry out remediation, but often seeks to reach agreements, so that the latter will undertake the necessary environmental assessments, establish a remediation plan, carry out remediation and so on. When such an agreement is entered, the EPA may receive cost recoveries from already undertaken activities, but from that point of time, EPA's role will mainly be limited to controlling the activities undertaken by the responsible parties.



Source: GAO analysis of EPA data.

Note: These data exclude reimbursable expenditures and other expenditures related to the Brownfields program, transfers to other EPA appropriations, and the 2002 Homeland Security Supplemental appropriation. Other Superfund expenditures related to homeland security are included in various categories. The level of expenditures in each category—but not the total—could vary based on whether certain costs are classified as administration-related. Due to changes in EPA's budget structure, EPA was unable to comparably categorize some expenditures. These expenditures never accounted for more than 0.2 percent of annual expenditures. Over the entire period, these other expenditures constituted 0.05 percent of Superfund expenditures.

3.8 Costs Affecting Return

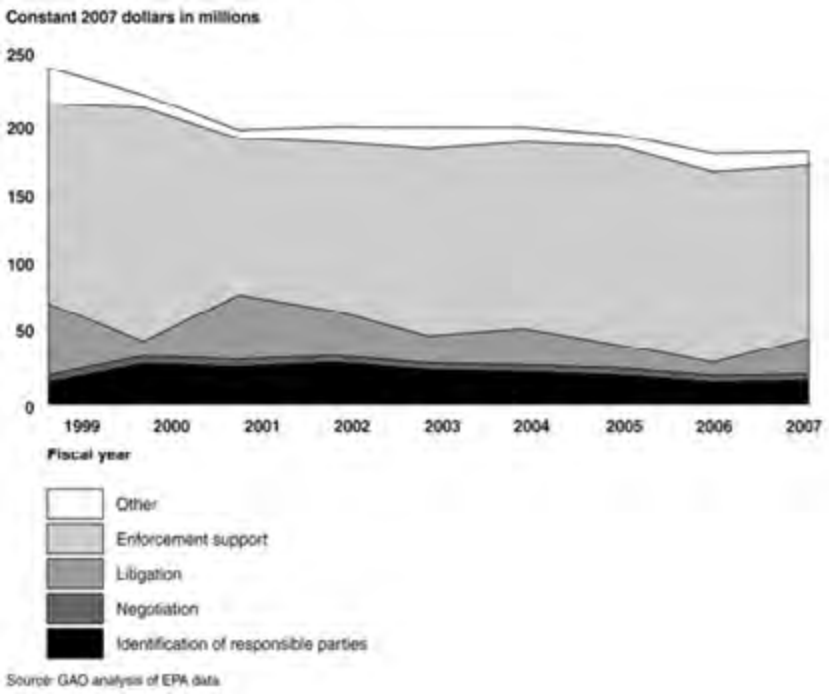
The Superfund program received approximately USD 97 billion from 1980 to 2016. A breakdown of costs affecting return through the entire period is not available. However, a letter from the U.S. Government Accountability Office (2008) to Congressional Requesters enlightens the use of funds to various activities from 1999 to 2007. The EPA spent about 77 per cent of the Superfund on cleanup, through remediation or removal of contamination. Figure 3 shows the trend for expenditures on remediation, removal and other activities. Most of the resources spent on other activities were in enforcement and administration.

Figure 3. EPA Superfund expenditure, fiscal years 1999 through 2007 (expressed in 2007 USD).

Source: U.S. Government Accountability Office, 2008

3.8.1 Transaction Costs

Through the Superfund program, the EPA aims to make the responsible parties pay for cleanup of contaminated sites. Transaction costs occur when the EPA negotiates with the PRPs and includes costs relating to enforcement support, litigation and negotiation. Figure 4 shows the EPA's enforcement expenditure from 1999 to 2007. Cleanup, non-site and enforcement expenditures decreased through the period, leaving the share of spending on enforcement relatively stable at 14 per cent of total expenditure (U.S. Government



Accountability Office, 2008). Most of the resources spent on enforcement activities were used to support enforcement, about 49 per cent in 1999 and 64 per cent in 2007. Litigation expenditures varied between 5 per cent (2000) and 23 per cent (2001) of total enforcement expenditure. Negotiation expenditure was stable at 2 per cent of total enforcement expenditure through the period.

Other expenditures in Figure 4 relate to oversight of PRPs, some general technology projects, site assessments, technology support during remediation, community relations activities and development of cost recovery claims (U.S. Government Accountability Office, 2008). Development of cost recory claims is the only cost that could be categorized as transaction costs.

Figure 4. Superfund enforcement expenditures, fiscal year 1999 through 2007 (expressed in 2007 USD)

Source: U.S. Government Accountability Office, 2008

3.8.2 Information Costs

Through the Superfund program, information costs arose when identifying PRPs and assessing causality between a PRP's activities and the site's environmental state, as well as assessing a PRP's company status in terms of existence and financial state. Figure 4 shows the trend for costs associated with identifying responsible parties. The costs varied between 6 per cent (1999) and almost 15 per cent (2002) of total enforcement expenditure.

3.9 Risks for Financing Remediation

There are many risks involved when financing remediation. Here we distinguish between legal, regulatory, social, political, technical and market risks.

3.9.1 Legal Risks

In most Superfund cases, either the EPA or a polluter is involved as a financial actor. In some projects, there are also investors involved. Both the polluter and the investor can be public and private, and they can be a polluter through their actions and/or as landowner depending on CERCLA's liability regime applied to the specific case. Since the Superfund program involves projects all over the United States in many different ways, the risks vary

depending on size and complexity of the project, its costs, the type of contamination, urban or rural location, actors involved and the role of EPA. Here we will mention the possible legal risks for the various actors.

RISKS FOR EPA

As discussed in Section 3.4 on financial actors, there are three methods to finance remediation projects. The first is to enter an agreement with the PRPs; the second is through Superfund grants funding for a project; and in the third, the EPA first carries out a project itself and then tries to recover the costs from the PRP(s). When the EPA applies the first strategy of making PRPs conduct or pay for the environmental assessments, remediation and monitoring activities, either through a contract or compulsion through an administrative order or litigation, the EPA risks the costs of negotiation and contract entering, litigation and the liability of losing in court. If the EPA uses the second strategy, it faces, to a large extent, the same risks as the investors for the specific projects, as described below. If the EPA uses the third strategy, it initially faces investment risks and, thereafter, litigation risks. If successful, the EPA transfers all or a part of its costs to the polluter. If unsuccessful, EPA would carry all the initial costs, in addition to litigation costs and perhaps even damages. If the EPA is not certain to recover the costs from PRPs, the risk level of the third strategy is very high.

LEGAL RISKS FOR INVESTORS OF THE SPECIFIC PROJECTS

When it comes to legal risks in the narrow sense, these risks arise from federal, state and local laws and regulations. For example, CERCLA's innocent-purchaser defence limits a landowner's liability if they "did not know or have reason to know" that any hazardous substances had been or were being released on it (Slutzky & Frey, 2010). Even though the purchaser knew about a certain type of contamination, later in the remediation process, a lager quantity or a different type of contamination could be identified. In that case, the question arises if the innocent-purchaser defence applies, and the due diligence assessment related to this question will involve uncertainty.

Another example is the concept of the bona fide prospective purchaser (BFPP) in the Small Business Liability and Brownfields Revitalization Act (Brownfields Act) in 2002.[2] The criteria for the BFPP are extensive and complex, thus creating a non-negligible amount of uncertainty.

Investors may also face liability risks that typically stem from negligence of duties as high-level administrator, from accidents and damages. Claims of damages are not only possible from contracting parties such as the remediating company and consultancies, but also from third parties such as the local authorities, neighbouring companies and residents. Remediation projects in general are unpredictable and relatively dangerous depending on size, complexity and type of contamination.

Finally, remediation projects entail contractual risks deriving primarily from tendering processes and individual contracts with the different actors. Among the risks are also the entering, interpretation and compliance of contracts related to grants or loans from the Superfund program. The risks depend greatly on the size and complexity of the contract.

3.9.2 Regulatory Risks

Regulatory risks are related to changing legal frameworks, legal requirements and obligations, which vary between projects. Factors that affect the risks are the length of the project, local laws and regulations, size and complexity of the project, and so forth. The relatively long time frame of Superfund projects, on average about 12 years or more (Dower, 1990), increases the risk for changes in relevant laws and regulations. These changes can, for instance, affect the contamination levels that require action by the polluter or EPA, change the liability regime affecting who must take the cost, or outcome goals for the remediation. These changes can affect the costs for the actors involved. More stringent outcome goals, such as lower accepted values of certain chemicals in the soil or groundwater, can increase the remediation costs enormously.

[2] 42 U.S.C. § 9601(40).

On the other hand, the law and regulation-making process in the United States is generally easily accessible and predictable, lowering the regulatory risks.

3.9.3 Social Risks

In the Superfund case, social risks can arise on both the project and program levels. On the project level, dissatisfaction and disputes may arise if the project has inadequate remediation goals or methods, require resettlement or transfer of land, rights and/or the property use must cease during remediation. The social risk level will vary from project to project.

Social risks on the program level may arise if there is dissatisfaction with, for instance, the Superfund's financial sources and actors, priorities, remediation goals, and the time between when a site is proposed for the NPL and when cleanup is completed. Some of these risks have materialized, as described in the background section (5.1).

3.9.4 Political Risks

Political decisions can affect the Superfund program on superior and project levels. For example, on the superior level, the acceptable level of pollution and funding from taxes or general fiscal revenue can lead to project-level changes in the remediation goal and, consequently, methods in use.

Both general fiscal revenue and earmarked taxes have been important financial sources for the Superfund program. Almost 50 per cent of revenue received by the Superfund trust fund originates from taxes and general fiscal revenue. Political decisions affecting the amount of funding from these sources can alter the Superfund program's ability to assess the need for remediation at different sites, fund projects and enforce PRPs to pay or conduct remediation activities. Generally, political risks will increase the longer a program or project lasts. The Superfund has existed since the early 1980s. Political risks materialized when the taxes expired. As a result, the majority of funding shifted from earmarked taxes to general fiscal revenue, but the increased funding from general fiscal revenue did not fully substitute the previous tax revenue.

3.9.5 Technical and Physical Risks

Technical and physical risks depend on the remediation methods in use. As we focus on the system as a whole, we will not discuss technical and physical risks. Such risks will vary from project to project.

3.9.6 Market Risks

Detection of contamination at a property may influence the use of the property. Also, potential buyers may be hesitant to invest in a contaminated property, due to the unknown future allowable use of the property and possible liability for future remediation. These factors may affect the property value negatively, which will probably be affected as long as contamination exists at the property.

3.10 Lessons Learned

SUCCESS FACTORS

The most important success of the Superfund program is remediation of numerous sites, including mega sites, which would be an enormous burden for individual states. Through a centralized EPA, all the states can benefit from the same expertise and from common accumulated knowledge and experience.

Often the environmental outcome goals have been to remediate exhaustively so that no further remediation is needed. In many cases, the outcome goal of drinking water quality for groundwater has been applied

independently from the land's intended use. In this way, once the goals have been reached and confirmed by a later surveillance period, the need for special treatment of the sites ceases completely with no further costs.

Until 1995, the fund was financed mainly through the special taxes and liability by polluters. The special taxes eliminated the need for large appropriations from general fiscal revenue.

Special taxes in combination with liability by polluters could be a feasible long-term solution. To address some of the criticism related to fairness, the taxes could be more differentiated in relation to toxicity and danger of the chemicals, or to the risks of certain production technologies. One approach could be to gradually reduce the taxes.

WEAKNESSES

The special taxes as they were applied were perceived as unfair, which made it harder to maintain them. The decline in funding caused delayed startups in one out of three remediation projects in the period of 1999–2013 (U.S. Government Accountability Office, 2015).

The Superfund process seems very centralized, bureaucratic and inflexible, slowing the process down and increasing the costs. The Superfund program seems, to a large degree, to apply the same procedures and standards for all NPL sites, despite variations in size, type of contamination, soil or sediment, and the area immediately surrounding the Superfund sites. This perhaps creates unnecessary paperwork and measures. As stated in the Clean Michigan Initiative (CMI) case (Section 4), many states have created their own parallel remediation programs because of the inflexibility of standards, procedures and lengthy processes. A strongly centralized EPA can also increase distrust among local actors when they feel their voice is not heard and their decisions are overruled.

A serious weakness of the Superfund program is the massive amount of litigation the system creates. On the one hand, strict and retroactive liability can realize the polluter pays principle and increase the funding. On the other hand, however, long and hard litigation cases with complicated questions of causality and evidence can be so expensive that much of the funding is lost. If the site is not cleaned in the meanwhile, it can also remain a danger during the litigation period. The strict and retroactive liability regime is, by some, perceived as unfair and can increase resistance against the entire Superfund program.

4 Clean Michigan Initiative Bonds

The Clean Michigan Initiative (CMI) is a program that consists of a municipal bond, established in 1998, that supports activities related to remediation and redevelopment of brownfields, redevelopment of waterfronts, remediation of contaminated lakes and sediments, and pollution prevention. Loans and grants are the main instruments used to finance the projects.

4.1 Background

Past industrial activity in Michigan has left the state with a large number of brownfields (Simons, 1998). In 2017 there were 7,300 contaminated sites remaining according a report from the state's Auditor General (Michigan Office of the Auditor General, 2017). While the 1980 CERCLA and 1986 SARA contributed to the cleanup of sites, it also had several flaws (see Section 4.1) (Jones & Williams, 2010, p. 7). Regarding brownfields in particular, CERCLA and SARA were considered unsatisfactory; CERCLA's regulations were not always suitable for financing remediation and redevelopment projects on a *local* level. Further, the CERCLA requirements to the brownfield grant process was viewed as unnecessarily complicated and bureaucratic. The federal Superfund was also regularly criticized for being too slow (Hird, 1994).

In response, the State of Michigan, as did many other states, increased their own efforts to redevelop contaminated sites (Jones & Williams, 2010). The Clean Michigan Initiative Bond was part of this effort and its introduction got relatively high support, with 63 per cent of the votes in 1998 (Katz, 2002). The legal basis for the CMI is the Clean Michigan Initiative Act (CMIA) 284 (1998).

ALLOCATION OF FINANCING TO VARIOUS ENVIRONMENTAL ACTIVITIES

The bond financially supports activities at Michigan's Department of Environmental Quality (84.4 per cent), Department of Natural Resources (14.8 per cent), and Department of Health and Human Services (0.8 per cent) (Michigan Department of Environmental Quality, 2017b, p. 10).

The CMI aims to finance efforts to remediate contaminated sites and sediments, redevelop brownfields and waterfronts, protect and improve water quality, prevent and control pollution, and enhance recreational opportunities (Michigan Legislature, 1998, section 2). Figure 5 gives an overview of the authorized distribution of funding.

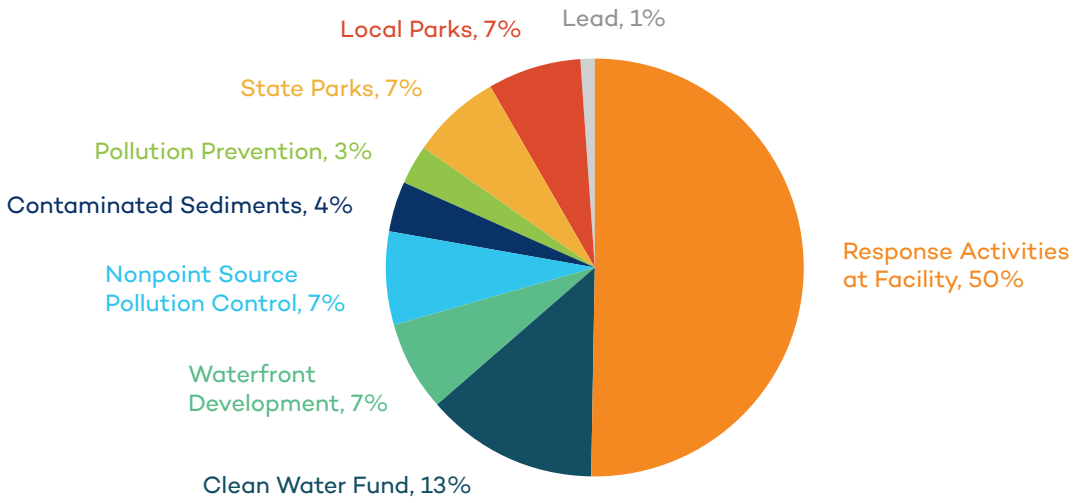


Figure 5. Authorized distribution of funding by CMI bonds. NOTE: The Department of Natural Resources receives funding for State and Local Parks. Funding for lead are received by the Department of Health and Human Services. The Department of Environmental Quality receives the residual.

Source: Clean Michigan Initiative Act 284 of 1998, Section 324.95102; and Natural Resources And Environmental Protection Act 451 of 1994, Section 324.19607.

The CMI offers grants and loans as main instruments to finance remediation. Table 3 provides an overview of possible categories of activities and financing mechanisms.

Table 3: Description of instruments and activities under the CMI

Category	Instruments	Description
Response Activities at Facility	Grants, loan	Remediation of known or suspected contaminated sites suitable for redevelopment.
Clean Water Fund	Grants	Supporting several programs—among others: Water Quality Monitoring; implementing watershed managing plans approved by Michigan Department of Environmental Quality; identifying and eliminating of illicit connections (drain, sinks, pipes) that cause waste discharging directly into lakes and streams; locating and remediating abandoned wells and failing septic systems.
Waterfront Development	Grants	Redevelopment of waterfronts, aiming to improve public access to great lakes and boost local economy and neighbourhoods.
State parks	Grants	Infrastructure improvements of state parks, such as drinking water systems, restrooms, buildings, road and electrical systems (Michigan Office of the Auditor General, 2004). Drinking water systems and restrooms were the highest priority.
Local recreation	Grants	Development and renovation of indoor and outdoor recreation facilities, such as community centres, skating rinks, playgrounds, sport fields, beaches, trails and campgrounds (Michigan Office of the Auditor General, 2004).
Nonpoint Source Pollution Control	Grants	Support projects that implement physical structures to control runoff of pollutants or reduce pollution from a specific source identified by Michigan Department of Environmental Quality. Both NGOs and local governments could apply for the grants.
Contaminated sediments	Grant	Up to USD 25 million could be distributed to remediate lake and river sediments contaminated by bioaccumulative toxins.

Category	Instruments	Description
Pollution Prevention	Grant and loans	Provides endowments for pollution prevention assessments by retired professionals for small business, local governments and public institutions. Revolving loan fund for pollution prevention measures by small entities. Grants for pollution prevention measures by local governments, public and private organizations.
Lead	Grant	Protecting the public from lead exposure by removing lead sources in private homes (Katz, 2002).

Source: Michigan Department of Environmental Quality, 2017; Ringler, 2017

About 50 per cent of the CMI bond's finance was available for the first category of Response Activities at the Facility, which consisted of three different programs: the Environmental Cleanup and Redevelopment Program, the Brownfield Redevelopment Grant and Loan Program, and the Municipal Landfill Cost-Share Grant Program (Ringler, 2017, pp. 30–31)

Environmental Cleanup and Redevelopment Program	USD 241 million
Remediation of sites that are severely contaminated, threatening public health, safety or the environment. The program also funds remediation of sites that could be redeveloped, and thus provides new jobs and boosts the surrounding neighbourhood (Ringler, 2017, pp. 30–31). By the end of fiscal year 2015, 634 projects were completed through this program at a cost of USD 224.5 million (Ringler, 2017, p. 16).	

Brownfield Redevelopment Grant and Loan Program	USD 75 million
The grant program (USD 50 million) and loan program (USD 25 million) support local governments' environmental assessments or remediation of known or suspected contaminated sites suitable for redevelopment (Ringler, 2017, pp. 30–31). The loans have a grace period and are interest-free for the first five years (Michigan Department of Environmental Quality, 2017a). Loans could be repaid through tax increment financing. Repayments of loans are reused as loan for future projects (Michigan Department of Environmental Quality, 2017b). By the end of fiscal year 2015, 63 projects were completed through the grant program at a cost of $42.1 million, and 35 projects through the loan program at a cost of $25 million (Ringler, 2017, p. 16).	

Municipal Landfill Cost-Share Grant Program	USD 12 million
Supports local governments' remediation efforts at municipal landfills listed or nominated for the Superfund's NPL (Ringler, 2017, pp. 30–31). By the end of fiscal year 2015, 42 projects were completed through this program at a cost of $8 million (Ringler, 2017, p. 16).	

Another interesting example is the Contaminated Lake and River Sediments Program which facilitates the remediation of sediments that are polluted by bioaccumulative toxins (Michigan Department of Environmental Quality, 2010, p. 47). The riskiest sites in terms of public health and the environment are prioritized.

THE FUND'S IMPLEMENTATION AND STATUS

The CMIA enables Michigan Department of Treasury to issue new bonds as long as the total amount does not exceed USD 675 million (Michigan Legislature, 1998, section 2; Michigan Legislature, 1994, section 19606). The departments involved evaluate annual spending in order to assess the need for new bonds to be issued and sold (Michigan Department of Environmental Quality, 2017b, p. 44). In the end of fiscal year 2016 (September 30) approximately USD 80.4 million remains to be issued if needed. The funding granted for state parks, local recreation and lead is depleted.

There are about 7,300 contaminated sites which lack sufficient CMI funding for environmental assessments and/or remediation after 2017 (Ringler, 2017, p. 10). For instance, initial assessments of 6,186 sites have not been conducted, all of which may be suitable for the Environmental Cleanup and Redevelopment Program. These sites may be severely contaminated and could pose a threat to public health or the environment.

4.2 Level of Development

Michigan is located in the northeastern United States. Agriculture, forestry and mining are been important for Michigan's economy. Agriculture is still an important livelihood in the southern parts of the state. Since the beginning of 20th century, the automobile industry has had a major role in Michigan's economy. In times of recession, however, the demand for new cars decreases substantially, making the industry suffer. As a result, the unemployment rate in Michigan exceeds the national average during recessions. As shown in Figure 6, the unemployment rate in July 2009 was 14.7 per cent in Michigan and the national average was 9.5 per cent.

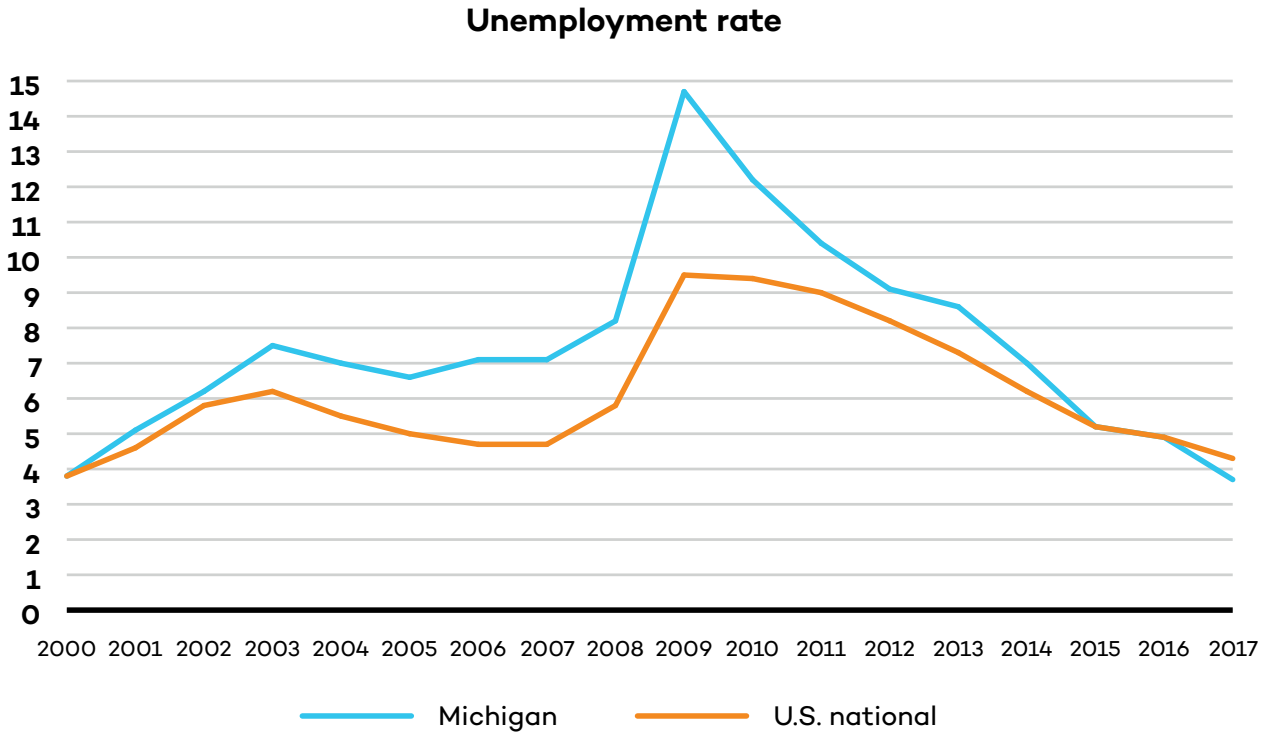


Figure 6. Unemployment rate in Michigan (blue) and the national average annually from July 2000 to 2017.

Source: U.S. Bureau of Labor Statistics (n.d.a, n.d.b).

In July 2000, the unemployment rate in Michigan was 3.8 compared to 3.7 in July 2017 (see Figure 6). As shown in Figure 7, Michigan's GDP per capita has increased, but it has not managed to keep step with the average GDP increase in the United States.

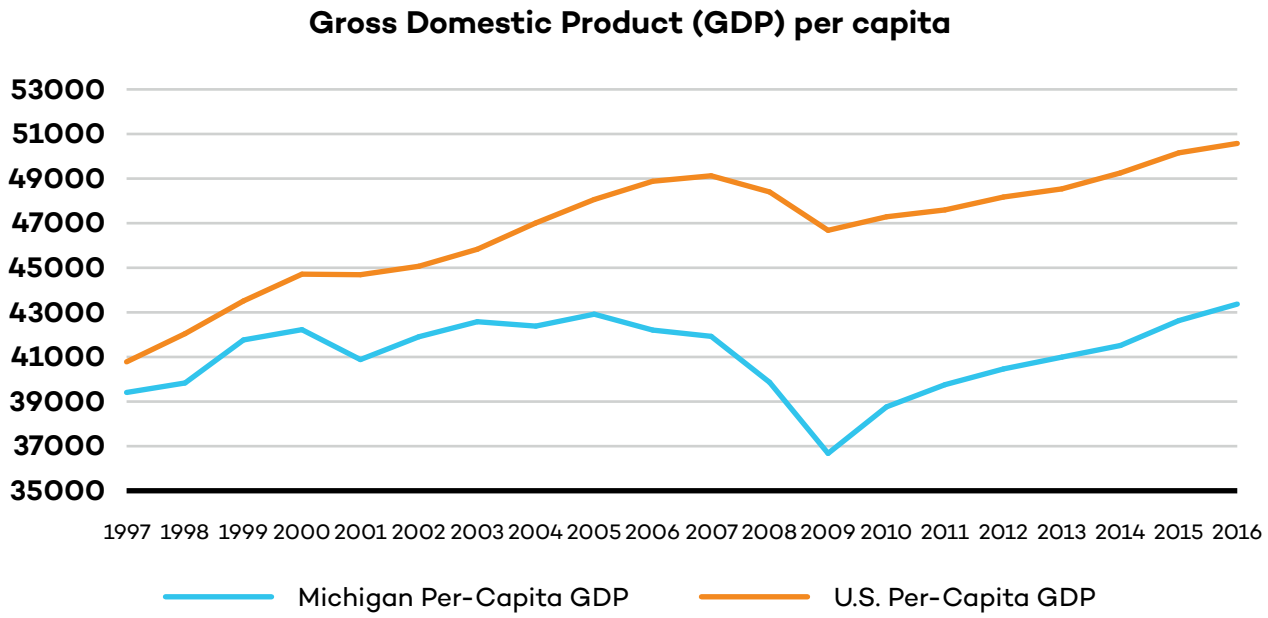


Figure 7. GDP per capita in Michigan and the U.S. as a whole (expressing in 2009 USD)

Source: Department of Numbers, n.d.

4.3 Type of Land

The state is split by the Great Lakes into the Upper Peninsula and Lower Peninsula. The Upper Peninsula does not support agriculture, but is partly used for mining. All of the Upper Peninsula has a high percentage of forest cover. The Lower Peninsula consist of agriculture and urban settlements, and large parts of the northern areas are remote and covered by forests (Delamater et al., 2013; Gazer Hathaway & Schaetzl, 2017). Most of the agriculture production takes place south in the Lower Peninsula because of the fertile soil made of clay, peat and muck (Galzer et al., 2017). Most of the Michigan population lives in the Lower Peninsula, in urban settlements close to the industry in Detroit, Grand Rapids, Flint, Lansing and Kalamanzoo. As shown in Figure 8, these areas also received most resources from the CMI bonds.

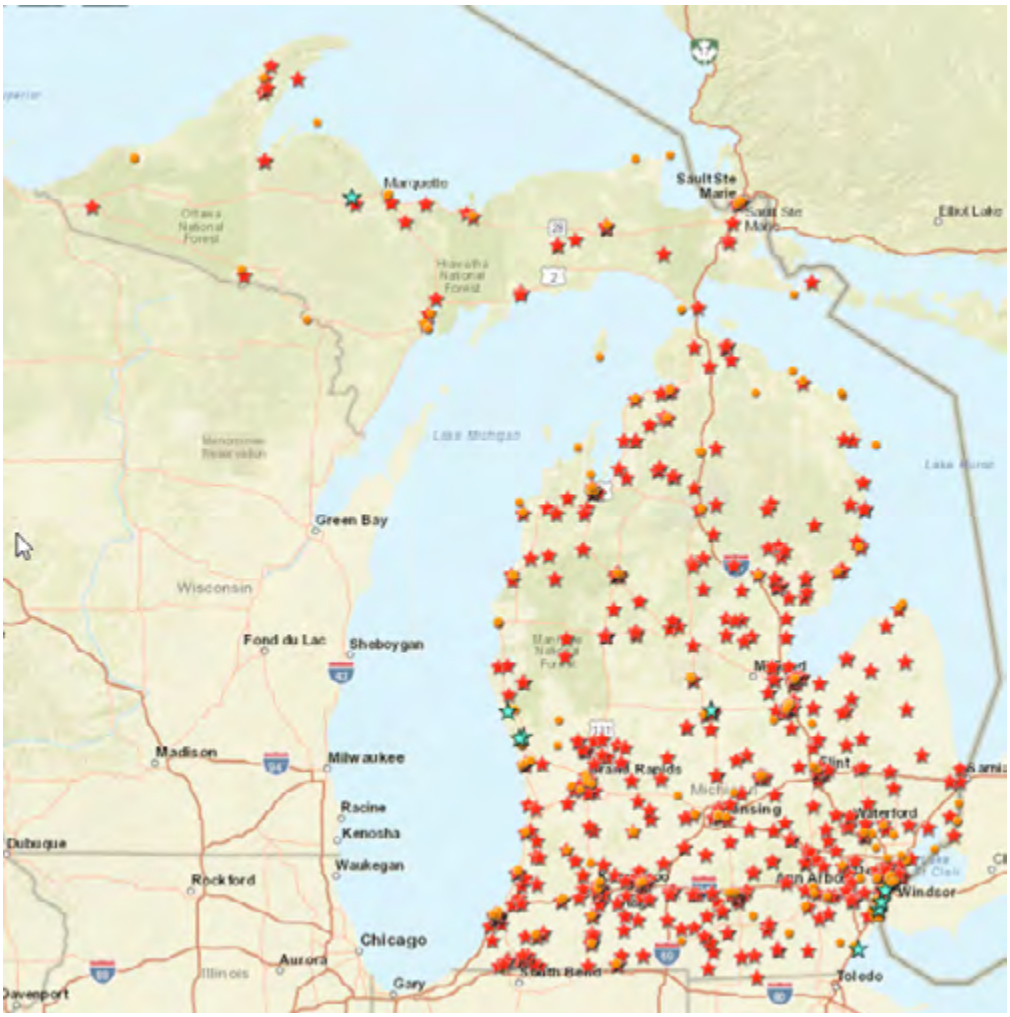


Figure 8. Map viewing remediation costs on sites financed by the CMI bonds. Sites marked with green stars were contaminated sediments which have been remediated. Sites marked with red stars were contaminated sites which have been remediated. Prior to remediation, these sites posed a risk to public health, safety, welfare and the environment. Sites marked with orange dots were contaminated sites, which have been redeveloped

Source: Michigan Department of Environmental Quality/Personal communication with Jeff Hukill.

4.4 Financial Sources

The initial financial source are the buyers of the bonds issued through the CMI, which is to say investors. The State of Michigan will repay the principal and interest with general fiscal revenue (Michigan Legislature, 1997).

4.5 Financial Actors

The general obligation bonds issued through the CMI were issued by the public financial institution Michigan's Department of Treasury (Michigan Legislature, 1994).

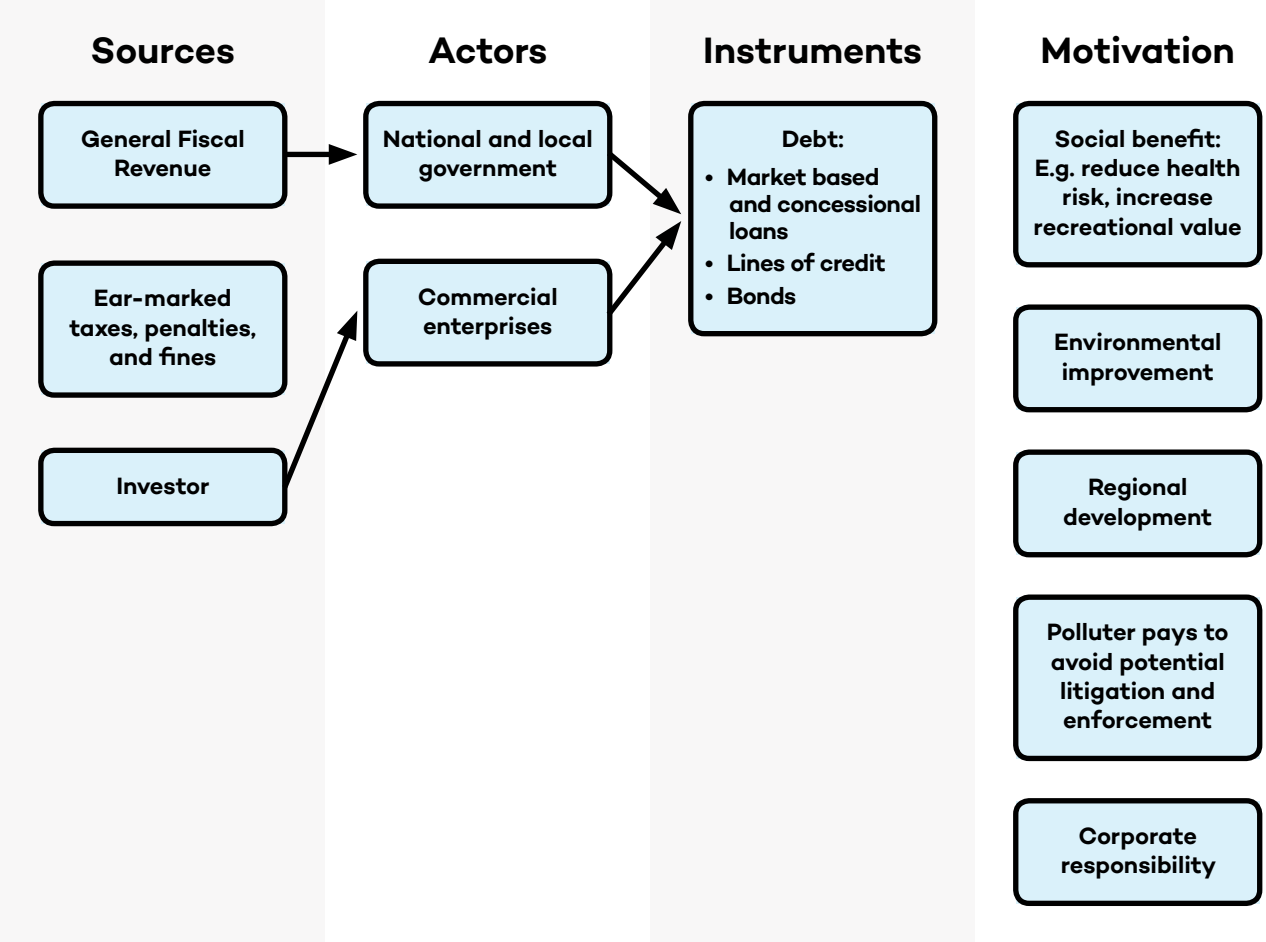


Figure 9. Marked in blue are the types of sources, financial actors and instruments in use in CMI, as well as the financial actors motivation to contribute to the project

4.6 Financial Instruments Utilized

General obligation bonds issued by the Michigan State Treasury are utilized to fund efforts to improve environmental quality and prevent degradation. The bonds are exempted from both federal and state income tax on interest (Michicagn Legislature, 1994).[3]

Grants and revolving loans are utilized through funds raised by the bonds. Two revolving loan funds were created: the Small Business Pollution Prevention Assistance Loan Fund, and the Brownfield Redevelopment Loan Program, both of which are low-interest loans (Michigan Department of Environmental Quality, 2017b, pp. 32, 54). An interesting feature in the Small Business Pollution Prevention Assistance Loan Fund is the requirement that lending institutions and CMI funding should contribute 50/50 into the program. This feature expands the initial loan fund by USD 5 million. The other programs funded by the bonds are based on grants to the departments conducting the activities, local governments (municipalities, townships, cities), non-profit entities and small entities (pollution prevention only) (Michigan Department of Environmental Quality, 2010, 2017b).

4.7 Financial Recipients

Funds raised through the bonds were distributed to three state government departments; Michigan's Department of Environmental Quality (84.4 per cent), Michigan's Department of Natural Resources (14.8 per cent), and Michigan's Department of Health and Human Services (0.8 per cent).

[3] 26 U.S. Code § 103. Available: https://www.law.cornell.edu/uscode/text/26/103

These departments either conduct the activities themselves or supply funding for local governments, non-profit entities and small entities,[4] which conducts the activities (Michigan Department of Environmental Quality,[5] 2010).

4.8 Costs Affecting Return

After the issuance of three CMI bond series, Katz (2002) estimated that taxpayers had to repay about USD 1.6 for every dollar spent on CMI projects, due to interest and legal and other administration costs.

4.9 Risks for Financing Remediation

There are many risks involved when financing remediation. Here we distinguish between legal, regulatory, social, political, technical and market risks.

4.9.1 Legal Risks

The process of financing the remediation projects with the bonds roughly goes through three steps with three actors: the bond buyers, the state actors such as the Michigan's Department of Treasury issuing the bonds and other departments allocating funds; and the final investors which receive financing from the program for specific projects. Here we will mention the possible legal risks for the various actors.

LEGAL RISKS FOR THE BOND BUYERS

A major concern for the bond buyers is whether the bonds qualify for all the expected benefits, such as tax-exemption on interest and others. While in most cases this does not create any problems, in a complicated finance and tax-law regime intersecting both the federal and state level, there is a risk that nuances turn out differently than expected. While the state itself can make it relatively certain that the bonds are qualified on local and state levels, the CMI-bonds did in fact qualify (Katz, 2002, p. 7–8). At the federal level, it also depends on how the state actually uses the bonds, and thus fulfills the criteria in federal law.

LEGAL RISKS FOR THE STATE ACTORS

A legal risk in the narrow sense is the state actor's duty to allocate the money from the bonds to the legitimate projects, in accordance with CMIA section 2.[6] Section 2 is formulated rather widely, creating uncertainty with regard to the legitimacy of certain remediation purposes. More specific eligibility criteria of projects for the Brownfield Redevelopment Grant Program and the Brownfield Redevelopment Loan Program are set forth in parts 196 and 201 of Act 451 (1994) (Michigan Legislature, 1994).

A similar uncertainty is faced in the other sections of the CMIA. For instance, there could be uncertainty whether bonds have been issued in accordance with conditions and procedures established by law according with CMIA section 3.

The Michigan departments that allocate the CMI funds can face lawsuits by, for example, environmental NGOs with invalidity claims towards project-specific allocations stating that the agency exceeds its legal and regulatory powers, and that its decisions conflict with existing Michigan law, such as the CMIA and Act 451. Thus, the main liability risk is lawsuits by buyers of CMI bonds against the issuing state actor claiming breakage of bond issuance procedures and bond-related rights and duties.

In addition, liability risks typically stem from negligence of high-level administrator duties from accidents and damages. Claims of damages are not only possible from contracting parties such as the remediating company

[4] 500 employees or fewer worldwide.

[5] Formerly: Michigan's Department of Health and Agriculture

[6] Clean Michigan Initiative Act 284 of 1998, section 2: "to finance environmental and natural resources protection programs that would clean up and redevelop contaminated sites, protect and improve water quality, prevent pollution, abate lead contamination, reclaim and revitalize community waterfronts, enhance recreational opportunities, and clean up contaminated sediments in lakes, rivers, and streams" (Michigan Legislature, 1998).

and consultancies, but also from third parties such as the local authorities, neighbouring companies and residents. Remediation projects in general are unpredictable and have a relatively high damage potential. The risks depend on factors as mentioned before, for example the type of contamination.

The contractual risks come primarily from tendering processes and individual contracts with the different actors. Risks include the entering, interpretation and compliance of contracts related to grants or loans from the CMI programs.

LEGAL RISKS FOR INVESTORS OF THE SPECIFIC PROJECTS

Since CMI is a program that contributes to hundreds of projects through loans and grants, the risks vary among projects depending on size and complexity of the project, costs, type of contamination, location, and so forth.

4.9.2 Regulatory Risks

Regulatory risks are related to changing legal frameworks, legal requirements and obligations. The regulatory risks vary between projects. Factors that affect the risks are the length of the project, local laws and regulations, size and complexity of the project, and so forth.

Michigan's law and regulation-making processes are generally well accessible and predictable, contributing to lowering the regulatory risks for the investors.

4.9.3 Social Risks

Social risks can arise both on a superior level and a project level. Regarding remediation projects, dissatisfaction and disputes may arise, for instance, if the project has inadequate remediation goals or methods, requires resettlement, transfer of land rights and/or the property use must cease during remediation.

The risk of community engagement caused by dissatisfaction with the chosen methods or the prioritizing of projects may arise in all programs supported by the CMI bonds. The social risk level will vary from project to project.

On a superior level, social risks may arise if there is dissatisfaction with, among others, the utilized financial instrument (i.e., issuance of bonds) and the allocation of the fund resources.

4.9.4 Political Risks

Political decisions can influence the CMI on a superior level and project level. Regarding remediation projects, as well as pollution control and prevention project, changes in the acceptable level of pollution may change the project goals and, consequently, the methods in use.

On a superior level, political decisions can, to some extent, influence how projects are prioritized within some of the programs. However, allocation of the funds is regulated through the Natural Resources and Environmental Protection Act (Michigan Legislature, 1994). As a result, political decisions have limited power over allocation of the funds. Although the CMIA authorizes the Michigan Department of Treasury to issue bonds of up to USD 675 million, it does not contain a duty to do so, and thus the Government of Michigan can prevent issuance through their executive power.

4.9.5 Technical and Physical Risks

Technical and physical risks depend on the remediation methods in use. As we address the system as a whole, we will not consider technical and physical risks, because these will vary between projects.

4.9.6 Market Risks

PROJECT LEVEL

Market risks are dependent on the type of project. In the long run, remediation and redevelopment projects can increase the demand for the properties, which in turn can positively influence property value. In the short run, detection of contamination at a property may influence the use of the property, and therefore affect the property value. The longer a contaminated site remains untreated, the higher the risk of loss in revenue stream. In order to reduce accompanying market risks, remediation should be started as soon as possible.

Market risks related to redevelopment of brownfields and waterfronts relate to whether there is a demand for the project outcome, for instance shopping malls, sports arenas, farmers market, residential buildings or restaurants. These projects aim to enhance the economy in the area, provide new jobs and boost the surrounding neighbourhood. If the demand for the projected development turns out to be lower than expected, revenue streams and other benefits may be lower than calculated. Consequently, there is a risk of the projects financed by loans through the CMI programs may struggle to repay their debt.

BONDHOLDERS

Macroeconomic factors such as inflation, unemployment and economic recession can influence Michigan's decisions and abilities regarding the bonds, and hence, pose a risk to bondholders. Typical risks are call risk, credit risk, inflation risk, interest rate risk and liquidity risk (U.S. Securities and Exchange Commission, 2010). For instance, economic recession may affect the State of Michigan's ability to repay the principal and interests, thus the credit risk is increased. The automobile industry has a major role in Michigan's economy. In times of recession, the automobile industry is often deeply affected.

Call risk is the risk of the bond issuer retiring a bond before its maturity date if the interest rates decline and the bonds have fixed interest rate and are callable (U.S. Securities and Exchange Commission, 2010). Bondholders of bonds with fixed interest rates are also subject to the risk of declining purchase power if inflation rises. We do not have sufficient information about the bonds to assess these risks.

Bondholders could also be exposed to liquidity risks, arising when there is low demand for a certain bond, which in turn prevent the bondholder from selling the bond when they want and for a good price.

4.10 Lessons Learned

SUCCESS FACTORS

With its bond issuance, the CMIA provided a medium-term solution for funding remediation and development projects in Michigan. Through the CMIA, Michigan citizens approved bonds for USD 675 million, instead of having to approve each separate issuance.

The CMIA stated the purpose and type of activities to be financed through the CMI bonds. These activities include for instant remediation and redevelopment of contaminated sites, as well as pollution prevention and control. As a result, CMI bonds provide more comprehensive and forward-looking efforts towards the environment and public health.

WEAKNESSES

The greatest weakness of the CMI is that is does not provide a long-term solution. While the bonds ran out in 2017, there are still about 7,300 contaminated sites, which lack sufficient CMI funding for environmental assessments and/or remediation (Ringler, 2017, p. 10).

Another weakness is that it is more expensive to finance projects through bonds than through general fiscal revenue.

5 Bonfol

This project concerns the remediation of 284,200 tonnes of contaminated soil, chemical waste and attached material in Switzerland, and transportation of these masses to special treatment plants in the Netherlands and in Germany. The project is one of the most expensive projects undertaken in Europe. It involves high risk because of the treatment of extremely toxic waste, which was transported over large distances. The total costs of about CHF 380 million was financed by the commercial entities BASF, Clariant, Novartis, Syngenta, Roche, Rohner, CABB and Henkel, which are identified as the polluters.

5.1 Background

Bonfol is a small municipality in the canton Jura in northern Switzerland. The Bonfol chemical waste landfill, was with its 114,000 tonnes of hazardous waste (bci Info-Center, 2016; Joria, 2016; Dupuis & Knoepfel, 2015, p. 60), Switzerland's second biggest contaminated site in terms of toxic waste quantity (Dupuis & Knoepfel, 2015, p. 60). The landfill was in use from 1961 to 1976 (Dupuis & Knoepfel, 2015, p. v). A simple partnership called Basler Chemische Industrie (BCI), which regrouped the then biggest chemical companies of Switzerland CIBA, Geigy, Sandoz, Roche, Duran, Huguenin, Rohner and Henkel, managed almost autonomously the landfill in Bonfol, in order to dispose waste resulting from chemical production processes (Dupuis & Knoepfel, 2015, p. 60). The landfill also received waste from the watch industry and Swiss military (bci Info-Center, 2016).

The waste was disposed into clay pit, which was closed in 1976 due to lack of further capacity (bci Info-Center, 2016). The pit was then covered with a layer of clay soil and trees were planted. Right from the opening of the landfill the groundwater and surface water were under regular surveillance, which was considered as best practice at the time. The soil was impermeable, which hindered the rainwater from being absorbed into the ground and toxic liquid began to overflow in the early 1980s. The chemical industry tried to contain it by draining the water and installing a purification plant while reinforcing the cladding.

In 2000, the canton Jura and BCI reached a framework agreement, where BCI agreed to remediate the site: "completely and definitively (…) within the framework of legal requirements and as soon as possible" (BCI, 2000).[7] The public authorities interpreted the agreement as to BCI financing all remediation. However, BCI intended to make the municipality contribute in financing remediation, by virtue of their ownership of the property (Dupuis & Knoepfel, 2015, p. 133–134). An information committee was established in the spring 2001, consisting of environmental associations, French and Swiss authorities, as well as BCI, in order to improve the information flow between the stakeholders (Canton of Jura, 2001). Throughout the next five years, BCI, public authorities and several environmental associations negotiated the environmental outcome, remediation methods used and financing. The parties finally settled on an agreement in November 2005, regulating financing and the basic concept of the remediation (Canton of Jura, 2005). BCI accepted the full financial responsibility for the remediation project. Further negotiations regarding the remediation methods, environmental outcomes and safety measures took place between several environmental associations, locals, farmers and a foundation, public authorities and BCI in 2006–2008 (Dupuis & Knoepfel, 2015). After several supplementary agreements, the construction of necessary infrastructure could finally begin in 2008.

The detailed composition of the chemical substances of the waste was not examined as it was considered unnecessary for the remediation. However, the site was tested for chlorine, bromine, fluorine, iodine, sulphur, volatile heavy metals, polychlorinated biphenyl (PCB) and calorific value (bci Betriebs-AG, 2003, clause 7.2.1.3, p. 58; bci Betriebs-AG, 2008). Because of their quantity in the landfill, their mobility and their toxicity, anilines, HHVs and benzenes have been identified as the classes of substances that represent the greatest risk to humans and the environment (bci Betriebs-AG, 2008, clause 4.2.1, p. 13). The waste contains small amounts of radioactive isotopes from the watch industry (bci Betriebs-AG, 2003, clause 6.2.1, p. 30).

[7] NIVA's translation, taken from "Accord-Cadre, Concernant l'assaissement de la decharge industrielle de Bonfol"

A special feature of the project was the necessity to construct extensive infrastructure, such as a new road to the contaminated site, connection to the local water and power network, 18,375 m^2 excavation hall, treatment hall, sewerage cleaning facility, air cleaning facility, industry water tank and weather station. The local railway tracks were extended 700 m to the site. Instead of trucks, rail was chosen to minimize risk and environmental footprint (bci Betriebs-AG, n.d.c).

In total 202,200 tonnes of chemical waste and attached material was transported to special treatment plants outside of Switzerland. Simultaneously, 84,000 tonnes of light and medium contaminated soil material was treated at special treatment plants in Switzerland and the Netherlands (bci Betriebs-AG, 2016b). The original plan was to finish the project in 2015; however, the remediation was delayed, mainly due to an explosion on the site in 2010 and the subsequently increased safety measures. In 2016, the last toxic waste was removed. The entire project, including the removal of the infrastructure for the project, was due to be finished in the end of 2017 (bci Betriebs-AG, 2017).

After the remediation project has ended, the site will be supervised for a minimum of 10 years (bci Betriebs-AG, 2012). In this period, the site will also be replanted, supporting habitats for deer, fox, hare, weasel, woodpeckers and other species (bci Betriebs-AG, n.d.a). Wetlands will also be rebuilt, thus enhancing biological diversity in the area. The remediation will likely end the Bonfol municipality's reputation as a "village of waste" (Joria, 2016). This will create a more positive environment for local development and investment.

The remediation project is managed by the public limited company bci Betriebs-AG, which was established especially for the remediation project in Bonfol by the BCI companies. The member companies of BCI funded the entire project costs of about CHF 380 million (USD 393.50 million or EUR 344.75 million) (bci Betriebs-AG, 2012).[8] It is one of the most expensive remediation projects in Europe.

ENVIRONMENTAL LAW RELEVANT FOR REMEDIATION

When it comes to the remediation of contaminated sites, the polluter pays principle is primarily implemented through article 2 and article 32d of the Federal Act on the Protection of the Environment (Environmental Protection Act).[9] Article 2 states the polluter pays principle as a guideline for the interpretation of the law. Article 32 paragraph 1 states that "the person responsible bears the costs of the measures required to investigate, monitor and remediate polluted sites." While the "responsible person" is not defined in the law, the courts have, based on the "disturber concept" pursuant to police law principles, interpreted the notion as encompassing both "persons who cause a disturbance by their own conduct" (polluter through behaviour) and "persons who control the source of a disturbance" (polluter by status) (Caluori, 2011, p. 55; Imhoff & Lips, 2016). For instance, a polluter through behaviour could be the operator of the landfill, while a polluter by status would be landowner. The owner can include the actual owner, leaseholder, tenant and agent (Federal Office for the Environment [FOEN], 2016). The polluter is often both a polluter through behaviour *and* by status. If the (legal or natural) person still exists, the person becomes exclusively responsible for the costs.

If two or more persons are responsible, they bear the costs according to their shares of the responsibility (article 32d, paragraph 2). Any person responsible can request a ruling on the allocation of costs by the relevant authority (article 32d, paragraph 4). The polluter who caused the need for measures through their actions carries the main share of the costs (Article 32d, paragraph 2).

Any person who is responsible simply as the proprietor of the site does not bear any costs if, by exercising the required care, that person could not have had any knowledge of the pollution (article 32d, paragraph 2). If the proprietor did not exercise the required care, or did know about the pollution, then the proprietor normally must carry between 10 and 30 per cent of the total costs (Griffel, 2015, p. 146). If the person responsible cannot be identified or is unable to pay, the public, through the municipality or the canton, carries the costs (article 32d, paragraph 3).

[8] Exchange rate 1 CHR to USD 1.04, and € 0.91 (July 13, 2017)

[9] Bundesgesetz über den Umweltschutz vom 7. Oktober 1983.

Remediation of contaminated soil is regulated in detail in the Ordinance on Contaminated Sites (OSites).[10] The OSites contains requirements for the procedure, remedial measures, objectives and monitoring during and after sanitation. The general objective of remediation is the elimination of impacts that led to the need for remediation, or of the real danger of such effects. Further, the objective of remediation must be achieved by measures that enable environmentally hazardous substances to be eliminated (decontamination) or to enable the diffusion of environmentally hazardous substances to be prevented in the long term and monitored (securing) (OSites article 16). OSites article 4 requires that investigations, monitoring and remediation measures are state of the art. The project's specific final objectives and measures are decided by the relevant authorities (OSites article 18).

Several other regulations supplement OSites, such as the Ordinance on Water Protection and the Ordinance on Air Protection.

THE OCRCS CONTAMINATION FUND

The Ordinance on the Charge for the Remediation of Contaminated Sites fund (OCRCS Contamination Fund) is a federal fund that contributes to financing investigation, monitoring and remediating polluted sites (FOEN, 2015b). In the Bonfol case, it was highly possible that the project would receive funding from the fund, and it was an important topic in the negotiations between the BCI and authorities, as addressed under legal risks in Section 5.9.1.

The fund went into force on January 1, 2001 (FOEN, 2016). It is administered by the Federal Office for the Environment (FOEN), which levies the charges and decides on the allocation of subsidies (FOEN, 2015b). Between 2002 and 2016 the fund paid out CHF 328 million and gave CHF 94 million in assurances (FOEN, 2017).

The fund is regulated primarily by Environmental Protection Act article 32e and the OCRCS. It is financed by a tax on the deposit of waste in landfills. To receive funding, at least one of these conditions must be fulfilled (FOEN, 2015a):

- The party responsible cannot be found or is insolvent.
- A large part of the waste deposited in the landfill consists of household waste.
- The investigation of the site shows the site is not contaminated.

The subsidies are only paid if the measures taken are environmentally friendly, economical and use the most up-to-date technology (EPA article 32e, paragraph 4). The subsidies paid to the cantons can make up to 40 per cent of the chargeable costs (EPA article 32e, paragraph 4).

5.2 Level of Development

Bonfol is a small municipality, with less than 1,000 inhabitants, low population density and a declining population. In 2014, the GDP per capita of the canton Jura, the region in which the Municipality of Bonfol is located, was CHF 64 606, compared to CHF 78 619 in Switzerland as a whole (Bundesamt fur Statistik, 2016). Thus, the regional GDP per capita was 82 per cent of the national GDP per capita. In 2014, most of the municipality's inhabitants worked in the industry (61.8 per cent) and service sectors (27.7 per cent) (Swiss Federal Statisical Office, 2014). The remaining 10.5 per cent worked in the primary sector.

5.3 Type of Land

The area of the contaminated site is a forest zone according to the zoning plan of canton Jura. The landfill area is about 20,000 m^2. The average waste thickness is 5 m and reaches 12 m at its thickest. The landfill is covered with a spruce plantation of little ecological value. The site is surrounded by oak forest. It is a logging association

[10] Verordnung über die Sanierung von belasteten Standorten vom 26. August 1998. https://www.admin.ch/opc/de/classified-compilation/19983151/index.html

worthy of protection according to the Ordinance on the Protection of Nature and Cultural Heritage. Near the landfill, two artificial ponds contain many rare and protected animal and plant species (Swiss Federal Statisical Office, 2014, p. 104).

Closest to the site is agricultural fields, at a distance of around 100 m. Around 500 m to the southwest is a service garage and some other service and industrial enterprises. One km to the southwest of the site is the Village of Bonfol, and about to 2 km to the north is the Village of Pfetterhouse.

5.4 Financial Sources

Private capital funds 100 per cent of the project costs.

5.5 Financial Actors

After years of negotiations, BCI and public authorities finally reached an agreement saying that the member companies of BCI (i.e., the polluters) will fund the project. Polluters have a legal duty to fund environmental assessments and remediation in Switzerland. Also, the landowner has a legal duty to fund such projects, if the landowner had or could have had knowledge of the pollution. The landowner usually has to fund between 10 and 30 per cent of the remediation costs, according to established practice in court (Griffel, 2016, p. 146). Nevertheless, the member companies of BCI agreed to take full financial responsibility for the remediation, after considerable pressure from public authorities. Possible reasons the property owner, Bonfol municipality, does not contribute include its financial situation and desire to avoid a judicial process.

COMMERCIAL ENTERPRISES

The financial actors involved in the project are private firms that are part of BCI. These are BASF (42.54 per cent), Clariant (21.60 per cent), Novartis (12.71 per cent), Syngenta (12.71 per cent), Roche (3.99 per cent), Rohner (3.86 per cent), CABB (1.18 per cent) and Henkel (1.41 per cent) (bci Betriebs-AG, 2018). These enterprises are either directly the polluting entities or are successors after takeovers and reconstruction. The cost allocation is based on each firm's contribution of waste to the landfill. Together they finance 100 per cent of the project costs.

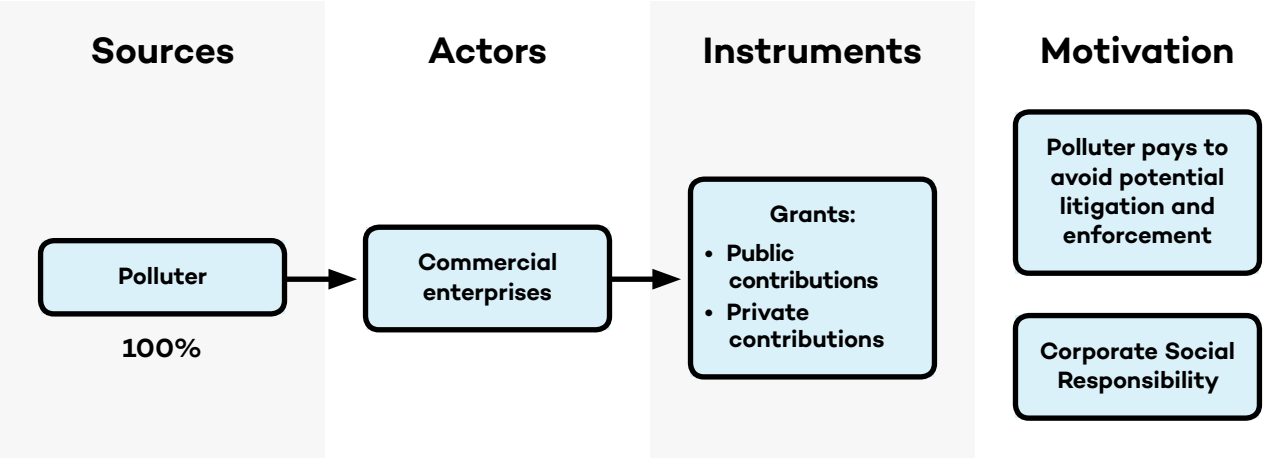


Figure 10. Marked in blue are the types of sources, financial actors and instruments in use in Bonfol, as well as the financial actors motivation to contribute to the project.

5.6 Financial Instruments Utilized

Swiss authorities managed to reach an agreement with the polluters where the polluters commit themselves to fund *all* remediation of the Bonfol landfill, although Swiss law and established practice in court usually enforce that the landowner contribute as well as the polluters.[11]

The project is funded by grants, in the sense that their contributions are not reimbursed.

5.7 Financial Recipients

The financial recipient is bci Betriebs-AG. The non-sovereign recipient was created in order to solve the remediation of Bonfol in a professional and effective manner (bci Betriebs-AG, 2018a). The company is responsible for the planning and implementation of remediation and handles all matters related to the Bonfol landfill. The financiers will monitor the non-sovereign recipient's ability to handle the project finances. If the recipient fails to conduct remediation at budgeted cost, the financiers will have to provide more funding, by virtue of being the responsible polluters with obligations to the public authorities. As an example, BCI members funded the CNF 30 million price tag when stricter safety measures were implemented after an explosion (Jubin, 2013).

5.8 Costs Affecting Return

The total project costs are approximately CHF 380 million (USD 393.50 million or EUR 344.75 million),[12] which is CHF 30 million more than the budget (as noted above) (Betriebs-AG, 2013). The actual remediation and construction of infrastructure imposed most of the costs, amounting to 69 per cent and 19 per cent respectively of the overall project costs (Table 4).

Table 4: The distribution of costs during the remediation stages, as well as preparation and maintenance.

	Cost distribution
Preparation work	5 %
Stage 1 – Planning	1 %
Stage 2 – Detailed planning	1 %
Stage 3 – Construction of infrastructure	19 %
Stage 4 – Remediation	69 %
Stage 5 – Deconstruction	3 %
Follow-up maintenance	2 %

Source: bci Betriebs-AG (2018b)

[11] More detailed information in Section 5.8 (legal risks).

[12] Exchange rate CHR 1 to USD 1.04 (EUR 0,91) (July 13, 2017)

In the following, costs associated with the financial investments in the remediation project of the Bonfol landfill will be described. As in all investment projects, some transaction and information costs will occur, as well as other costs affecting *rate* of return. Transaction costs occur in the process of buying or selling goods and services, when prices and requirements are negotiated and agreements are enforced. Information costs arise when an investor or potential buyer of a good or service gathers information about the alternatives. In addition, other factors may affect the rate of return.

5.8.1 Transaction Costs

Taking into account the size of the Bonfol project, there were considerable transaction costs in this project. The transaction costs arose when the issues of project financing, remediation methods and objectives were negotiated. Because the polluters contribute mostly because of a legal duty, without the expectation of some kind of return, they attempt to minimize their share of cost or the actual project cost. This desire faced opposition from other stakeholders, such as the municipality and environmental associations. Several environmental associations, the Municipality of Bonfol, the Canton of Jura, FOEN, representatives from French regional authorities and the member companies of BCI were at some point involved. Several years passed before the stakeholders agreed upon a remediation plan and cost allocation.

Table 5. Factors affecting transaction costs and their effects.

Factors affecting transaction costs	Effect on transaction costs
Voluntary agreements to settle cost allocations	Reduced
Choice of remediation methods and objectives	Increased
Tendering	Reduced

VOLUNTARY AGREEMENTS TO SETTLE COST ALLOCATIONS

On behalf of the polluters, BCI negotiated the financing of the project with the municipality and canton. In May 2000, Greenpeace started a demonstration on the landfill, and as a result BCI declared their intentions to remediate the landfill two days later (Dupuis & Knoepfel, 2015, p. 118).

In October 2000, canton Jura and BCI reached a framework agreement, in which BCI agreed to remediate the site as soon as possible. While the public authorities believed that BCI also accepted to take on the full remediation costs, BCI later demanded that Bonfol, as the landowner, contribute their part of the costs in accordance with Swiss law (Jubin, 2002).

The municipality did not have the financial means and was not willing to contribute financially. The financial issue was a source of negotiation on and off until they reached a new agreement in November 2005 (Canton of Jura, 2005b). The issue has likely postponed the remediation process and caused noteworthy costs for all parties involved in the negotiations. A judicial process was avoided when they reached a voluntary agreement, which most likely lowered the transaction costs.

CHOICE OF REMEDIATION METHODS AND OBJECTIVES

The second issue was the choice of remediation methods and objectives. An information committee had been formed for civil society organizations to be informed about the remediation process (Canton of Jura, 2001). Through the committee, environmental associations were informed about the process and could take action

whenever they disagreed with decisions made by BCI or the public authorities. The environmental associations also acted as a support for the canton and municipality, through their expertise on remediation (Dupuis & Knoepfel, 2015, p. 132). However, conflicting environmental ambitions between BCI and the environmental associations prolonged the negotiations (Dupuis & Knoepfel, 2015, p. 118–121). BCI wanted remediation methods and objectives that were less costly than those proposed by the environmental associations and the public authorities. The issue of selecting remediation methods and objectives lead to years of negotiations, and the relationship between the parties were extremely tense from time to time. Surely, these conflicts have caused high transaction costs.

TENDERING TO REDUCE TRANSACTION COSTS

The large amount of chemical waste and contaminated soil required extensive infrastructure (bci Betriebs-AG, n.d.c): 286,200 tonnes of chemical waste and contaminated soil was treated in this project (bci Betriebs-AG, 2016). Several entities were needed to build the infrastructure, excavating chemical waste and contaminated soil, and transport these masses to the treatment plants. The latter must be able to treat extremely large quantities of chemical waste and contaminated soil, and their methods must be sustainable. Remediation of the Bonfol landfill, including infrastructure work, was subject to a tendering process (bci Betriebs-AG , n.d.d). Without a tendering process, transaction costs would arise as the parties negotiated about the specifications, contract and price. Since this project was tendered, associated transaction costs would relate to ensure that the parties' offer complies with the requirements. The use of tendering probably reduced transaction costs greatly. Still, in a project of this size, these costs are likely to be high, because of the amount of entities involved.

5.8.2 Information Costs

Information costs relate to the process of gathering information about infrastructure, remediation and transportation entities, as well as an information search about the remediation process and polluters. Normally, there is a need to identify the polluters and their share of pollution for the public authorities to enforce the polluter pays principle in Swiss laws. However, because of the joint and unlimited liability of the simple partnership, it is not necessary for the public authorities to identify the individual polluters' contributions to the pollution. Thus, the authorities are free to demand all cost covered by the partnership members of their choice.

Table 6. Factors affecting information costs and their effects

Factors affecting information costs	Effect on information costs
Information committee to simplify information search	Reduced
Tendering	Reduced

INFORMATION COMMITTEE TO SIMPLIFY INFORMATION SEARCH

Many were involved in the remediation of the Bonfol landfill, including, among others the municipality, canton, environmental associations, the local community, French local government and the members of BCI. In order to make the information search process easier for everybody involved, an information committee was formed in 2001 (Dupuis & Knoepfel, 2015, p. 131). BCI was obligated to inform the committee about the remediation process and to finance the committee. This initiative has likely reduced the overall information cost, as information was more available for the other parties involved.

TENDERING TO REDUCE INFORMATION COST

This project requires several entities to participate in different stages of the project. Some of the processes are unusually large, and particularly demanding, such as treatment of the large quantities. Other processes may have a more common level of difficulty. Interested entities could submit offers during a tendering process (bci Betriebs-AG , n.d.d). Since BCI did not have to search for potential entities, the information search was limited to identifying whether the entities would be able to comply with their contract. Although the tendering process reduced information costs, these costs might still be of a substantial size.

5.8.3 Costs Affecting Rate of Return

BCI formed the public limited company bci Betriebs-AG in 2002 and entrusted all planning and remediation to this company on behalf of the polluters (bci Betriebs-AG , n.d.d). This simplified the decision-making process, and allowed the planning and remediation processes to run more smoothly—for example, the schedule and coordination of all entities that are involved at different stages of the project.

Greenpeace and other environmental associations have had significant influence on the chosen remediation methods, safety measures and preferred environmental outcomes. Their influence on the project has likely increased the overall project costs by increasing the ambitions, in addition to the transaction costs related to the negotiations. For instance, the additional treatment of air released from the installation, demanded by Greenpeace and the Edith Maryon Foundation, was estimated to cost around CHR 8 million (Dupuis & Knoepfel, 2015, p. 141).

An explosion occurred in the excavation hall on July 7, 2010 (bci Betriebs-AG , n.d.d). The explosion caused an 11-month delay of the remediation work and enhanced safety measures. Pressure relief flaps were installed in the excavation hall and from then on, a crane crab and remote-controlled excavator lifted waste out of the landfill, crushed the waste and moved the waste to the treatment hall.

5.9 Risks for Financing Remediation

There are many risks involved when financing remediation. Here we distinguish between legal, regulatory, social, political and market risks. The technical and physical risks are not covered for this project due to its extreme size and complexity.

5.9.1 Legal Risks

The financing actors in the Bonfol remediation project are the private companies part of the simple partnership BCI. In Swiss corporate law, a simple partnership is not a judicial person and cannot obtain duties itself. When the partnership's members enter into a contract through BCI, they accept that their duties on a given issue are regulated by BCI's partnership agreement. The main effect is that, in relation to external parties, the member companies have unlimited and joint liability, while internal responsibility is based on their internal agreement.

Both the framework agreement of October 17, 2000 and the main contract of November 20, 2005 regulating the allocation of costs of the project were entered into by BCI and the canton Jura. In the contract of 2005, BCI took the responsibility for all the costs of the project, and therefore also most of the risks.

In 2002 BCI established an SPV, the limited company bci Betriebs-AG, for planning and implementation of the remediation project (bci Betriebs-AG , n.d.d). By establishing an SPV, there was no need for all BCI members to enter into contracts with expert consultancies, remediating companies, transporting companies and special treatment plants directly; instead bci Betriebs-AG alone could. While this does not limit BCI's obligations and liability deriving from its contract with the canton Jura, and from mandatory laws and regulations such as Environmental Protection Act article 32d, this limits BCI's liability towards other contractual parties, entities and individuals. The piercing of the corporate veil concept is only relevant in exceptional cases and

is rarely applied by the courts. BCI's legal risks in the tendering process, contract closing and liability during remediation were thus reduced.

When it comes to BCI's legal risk in the narrow sense, it is useful to differentiate between the period before the 2005 contract and the period thereafter. Before 2005 it was relatively clear that BCI should carry at least 70 per cent of the costs according to Environmental Protection Act article 32d in conjunction with the case law mentioned previously. However, regarding the remaining 30 per cent, the degree of BCI's responsibility was highly doubtful. BCI requested the Municipality of Bonfol to contribute as owner of the site. The canton Jura, which would have to take the costs due to low solvency of Bonfol, refused to even consider contributing (Dupuis & Knoepfel, 2015). An owner of the site that is not innocent has normally to carry between 10 and 30 per cent of the remediation costs in accordance with Environmental Protection Act article 32d in conjunction with practice by the courts (Griffel, 2015, p. 146). The Swiss Federal Supreme Court has stated that a share of zero per cent could be used in exceptional cases.[13] The uncertainty of having to finance a part, or all, of the remaining 30 per cent of CHR 380 million was a high legal risk for BCI.

In the 2005 contract, BCI is responsible for all the project costs except potential refunding by the federal OCRCS Contamination Fund.[14] The idea was to transfer part of the costs to the federal level. BCI's plan has been described in detail in *The Politics of Contaminated Sites Management* (Dupuis & Knoepfel, 2015). The plan involves many administrative and legal uncertainties. It is not certain whether the federal administrative authorities, or the courts, will accept such a creative manoeuvre to transfer the costs to the federal level while mainly profiting the private firms (Dupuis & Knoepfel, 2015). Thus, the legal risks for BCI were still very high after 2005, however with changed circumstances. By the end of the project in 2017, the remediation project had not yet received any funding from the OCRCS Contamination Fund.

Another legal risk is the potential misinterpretation of environmental standards in environmental law and regulations, and specific requirements set by the Swiss Environmental Protection Agency. This can be both regarding the remediation and treatment measures, and the quality of the results. Decisions by the authorities can also be challenged by third parties if they took part in the previous proceedings, if they are particularly affected by the challenged ruling and have a legitimate interest in the cancellation of the ruling (Global Legal Group, 2016, Section 5.3). Even though such a procedure is between the public authorities and the third parties, they can increase the costs for BCI through their potential suspensive effect and increase of requirements. This risk was relatively high through the entire project, due to the size of the project, closeness to the local community, active NGOs and media attention.

The risk materialized to a large extent in 2006 when farmers, local residents, NGOs (hereunder Greenpeace) and a foundation lodged objections against a special cantonal plan for the project. The objections were denied by Jura's government. Greenpeace and a foundation took the decision to court in 2007. In a conciliation organized by the cantonal administrative court of the Jura in 2008, BCI conceded to most of Greenpeace's demands. One of the additional measures was the burning of air released from the excavation hall, which increased the cost of the project by about CHR 8 million (Dupuis & Knoepfel, 2015, p. 141).

The entire project has seen high liability risks for BCI and bci Betriebs-AG. The primary source of liability risk stems from the vast quantity of toxic and chemical unstable waste. Potential leakages from the site, during all phases of the project including transport and final treatment, have the potential to create vast damages. Leakage of toxic material near people and property could lead to compensation costs for lost life and health, cleanup costs of property and also for the costs of evacuation of entire areas. This risk materialized to some degree when an explosion at the site in 2010 injured a dredge operator, who in 2015 still fought for compensation (RTS Info, 2015; bci Betriebs-AG, n.d.d). In addition, the explosion led to a suspension of the remediation work for 10 months and increased costs for extra safety measures during remediation work (bci Betriebs-AG, n.d.d).

The contractual risk stems from the four major contracts with the Canton of Jura: the framework agreement of 2000, the main contract of 2005, and the two contracts of 2006 and 2007 (bci Betriebs-AG, 2018e). Another

[13] Swiss Federal Supreme Court decision 1C_231/2012 (29. November 2012) section 3.1.3, 3.5 and 5.

[14] Contract of 2005, section 4 http://www.bci-info.ch/pdf/20051129_DIB_Convention_JU_bci.pdf

considerable risk comes from the tendering process for this huge project. Finally, the separate contracts with all the actors within and outside the tendering process create risks. This includes contracts with the public limited companies Marti Infra AG and Züblin Umwelttechnik AG who were building the infrastructure and carrying out the lifting of the toxic waste, and the German private limited company HIM GmbH responsible for the transport and treatment of the toxic waste. In addition, BCI had contracts with the consultancies public limited companies CSD Ingenieure und Geologen AG and BMG Engineering AG, as well as the environmental supervision firms WESSLING Laboratorien GmbH (a private limited company) and InNet Monitoring AG (a public limited company) (bci Betriebs-AG, 2018d). Due to the number, complexity and size of the contracts and the tendering process, the contractual risk was high.

5.9.2 Regulatory Risks

The regulatory risks for BCI are low to medium. On the one hand, a large number of laws and regulations are relevant for the project (bci Betriebs-AG, 2018c) and the project has a very long time frame (18 years from the framework agreement of 2000 to the final deconstruction of infrastructure in 2018 [bci Betriebs-AG, 2017]). Thus, relevant changes that can affect BCI's cost were not unlikely. However, the law- and regulation-making processes in Switzerland are, in general, open, accessible and well structured. Thus, changes can be predicted to some extent.

5.9.3 Social Risks

Social risks are usually related to community engagement, resettlement and land rights. In Bonfol, the social risks depend on the objectives regarding environmental outcome, as well as the location of the new road and railway.

The remediation of the Bonfol landfill was funded by the polluters, mainly because of their legal duty to remediate the site. The polluters would normally want to comply with their legal responsibility at lowest possible cost without injuring their reputation. In such cases, the polluters, the local community and environmental associations might have different desires for the environmental outcome. Therefore, there is a risk for community dissatisfaction and engagement if BCI's remediation plan and outcome objectives do not correspond with the desires of the local community and environmental associations.

This risk materialized several times throughout the years of planning the remediation of the Bonfol landfill. Greenpeace has demonstrated both on the property (in May–July 2000) and on a neighbouring property (in July 2005) (Greenpeace, 2000, 2005; bci Betriebs-AG, n.d.d). The Bonfol Collective has had significant influence on the project since it was formed by several environmental associations[15] in June 2000 (Dupuis & Knoepfel, 2015, pp. 118, 135, 136; Commission d'information et de suivi, n.d.). In addition to their influence through the information committee, their criticism of a remediation plan submitted by BCI resulted in 54 additional measures to the remediation plan in 2004.

Although cooperation with the Bonfol Collective through the information committee helped reach more sustainable remediation methods and objectives, it also prolonged negotiations and reduced efficiency. In order to increase efficiency, BCI and the Canton of Jura formed a selected committee responsible for further project planning and decision making (Canton of Jura, 2005a). The Canton of Jura, bci Betriebs-AG, the municipality of Bonfol and FOEN were represented in the committee, leaving out the environmental associations from the decision-making process. Even though the decision-making process between BCI and the public authorities was now more effective, it also enhanced the risks for more dramatic action taken by the environmental associations or other representatives from the civil society. For instance, the local authorities rejected all 12 objections[16] to a special plan that was submitted for public comments in November 2006 (Dupuis & Knoepfel, 2015, p. 139–140). As a result, Greenpeace and the foundation took the case to the Cantonal Court and demanded some changes in the plan, which resulted in an agreement (dated February 26, 2008) between BCI and Greenpeace where most of the demands were fulfilled.

[15] Consisting of Greenpeace, Pro Natura, UNIA, WWF and the French Green Party.

[16] Made by locals, farmers, NGOs and a foundation.

Social risks can also arise if the project involves resettlement and displacement. The remediation project in Bonfol does not involve such resettlement, but a new road or expansion of the railway could damage paths used for recreation depending on the chosen route. However, the project management has been aware of the issue and chose a route for the new road that did not damage such paths (bci Betriebs-AG, n.d.a).

5.9.4 Political Risks

Political risks are related to policy changes or individual political decisions that affect the remediation project. Policy changes might occur as a result of political instability or scientific discoveries; differing priorities between political parties can cause changes after an election. These policy changes can affect remediation projects, such as Bonfol, since they rely on approval from public authorities. In our research, we found that the political decisions affecting the project were related to the interpretation of the law regarding financial responsibility and environmental outcome, and therefore belong to legal risks. Thus, we consider the political risks as low in Bonfol.

5.9.5 Market and Commercial Risks

The contaminated site in Bonfol will be replanted, to support biological diversity and recreation. Remediation and replanting of the site will increase social benefits, such as recreational value and decreasing the health risk associated with polluted soil and water resources. If the remediation is delayed, the surrounding population will be exposed to the health risks for a longer period of time, possibly causing negative health effects. The area will also be less valuable for recreation purposes until the remediation and replanting are completed.

5.10 Lessons Learned

SUCCESS FACTORS

Environmental outcome

Involvement from several environmental associations, the local community, the Municipality of Bonfol and the Canton of Jura led to more comprehensive environmental outcome goals, monitoring, remediation methods and stricter safety measures. As far as it is possible to state at this point, the chemical waste and its risks were removed in accordance with the OSites article 15, paragraph 1. However, the final environmental assessments of the project and the environmental supervision of the site in the next 10 years will give final answers to the degree of environmental success.

Polluters pay all remediation costs

Perhaps the greatest success, besides the environmental outcome, is that the polluter pays principle was implemented to its full potential. All the direct costs of the remediation project so far, amounting to around CHF 380 million, were carried by BCI. The Municipality of Bonfol and the Canton of Jura are only carrying the indirect costs of the negotiations, administrative processes and supervision of the project. It is not entirely clear yet whether the OCRCS Contamination Fund will return any of BCI's costs.[17] Even if the OCRCS Contamination Fund does return some of the costs, the fund is financed by tax on polluters. If the fund does not pay, then the fund is preserved for other pressing remediation projects.

Enhanced information flow

BCI's obligation to update an information committee about the remediation process made the process more transparent and eased the stakeholders' information search. As the environmental associations were informed about the process, they could offer knowledge about the pros and cons of the suggested remediation methods to the canton and municipality.

[17] The parties were still negotiating as of September 12, 2017 with an officer from the department for contaminated soil in the Ministry of Environment in Switzerland (Bundesamt für Umwelt BAFU).

Leakages have been avoided

The risk of a major leakage of toxic waste during the remediation and transportation process was avoided. A leakage of that size could cause substantial damage to the environment and to the neighbouring population's health.

Major litigation has been avoided

In Bonfol, there have been substantial risks for litigation between the state and the polluters, which have been avoided through several agreements between the canton and BCI. The project's delay due to local authorities' refusal to take on any of the costs, as well as the increasing pressure from negative media attention, may have been key to BCI agreeing to take on all initial costs in 2005.

WEAKNESSES

Protracted process

Despite efforts by the chemical industry after the scandal in the early 1980s, when toxic liquid began to overflow, it later turned out that additional measures were needed. The subsequent process was very slow. It took 17 years from the first framework agreement to when the pollution was completely removed (see section 5.1). Deconstruction of the necessary infrastructure for the remediation project is still not finished, and the site will still be monitored for more than a decade.

There were three main reasons for the slow process. First, the disagreement between the parties about who is responsible for the costs and which environmental standards should be set as outcome goals illustrates the importance of clear laws regulating liability and outcome goals. Second, delays and additional safety measures were put in place after an explosion injured a worker. Third, almost 70,000 tonnes more material had to be removed than originally planned.[18] These factors have also increased the costs.

Lack of action

The Swiss EPA could be criticized for its lack of action when it was clear that BCI had a duty to remediate and had to take the main part of the costs. Avoidance of conflict and litigation was possibly not a sufficient reason not to use coercive fines or other measures.

Expensive

The remediation project in Bonfol turned out to be very expensive. The total project costs are estimated to be about CHF 380 million (USD 393.50 million or EUR 344.75 million) (bci Betriebs-AG, 2017).[19] The project was this expensive for three reasons: (i) input on chosen environmental outcome goal, remediation methods and safety measures from several environmental associations, which then were required by the local authorities; (ii) additional measures and delays caused by the explosion; (iii) several years passed before the parties involved agreed on the financing.

Need for financial means and willingness to pay

This project was funded by the polluters through an agreement with the public authorities. The prerequisite for large remediation projects being funded through such an agreement is an industry or polluter with the financial means and willingness to pay. A focus on corporate social responsibility or threats against the company reputation for the polluter may increase the willingness to pay.

[18] BCI expected that 134,000 tonnes had to be removed (bci Betriebs-AG, 2013); in the end 202,200 tonnes had to be removed (bci Betriebs-AG, 2016).

[19] Exchange rate CHR 1 to USD 1.04 (EUR 0.91) (July 13, 2017)

6 Flekkefjord

The project concerns remediation of contaminated sediments in the fjords in Flekkefjord. The dredged material will be used to establish a waterside waste disposal site and a marina for small boats in the same municipality. The sources of funding were general fiscal revenue (NOK 3 million + 27.8 million), polluters (NOK 2 million) and an investor (NOK 9.95 million). The Norwegian Environmental Agency (NEA) granted the project NOK 27.8 million from general fiscal revenue, with the condition that the municipality, polluters and other entities also contribute. The pollution is mainly historic, and many of the polluting companies do not exist anymore. For that reason, the polluters' contribution to this project is only close to 5 per cent.

6.1 Background

Located in southern Norway, the sediments in Flekkfjord are contaminated by polychlorinated biphenyl (PCB), polycyclic aromatic hydrocarbon (PAH), tributyltin (TBT) and heavy metals (Misund & Haker, 2011). Industry, harbour activities and city activities are the main contributors to the contamination. Flekkefjord municipality has applied for permission to remediate contaminated sediments in several parts of the fjords in the municipality (Kristiansen & Selmer-Olsen, n.d.). Investigations carried out in 2014 revealed a need for remediation on the sites of Tjørsvågbukta, the Loga channel and Grisefjorden (Figure 11) (Misund, Ulla, & Haker, 2014). The project was granted permission to dredge and cap contaminated sediments by the Flekkefjord municipality in 2015 (Fylkesmannen i Vest-Agder, 2015). The dredged material will be used to establish a waterside waste disposal site and a marina for small boats in the same municipality (Kristiansen &S elmer-Olsen, n.d.). The new marina will improve recreation opportunities, establishing about 350 berths, including boathouses (Løvland, 2016). The marina could lead to better use of the shoreline by supporting fishing and swimming activities outside the docks.

With regard to the environmental objectives for Flekkefjord, based on national guideline levels from the Water Regulation (the Norwegian implementation of the EU Water Framework Directive), it has been determined that the fjord shall have a "good ecological status" following specific guidelines on concentration levels for the contaminants, and will preserve known biological values such as eelgrass and fish spawning areas (Fylkesmannen i Vest-Agder, 2015). The chemical properties of the sediments shall be of such quality that there will be no restrictions for the use of the fjord for recreation (fishing, swimming) or industry. The county governor, who is the decision-making authority in this case, considered it positive that the measures of remediation will considerably improve the environmental status in Flekkefjorden. During the dredging and capping, it will be important to minimize the risk of spreading contaminants and sediment particles to avoid damages on ecological systems in the water, and hence the ecological values, and to minimize the risk of future leakages from the waterside waste disposal site and the areas to be capped.

Figure 11. Map over the relevant area in Flekkefjord. Contaminated sites that are going to be remediated are marked in red.

Source: Norwegian Mapping Authority. Numbers in red circles inserted manually by NIVA.

In Norway, the polluter pays principle is the main principle behind the remediation of contaminated soils and sea beds. However, in some cases it is not feasible to force the polluters to fund (part or all of) the remediation project. As contamination is often historic, the polluting companies may no longer exist or may have been subject to mergers or demergers, making it difficult to identify who should pay. It can also be difficult to find the source of pollution at the seabed, because pollution can be spread at great distances at sea.

In this case, the NEA issued a grant with certain conditions (NEA, 2015). The municipality, polluters and others had to contribute financially in order for the project to receive the grant. To some extent, this gives the project manager an incentive to identify polluters and force them to contribute to the remediation without relying entirely on either public or private funding. Thus, this releases some economic pressure for the parties involved.

6.2 Level of Development

Flekkefjord municipality has about 9,066 inhabitants, of which 73 per cent live in villages (Flekkefjord and Sire) and 17 per cent live in rural areas (Nilsen & Thorsnæs, 2017). The population density is low, especially in the uplands. There has been weak growth in population for the last 20 years (Nilsen & Thorsnæs, 2017; Statistics Norway, 2018). In 2016, GDP in Norway per capita purchase power parity was about USD 63,811, which supports a high standard of living (World Bank, n.d.c). The five most common workplaces were health and social services, accounting for 31 per cent the workplaces in the municipality, manufacture for 14 per cent, retail and repair of motor vehicles for 12 per cent, construction for 9 per cent and education for 8 per cent (Statistics Norway, 2015).

6.3 Type of Land

The project has received permission to dredge sediments in an area of 39,200 m^2 and cap 60,000 m^2 with shell sand (Fylkesmannen i Vest-Agder, 2015). The area has been identified as a regionally important spawning area for various fish species. It includes an eelgrass area and various other important values. The area also includes a nature reserve important for wetland birds, residential and leisure housing, industry, agriculture and an abandoned railway. Restrictions regarding methods to be used and the period of the year the remediation can be carried out will considerably reduce the risk of spreading pollutants, smothering eelgrasses and fish stocks, or disturbing birds.

The waterside waste disposal site and marina will be located at properties owned by Flekkefjord motorboat club and the Norwegian Public Roads Administration (personal communication, Terje Aamot, project manager, August 22, 2017). A boathouse accommodating 23 berths is located south on the property (Kristiansen & Selmer-Olsen, n.d.). Residential housing borders the property on several sides. There are boathouses both north and south of the property, and industrial buildings are located south of the property.

6.4 Financial Sources

Public funds (general fiscal revenue) contribute totally 72 per cent and private (investors and polluters) contribute 28 per cent.

6.5 Financial Actors

There are several actors involved in this project, both public and private actors. Private actors, including polluters, funded more than one quarter of the estimated project costs. The motivation for private actors to contribute might be a mixture of corporate social responsibility, city development, demand for a new marina and desire to achieve a positive reputation among the locals.

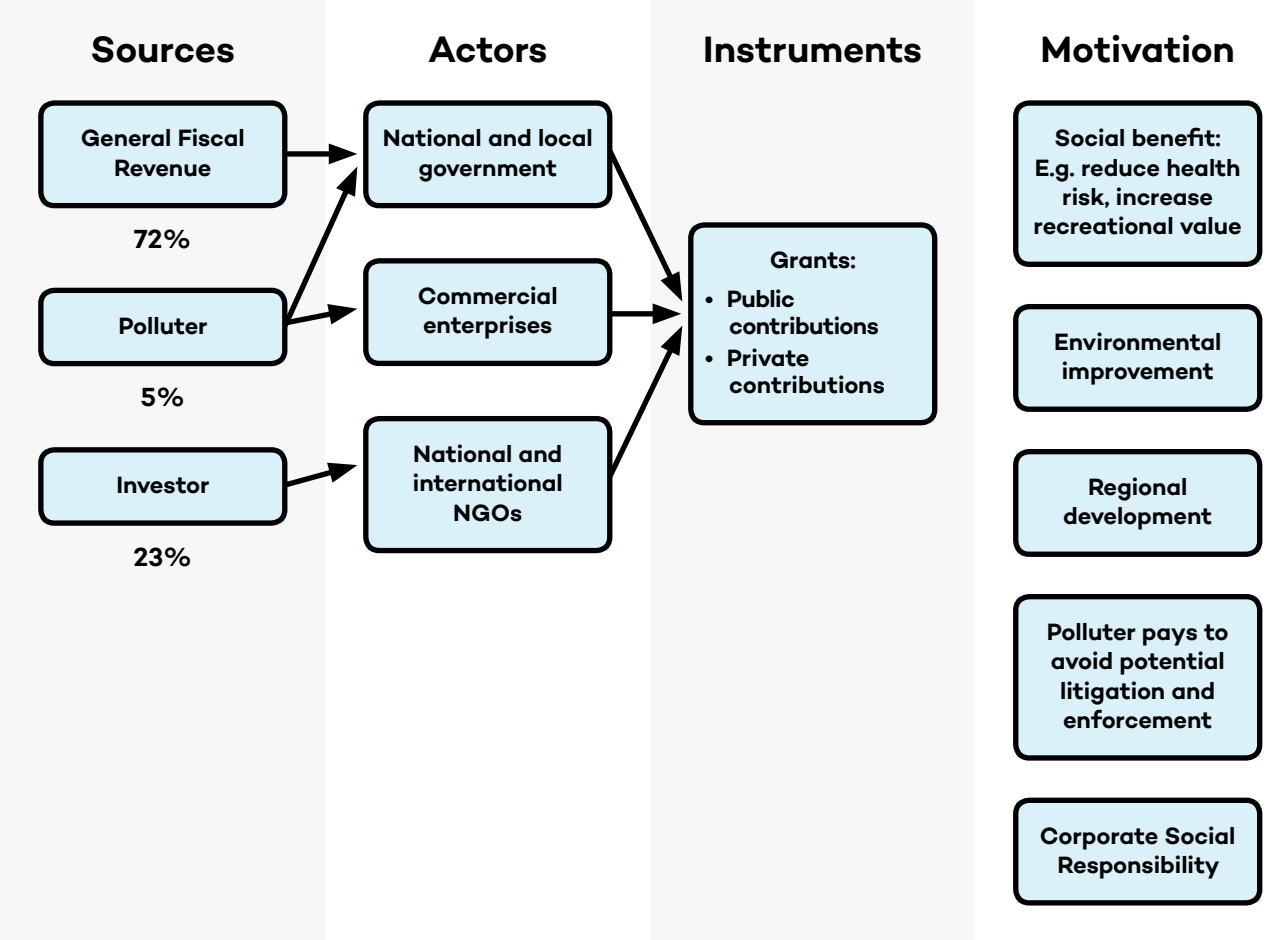


Figure 12. Marked in blue are types of sources, financial actors and instruments in use in Flekkefjord, as well the financial actors' motivation to contribute to the project. The share of sources in use are shown in percentage.

The project management considered potential contributors early in the process, and prepared a proposal based on the financing plan (personal communication, Terje Aamot, project manager, August 8, 2017). The proposed share of contribution from polluters was based on the polluters' financial situation and the severity of their pollution. The project manager then contacted the potential contributors and agreed on a sum. The NEA indicated early on that they would contribute financially to the project. Such a contribution has been essential

for the remediation project, as the Flekkefjord municipality has highly limited resources to fund remediation projects, and no active polluter could be held responsible for all the contamination at the site (NEA, 2015).

NATIONAL AND LOCAL GOVERNMENT

The NEA has granted the project NOK 27.8 million on the condition that the municipality, polluters and others also contribute (personal communication, Terje Aamot, project manager, June 27, 2017; NEA, 2015). Flekkefjord municipality, the operating party, granted NOK 3 million to the project.

COMMERCIAL ENTERPRISES

Local polluters[20] have voluntarily contributed about NOK 2 million to the project (personal communication, Terje Aamot, project manager, June 27, 2017). Main motivation is probably that it will be easier and cheaper to collaborate from the beginning.

The Flekkefjord motorboat club, a local NGO, contributed by buying one parking lot at a cost of NOK 75,000 for every third berth sold. If all berths are sold, the motorboat club contribute with NOK 9.75 million (personal communication, Terje Aamot, project manager, August 22, 2017). The motorboat club is probably motivated by the benefit of a new marina for small boats. The motorboat club owns the property where the waterside waste disposal site and marina will be located. Also, the municipality and motorboat club have a tradition of cooperation in terms of marinas, and the property was regulated as a marina already (personal communication, Terje Aamot, project manager, August 7, 2017).

Estimated revenue received from entities that deliver waste to the disposal site is NOK 300,000 (Løvland, 2015).

6.6 Financial Instruments Utilized

Up to now, this project has relied solely on grants from public and private actors. Flekkefjord municipality could utilize a loan as bridge financing if necessary in the future.

6.7 Financial Recipients

Flekkefjord municipality is the project owner and financial recipient. Flekkefjord motorboat club will receive revenue from the new marina, due to their ownership of the property (personal communication, Terje Aamot, project manager, August 22, 2017).

6.8 Costs Affecting Return

Estimated project costs are about NOK 53.8 million, including 25 per cent value-added tax (VAT). The project is fully compensated for any incurred VAT, as municipalities generally receive compensation for incurred VATs on goods and services they buy in order to neutralize competition distortions arising from the Norwegian VAT system (personal communication, Terje Aamot, project manager, June 27, 2017).21 The estimated project costs include rig and operation (7.6 per cent), feasibility studies (1.9 per cent), capping (13.9 per cent), dredging (8.2 per cent), unexpected costs (6.6 per cent), transportation (1.4 per cent) and building the disposal site (60.4 per cent) (NEA, 2015). Additionally, Flekkefjord motorboat club will build and finance the new marina.

[20] "Polluters" include a shipyard and two real estate companies originating from two polluting entities.

[21] Lov om kompensasjon av merverdiavgift for kommuner, fylkeskommuner mv. (merverdiavgiftskompensasjonsloven) [Act on compensation of value added tax for municipalities, county municipalities, etc. (VAT compensation law)] https://lovdata.no/dokument/NL/lov/2003-12-12-108?q=kompensasjon%20av%20merverdiavgift

6.8.1 Transaction Costs

An optimal grant program has simple eligibility criteria and clear requirements to the grantee regarding the remediation activities and use of grant. This will make the process of selecting the recipient of a grant as fast and straightforward as it can be, which is essential to reducing the transaction costs. Remediation projects applying for grants from the NEA must be either efforts to remediate sites or remediation of contaminated seabed, primarily the 17 coastal and fjord areas that are prioritized for remediation (Miljøverndepartementet, 2006; NEA, 2017).

Because Flekkefjord is located in one of the prioritized areas (NEA, 2015), transaction costs related to processing the grant application are low. However, the project management developed a new financing plan after the application was sent, even though they had already delivered one financing plan already. This increased the transaction costs.

The NEA funded parts of the project on the condition that the municipality, polluters and other parties also agreed to contribute. Polluters can either be forced to contribute or contribute voluntarily. Forcing polluters to pay can lead to high legal costs during negotiations if there exists uncertainty or other incentives for the accused party to resist liabilities. In comparison, transaction cost will be lower if the polluters contribute voluntarily. They may, however, pay less if they aren't forced to contribute, depending on their sense of social responsibility. The contribution from polluters also depends on their financial situation and the degree of their pollution at the contaminated site. In Flekkefjord, the polluters contributed voluntarily, funding almost 5 per cent of the total costs.

Public projects in Norway must be tendered to minimize the public spending. In the remediation project in Flekkefjorden, the proper remediation enterprise will be chosen via tendering process (personal communication, Terje Aamot, project manager, August 7, 2017). The size of transaction costs depends on the tendering process, requirements, contract design and experience with tendering. On one hand, a tendering process is a complicated legal process and involves complex contracts. This could lead to extra legal costs affecting the transaction costs of the project. On the other hand, the tendering process in Norway is well established and the local government has good capacity to carry out the process. The clear and distinguishable requirements, as well as experienced employees of both parties, will make choosing the right remediation enterprise a smooth process. Therefore, the tendering process is not expected to impose high transaction costs on the project in this case.

Transaction costs will also arise while obtaining property rights or negotiations with landowners. Without reaching an agreement, Flekkefjord municipality has negotiated with landowners that have rights to a 50-metre shoreline by the waterside waste disposal site and future marina (personal communication, Terje Aamot, project manager, July 5, 2017). Transaction costs arose out of these negotiations. However, as the municipalities are involved in the project, they have the means to expropriate these rights. No difficulties appeared to emerge in negotiations between the municipality and Flekkefjord motorboat club regarding the club's contribution to the waterside waste disposal site and marina. Thus, low to medium transaction costs increases are expected as the parties discuss the terms and responsibilities in the project.

6.8.2 Information Costs

The entire remediation project in Flekkefjord was funded by grants, which could influence information costs in a positive manner, because grants do not require as much financial or business information as some of the other financial instruments.

As the NEA required polluters and other investors to contribute, there were some information costs relating to the process of identifying polluters and gathering required information about causality, concessions to pollute and the status of the company in terms of their existence or resolution, merges or slit-ups. In Flekkefjord, it was challenging to enforce contributions from polluters because there was uncertainty regarding causality between all of the contamination and the existing companies' actions (Misund & Haker, 2011) and because not all polluters existed anymore.

If polluter contributions are not enforced, the project manager's knowledge about local polluters and their willingness to pay will be crucial to the level of information search and costs. In Flekkefjord, such knowledge was in place, which caused low information costs.

Non-polluters will examine benefits they could receive from their contribution. In our case, the marina investor already operates several marinas in Flekkefjord and there is a shortage in berths for large leisure boats and sailing boats outside the city bridge. As this information is already in place, the information costs related to the demand of new berths is low. As for other non-polluters, information about the project's impact on business and tourism, as well as reception by locals, will be obtained to decide whether they contribute. This will increase the information costs.

6.8.3 Costs Affecting Rate of Return

Regarding other costs affecting rate of return, grants have no financial cost for the grantee.

6.9 Risks for Financing Remediation

There are many risks involved when financing remediation. Here we distinguish between legal, regulatory, social, political, technical and market risks.

6.9.1 Legal Risks

While generally well developed with regard of environmental liability, there are still several aspects of Norwegian law that create uncertainty and thus a legal risk in the narrow sense. One such issue is the question of retroactive application liability, especially with regard to the Norwegian Pollution Control Act (PCA).[22] The practice of retroactivity by the courts in the Norwegian Constitution article 97 is dynamic and complex.[23] Legal scholars neither agree on the courts' doctrine on retroactivity in general, nor on its application on the PCA.[24] Another dimension of uncertainty is added because most cases do not address the question of retroactivity directly in regard of environmental liability. Legal scholars are left to transfer the Supreme Court's general approach to the question of environmental liability. This uncertainty creates both a legal risk in the narrow sense for the environmental authorities on the one side, which cannot be entirely sure whether their orders will stand up to the scrutiny of the courts, and on the other side for the "liable" subjects, which either have the choice of accepting liability or face the risk of litigation.

Another aspect of the uncertainty, primarily for the potentially liable subjects, is that the legal norms selecting the liable subject and the extent of the obligation to perform measures and to carry the costs give considerable discretion to the environmental authorities. Whether the subjects voluntarily or by administrative order contribute through performance of measures or financial support to the remediation project, they face uncertainty. Even after the measures have been carried out by the environmental authorities, the public can demand their costs be reimbursed by a number of potentially liable subjects. The selection of the subject that will be claimed and the extent of the reimbursement claim are hard to predict, especially if there are several potentially liable subjects.[25]

When it comes to liability risk, the parties face both liability claims based on PCA chapter 8 on pollution compensation and general Norwegian tort law. Simplified, the risk of liability is linked to the ability to influence the remediation project. Thus, parties that exclusively contribute with minor financing, such as

[22] Lov om vern mot forurensninger og om avfall LOV-1981-03-13-6.

[23] Since landmark decision Rt. 1996 p. 1415 until now, only the recent years with the decision Rt-2006 p. 293, Rt. 2010 p. 143, Rt. 2013 p. 1345 and HR-2016-389-A has a more or less consistent pattern developed. Still very complex.

[24] Based on their literature and articles discussing the EPA in relation to the Constitution article 97 legal scholars such as Hans Christian Bugge, Andreas Pihlstrøm, Øystein Wang, seem to disagree with Frode A. Innjord , Kristian Brandt og Cathrine Aulie on which legal norm should be applied to some elements of the retroactivity question.

[25] This discretion is especially relevant with regard to EPA articles 7, 51 and 76.

Simek AS, Aarenes Holding AS, Loga Eiendom AS and Flekkefjord Slipp Eiendom AS,[26] face low risk of liability. A medium risk is faced by the Norwegian state, which has considerable capacity to influence the project through the NEA, both as major financer and as the relevant administrative institution. However, Flekkefjord municipality probably faces the greatest risk as the main organizer of the remediation project. It is responsible for the tendering process, despite only contributing 7 per cent of the total project costs.

A major source of potential compensation claims is damage to third parties created by the physical remediation process. Such damage can consist of damage to property, pollution damage, damage to health and injuries, and loss in business, for example due to excessive noise, toxic air or blocked roads. Even though some or all of the costs can later be reimbursed by the entity carrying out the physical remediation, there is a risk that Flekkefjord municipality will have to carry some, or even all, of the costs—for instance, if the entity is bankrupt or the municipality is responsible to some degree through mismanagement or negligence. In addition, there are the risks and costs connected to litigation.

There are several contractual risks. First, there are risks related to entering into the contact, which would normally use a tendering process. Second, there are risks directly deriving from the contract and external factors. A tendering process is often complicated, especially when the public is the developer and the laws and regulations regarding public procurement apply. In the similar field of enterprise tendering processes and contracts, legal disputes are quite common (Hagstrøm & Bruserud, 2014, p. 128). Thus, Flekkefjord municipality should expect some extra legal costs related to the tendering process.

Soil remediation projects are indeed very similar to enterprise projects—projects regarding construction of buildings and facilities. Both projects normally have a long time frame and are highly sensitive to influence from external factors such as weather and unexpected soil and sediment conditions. Further, both require complex contacts and complicated liability structures due to the regular need of chains of sub- and side-contractors. There are often many actors involved, such as the main developer, consultancies, building and engineering enterprises, insurance providers, etc.

Such factors can lead to the need to renegotiate and supplement the contract, especially concerning the need for extra time and extra costs, thus increasing the project's total costs. In Norwegian enterprise projects of some size, it is rather the norm than the exception that the parties' rights and obligations are changed after the conclusion of a contract (Hagstrøm & Bruserud, Entrepriserett, 2014, p. 149). This also applies for an unclear liability regime in the contract complex, where it can be unclear who is factually and legally responsible for a failure. In case of dispute, litigation can further increase the legal costs.

6.9.2 Regulatory Risks

Regulatory risks include changes in regulations that are either project-specific or relating to the economy, technology standards, taxation and land use, among others. White Paper no. 12 (Miljøverndepartementet, 2002) and no. 14 (Miljøverndepartementet, 2006) state that an action plan for contaminated sediments should be prepared. Therefore, an environmental assessment was conducted in Flekkefjord in 2011 and an action plan was developed in 2014 (Misund & Haker, 2011; Misund et al., 2014). The project measures in Flekkefjord are to be implemented in 2018. Regulations are slowly changing. Since this project has taken some time to be carried out, it will likely be affected by more regulatory changes.

Changes in regulations in the Planning and Building Act and regulations, or laws relating to environmental standards, could affect the project if these came before remediation takes place. As of the writing of this report, there were no actual or planned changes in regulations that could affect the project substantially. In addition, when it comes to regulations regarding long lasting projects, it is common for the legislator and administration to include transition periods before the new laws and regulations fully apply. Therefore we consider regulatory risks as low for this project.

[26] According to the project manager, these contributed (personal communication, Terje Aamot, project manager, August 22, 2017).

6.9.3 Social Risks

Social risks explore the impacts of remediation on the surrounding communities during the cycle of a project, such as land rights, resettlement, objections from the community, etc.

These are highly dependent on people's perception of the necessity of the project, outcome and how it affects their personal finances and daily lives. This project will remediate contaminated sediments, build a waterside waste disposal site and develop a new marina for small boats. Locals have been informed about the project in the local newspaper and through information meetings (personal communication, Terje Aamot, project manager, June 27, 2017). They have also had the opportunity to give their views on the project during the project hearing process. Feedback from locals is positive, especially due to the new marina.

The municipality has reached agreements with most of the owners of the property, both private individuals and an enterprise (personal communication, Terje Aamot, project manager, July 5, 2017). Unfortunately, they have not reached agreement with some landowners that have rights within the 50-metre shoreline, which is why the remediation activities have not yet taken place. If they do not reach an agreement, the municipality will expropriate the beach rights and a dock located in the area.

Social risks in Flekkefjord are considered low or medium.

6.9.4 Political Risks

Political risks arise either on a superior level, such as political instability, or when individual political decisions affect the project. The political stability in Norway is good. There is seldom political upheaval and the frequency of fundamental policy changes is low.

Political parties in Norway differ in their environmental priorities. Every second year, there are either parliamentary or local elections in Norway. Current policy may change after elections as the political parties have different priorities. The lifespan of a remediation project is typically several years, thus there is a risk of policy change throughout the project period.

Political choices could change the acceptable level of pollution. Research could also change the acceptable level of pollution if it gains new knowledge about environmental and health effects caused by contaminated sediments or soil. As a result, choice of remediation technologies, costs and remediation goals may change.

The Norwegian political environment consists of many small political parties that must collaborate in order to implement their policies. Consequently, there needs to be broad consensus on an issue to change the current policy. We consider the level of political risks as low for this project, due to the political stability in Norway.

6.9.5 Technical and Physical Risks

The threshold fjord of Flekkefjord is contaminated with a long range of pollutants such as heavy metals, PCBs, PAHs and TBT, posing a risk for negative ecological effects to the ecosystem and human health. Currently, a dietary advisory for the area advises that specific demographic groups (e.g., small children and pregnant women) avoid eating local fish and shellfish. Regional environmental authorities (including the county governor) have permitted a combination of dredging (0-12 m depth) and capping (>12 m depth) of the sediments to reduce the exposure to humans. The dredged material will be used to establish a seabed waterside waste disposal site within the area. The main objectives in this project are: (a) no health risk for humans; (b) repeal the current dietary advisory; and (c) contaminated sediments in inner fjord areas cannot have a negative influence on the ecosystem in the outer fjord areas beyond the geological threshold.

Several possible technical risks may be relevant in a large remediation project such as the Flekkefjord case. It is crucial to the success rate of the remediation plan that all possible sources, both historically and currently active, are known and described. Dredging or capping of marine sediments will be of little, or at least short-lived, value if the harbour or fjord receives continuous, diffuse runoff from land-based sources. Dispersion of sediment

particles and, subsequently, adsorbed contaminants during the operational procedures is a possible risk factor. Minimizing the risk of suspended particles to other areas will be important, for example by using geotextile curtains anchored in the seabed; environmental online monitoring of suspended particles is most often necessary (Lofrano et al., 2017). In addition, dredging operations are often large scale and may pose a hazard for regular ship traffic within the fjord area. This traffic may also cause local disturbance of sediments, which may challenge the proper function of monitoring instruments. Another challenge in dredging operations is the presence of garbage, litter, large rocks and historical remains on the seabed, causing delays and large operational costs for the total remediation project. Underwater mudslides and the risk of oil spills from operation vessels are also to be considered.

Placing the dredged materials in a waterside waste disposal site is part of the disposal plan. Such a site may be enhanced and capsulated in concrete or other materials. Even so, the risk of future leaks from the disposal site, especially considering possible climatic effects such as increased sea level, may be considerable (e.g., Laugesen, 2007). Capsulation, sheet piling and monitoring of suspended particles may become necessary.

Capping of contaminated marine sediments on larger depths will be carried out by either a thick layer of clean materials (e.g., olivine) or a thin layer, often with a sorbent additive to reduce the uptake of contaminants in benthic organisms. The application of capping materials in large depths is challenging, especially in extreme weather conditions. There are, however, available technologies to secure a homogenous and steady application, but these may increase the total economic budget of remediation considerably (Cornelissen et al., 2011).

6.9.6 Market and Commercial Risks

Market risks include the risk for negative changes in property value, revenue stream and demand for the new marina for small boats. The Flekkefjord motorboat club will build the marina and has the rights to rent out or sell the berths. About 350 berths are planned in the new marina (Kristiansen & Selmer-Olsen, n.d.). The demand for new berths is good, as about 250 club members have shown interest already (Flekkefjord motorbåtklubb, 2017). Large leisure boats and sailboats have problems getting into the city centre because of the sailing height limits of the city bridge, causing the currently shortage of berths for larger boats outside the city bridge. The marina will be located near the city centre, but outside the city bridge, and will provide berths for larger boats.

Leisure boats are regarded as luxury goods. During economic downturn, there may be a risk that the boat owners would get rid of their boats and that the demand for new leisure boats decreases. This could in turn reduce the demand for new berths. However, the risk for change in demand for new berths is low because of the need for berths outside the city bridge and the amount of people showing their interest.

Property value could change because of the project, both for the property where the marina will be built and for surrounding properties of the contaminated sites. Investments in the new marina could cause an increase in the property value, while the waterside waste disposal site could cause a decrease. There is the risk of liability issues at the disposal site if leakage occurs, which could cause a potential decrease in the property value. Both the marina and waterside waste disposal site are located on property owned by Flekkefjord motorboat club and the Norwegian Public Roads Administration, which will bear most of the risks associated with a change in property value at the site (personal communication, Terje Aamot, project manager, August 22, 2017). The municipality's revenue stream could also be affected by the property value, as they collect property taxes in the area. The influence of investments in the marina or the waterside waste disposal site on property value is unknown.

Commercial risks arise when a company offers credit without any sorts of security (Business Dictionary, n.d.). As the project is financed by grants, commercial risks are irrelevant.

The possible effect of the waterside waste disposal site on property values is the only factor enhancing market risks. Therefore, the overall market and commercial risk is considered either low or medium high.

6.10 Lessons Learned

SUCCESS FACTORS

Public funding encouraged private contribution

The NEA granted 65 per cent of project cost on the condition that the municipality, polluters and others also contribute (personal communication, Terje Aamot, project manager, June 27, 2017; NEA, 2015). Altogether, public funding paid 72 per cent of the project cost, while the polluters paid 5 per cent and an investor and landowner paid 23 per cent. Thus, with their condition and contribution, the NEA managed to encourage private contribution.

Proper instrument utilized

This project has relied solely on grants as financial instruments. Grants have an advantage in projects where the expected future revenue streams are low, or at least less than investment and operating costs, while the expected social benefits are high. Besides the expected revenue stream from sales of berths in the marina, the project expects revenue streams from waste delivered by third parties to the disposal site. However, these revenue streams are not likely to cover the entire remediation project.

Prioritized areas for remediation

This project was located in one of 17 coastal and fjord areas that are prioritized for remediation (NEA, 2015). When the NEA has such a pronounced priority, the application process and decision making will be more straightforward for both parties.

Beneficial collaborations locally

The project management was engaged by the municipality, which was well connected with local entities and NGOs. Hence, the project benefited from these connections during the project planning. For instance, the municipality has traditionally collaborated with the motorboat club on the development of marinas. As a result, the parties involved knew what to expect from each other, which further facilitated cooperation.

Development in accordance with demand

The remediation project facilitates development of a new marina, in accordance with the demand and the local boat club's interest. This gave the boat club an incentive to cooperate and contribute financially.

WEAKNESSES

Public authorities pay

Although public funding encouraged some private contribution, the latter was limited to 28 per cent of estimated project costs, in which the polluters only pay 5 per cent. As the project mainly relies on public funding, the financing scheme requires a strong economy in the public sector.

Lacking incentives to lowering expenditure

By definition, grants are paid without the expectation of any return on the investment besides the benefits of remediation. As a result, grant funds must be refinanced after a while. Grants do not give incentives to keep expenditure lower than estimated, unlike some other instruments. Once the grant is handed out, the money will be spent on the project, even if the project costs could be reduced.

Need for action taken by the municipality

The municipality has negotiated with some of the landowners, without reaching an agreement, which enhances transaction costs. This is why the project has been delayed. The municipality could either expropriate these costs or seek a voluntary settling of the issue, offering some kind of compensation. The municipality needs to take action regarding this issue.

7 Hempel

The project concerns remediation of contaminated soil on the property of an abandoned paint and lacquer factory. The main motivation for the NEA was enhancing social benefits and improving the environment. This case, which includes a court dispute settlement procedure, set a precedent with regard to the liability question; the Norwegian Supreme Court transferred obligations from a subsidiary to its parent company.

7.1 Background

In 1918 a paint and lacquer factory (Monopol) was established on the property, located by a fjord basin, Florvågen, in Askøy municipality in the western part of Norway. The factory used legal synthetic substances and alkyds as binders in their production of antifouling paint for the ship industry. Monopol merged with a Norwegian subsidiary of the Danish Hempel group in 1983, owning a majority of the shares (53.3 per cent), and became the sole owner in 1989. The production continued until closing in 1991. The property was split, and sold in 1995 and 1996 respectively.[27] Today there is a blacksmith working on steel for industry purposes at the site. The property also provides boat storage and a garage lent out to a private person where he houses his hobby cars (Byfjorden Næringspark AS, 2017).

FIRST PHASE (1997–2009)

Assessments by the Institute of Marine Biology at the University of Bergen in the 1980s and 90s showed pollution in the area. Based on these findings, the regional authorities ordered Hempel Coatings (Norway) AS to carry out initial environmental assessments in 1997. The assessments, which were carried out and paid for by Hempel Coatings (Norway) AS,[28] detected high levels of a wide range of contaminants such as heavy metals, PCBs and PAHs in the topsoil. A storage area for waste barrels in the factory was considered the most acute area, posing a risk to human health (Golder Associates AS, 2017, p. 6). Hempel Coatings (Norway) AS was dissolved in 2001,[29] there, in 2004, the NEA required its parent company Hempel A/S to carry out more detailed environmental assessments on the property and in the adjacent marine sediments. The company complained to the Ministry of Environment, which dismissed the complaint. Consequently, the company took the case to court, where they lost in all three levels of the Norwegian legal system.

Meanwhile, the NEA found it necessary to immediately remediate the most heavily contaminated areas. Environmental assessments were carried out in 2008, including 10 drill cores, nine shafts, paint samples from buildings and the installation of five groundwater wells. In addition, sediment from runoff traps was removed to an approved landfill. Based on the results, the NEA carried out the first step of remediation in 2009, removing the barrels of hazardous waste and the soil on which the barrels were located, removing a total of 2,400 tonnes of contaminated soil, including 121 tonnes of materials labelled as hazardous waste.

COURT DECISION

In the Norwegian Supreme Court's decision in 2010[30] an obligation from a subsidiary company was given to the parent company (Hempel A/S), thus in a way, breaking the corporate veil of a limited stock company. The polluter pays principle in conjunction with the sustainable development principle triumphed over the principle of the shareholders limited liability (Sjåfjell, 2010, p. 7). This decision could open a new source of financing for remediation projects in Norway due to the judicial precedent role judgments by the Norwegian Supreme

[27] Supreme Court of Norway, Case no. 2009/896 "HR-2010-443-A Hempel I" of 10.03.2010

[28] Supreme Court of Norway, Case no. 2009/896 "HR-2010-443-A Hempel I" of 10.03.2010

[29] Supreme Court of Norway, Case no. 2009/896 "HR-2010-443-A Hempel I" of 10.03.2010

[30] Supreme Court of Norway, Case no. 2009/896 "HR-2010-443-A Hempel I" of 10.03.2010

Court can have in Norway (Eckhoff, 2001).[31] The decision can contribute to increased internalization of environmental costs among companies ((Sjåfjell, 2010, p. 13). However, the judgment has also been criticized among businesses and legal scholars in Norway.[32]

SECOND PHASE (2011–2018)

Additional assessments were carried out in 2011 and 2016, detecting levels of mercury (Hg), lead (Pb), benzene, PCBs, PAHs and oil compounds high above acceptable criteria set by the NEA (Golder Associates AS, 2017, p. 6–7). In 2017, Hempel and the landowner, Byfjorden Business Park, were obliged to remediate the rest of the contaminated soil at the property (personal communication, Erik Høygaard from NEA, August 21, 2017). The landowner is responsible for a small part, due to demolition materials in the marsh occurring at the property after the acquisition (Norwegian Environmental Agency, 2016b). Hempel and the landowner jointly hired a remediation company to remediate the contaminated site (personal communication, Erik Høygaard from NEA, August 21, 2017). Remediation of the soil is due to finish in early 2018.

THIRD PHASE (2018 →)

The contaminated soil at the property is seen as the source of pollution of the adjacent marine sediments. When the soil has been remediated, the remediation of marine sediments remains to be carried out. These sediments are planned to be remediated, according to the NEA.

REMEDIATION GOALS

Classification of the property, according to TA-2553 (NEA, 2009), places the property in the industry/business category.[33] The remediation plan from 2017 suggests that if site-specific risk assessments are carried out, class 4 concentrations of Pb, Hg, PCBs, PAHs and oil may be accepted in topsoil. Classes 4 and 5 may be accepted in deeper layers (> 1 m depth) if there is no risk of dispersion to nearby waterbodies. The NEA withheld a firmer strategy for the remediation, claiming that Class 3 and lower only may be accepted in topsoil, and Class 4 in deeper layers (Table 7) (Golder Associates AS, 2017, p. 8–9).

Table 7. Norwegian classification system for contaminated topsoil, with concentration ranges for selected contaminants applicable to the Hempel case.

	Class 1	Class 2	Class 3	Class 4	Class 5
Land use	All	Residential areas, playgrounds, parks	Urban, streets, markets, business	Industrial, main roads, railways	Landfills, waste treatment sites
Status	Very good	Good	Moderate	Poor	Very poor
Unit	mg/kg dw	mg/kg dw	mg/kg dw	mg/kg dw	mg/kg dw

[31] In Norway judgments by the Norwegian Supreme Court are not directly binding as in traditional common law countries such as the United Kingdom and the United States; however, the judgments are close to binding for lower courts and administrative organs (Eckhoff, 2001, p.160). The Norwegian Supreme Court itself has a quite strong tendency to follow their own practice in later case with similar facts (Eckhoff, 2001, p. 161).

[32] For example, in an article by Innjord, Brandt, and Aulie (2017)

[33] For examples of the classification, see Jartun, 2011.

	Class 1	Class 2	Class 3	Class 4	Class 5
Lead (Pb)	< 60	60-100	100-300	300-700	700-2500
Mercury (Hg)	< 1	1-2	2-4	4-10	10-1000
ΣPCB_7	< 0.01	0.01-0.5	0.5-1	1-5	5-50
ΣPAH-16	< 2	2-8	8-50	50-150	150-2500

Dietary advice (advice against consumption of local fish and shellfish) exists in the local fjord based on studies of marine sediments and uptake in local biota. A major objective for the remediation is to once again allow the consumption of local fish and shellfish after the remediation (Golder Associates AS, 2017, p. 6).

7.2 Level of Development

The contaminated site is located in Askøy municipality, in which there are 25,032 inhabitants spread throughout about 17 km^2 (Statistics Norway, 2017). About 80 per cent of the municipality's population lives in the Askøy settlement, located in the southeast corner of the island (Store Norske Leksikon, 2009). This is also the location of the contaminated site. The municipality has experienced significant population growth between the end of World War II and 2017, as the population is three times now as it was then. Industries account for 12 per cent of the municipalities workplaces and construction, water and power supply account for 11 per cent. Forty-seven per cent of the inhabitants commute to workplaces in Bergen. Norway's financial state and system allows for a focus on environmental threats and provides financing for remediation projects.

7.3 Type of Land

The Hempel property is located on an island by a fjord basin, Florvågen, in Askøy municipality in the western part of Norway. There is a small inclination to the south and the shoreline, with original ground mostly consisting of bedrock and deposited fill materials. Most areas are impermeable surfaces, supporting direct runoff from land to sea. Paint production buildings are located to the south, with several on pole foundations into the sea, in close proximity to the marine environment. There is no groundwater aquifer for drinking water in the area, but some groundwater is influenced by the tidal effect at the shoreline.

The area around Florvåg is densely populated, and the property is surrounded by residential buildings, workplaces and two marinas for leisure boats (Michelsen, 2009). Along the shoreline, a new grocery store and storage are planned adjacent to the Hempel property (Bø & Bø, 2017; Plan Vest, 2011, 02.07.).

Figure 13. Map over Florvåg. The Hempel property is marked in red.

Source: Norwegian Mapping Authority. Red circle inserted manually by NIVA.

7.4 Financial Sources

Public capital (NEA) paid the initial remediation costs from 2009. This capital stems from general fiscal revenue. As mentioned, these are considered to be disbursements, as Hempel has been ordered to pay these costs. Private capital paid for environmental assessments conducted on behalf of Hempel in 2008.

The second phase of the remediation project will be paid by private capital, as Hempel and Byfjorden Business Park will fund the remediation plan and activities (Norwegian Environmental Agency, 2016a; 2016b; personal communication, Erik Høygaard, chief engineer at NEA, August 21, 2017).

Thus, the first and second phases were paid solely by private capital. The financial actors and sources of the third phase are not clarified at this stage.

7.5 Financial Actors

The financial actors involved in the project are the private limited companies Hempel Coatings (Norway) AS (Askøy Property AS from 1998[34]), the Danish Hempel A/S, the NEA and the private limited company Byfjorden Business Park AS.[35]

NATIONAL AND LOCAL GOVERNMENT

The NEA contributed to the financing of the project through disbursements of the remediation in 2009 with NOK 2.38 million. All its costs were later recovered from Hempel A/S following judgments by court.

COMMERCIAL ENTERPRISES

Askøy Property AS, which was dissolved in 2001, was the sole financer of the preliminary assessment of the site in 2000, thus contributing only to a negligible part of the total costs. Due to its minor role as financing actor, it is not further assessed in this case study.

[34] In Norwegian: Askøy Eiendom AS

[35] In Norwegian: Byfjorden Næringspark AS

The Danish Hempel A/S was the parent company of Hempel Coatings (Norway) AS, and still is the parent company of Hempel Norway AS, owning 100 per cent of its shares. Hempel A/S financed all the costs of the first phase of the remediation project after losing in court.

Hempel A/S's total costs for the first phase of the project, exempting litigation costs and interest on overdue payment, are about NOK 3.13 million. Of that, NOK 756 321 is assessment costs and NOK 2.38 million is refunding costs for the remediation to the NEA.[36] In addition, there are unknown litigation costs and interest on overdue payment.

The second phase of the project was funded by Hempel A/S and Byfjorden Business Park AS. Hempel A/S funded most of the remediation activities, while the landowner, Byfjorden Business Park AS, funded remediation of the demolition materials in the marsh.

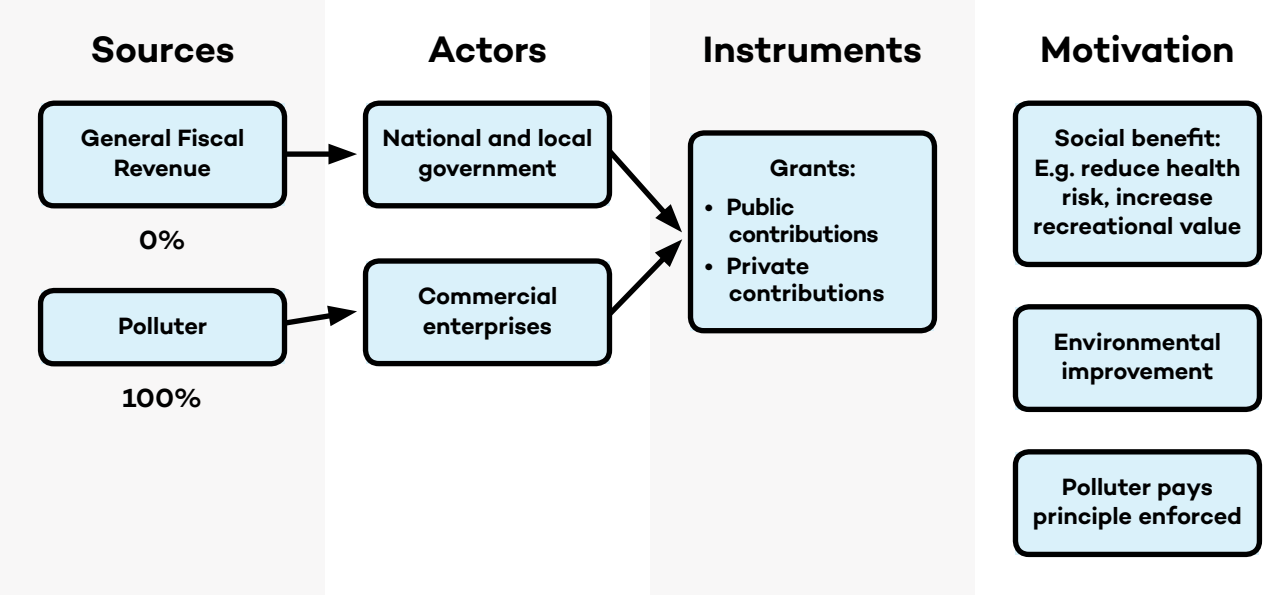


Figure 14. Marked in blue are the types of sources, financial actors and instruments in use in Hempel, as well as the financial actors motivation to contribute to the project

7.6 Financial Instruments Utilized

For the first phase of the remediation project, Hempel A/S was obligated to pay all the remediation costs according to Norwegian law and a verdict from the Court of Appeal. This could be seen as a type of grant, as they have no reason to expect reimbursement.

The second phase of remediation activities were conducted on behalf of Hempel and Byfjorden Business Park at their expense (personal communication, Erik Høygaard, chief engineer at NEA, August 21, 2017). This could also be seen as a type of grant.

7.7 Financial Recipients

The financial recipients in this case are the NEA and Hempel A/S.

The NEA has received payments from Hempel A/S after covering initial remediation costs. The NEA is a sovereign recipient, receiving funding from the National Budget (personal communication, Jeanette Bente

[36] Supreme Court of Norway, Case no. 2009/896 "HR-2010-443-A Hempel I" of 10.03.2010
Gulating Court of Appeal, Case " LG-2013-210482 Hempel II" of 11.11.2014

Beckius, senior engineer at NEA, July 12, 2017). The budget earmarks funds for remediation of contaminated sediments and soil. These funds will be used, for instance, in cases where the NEA finds it necessary to remediate before settling an agreement with the responsible polluter. Afterwards, the NEA could claim repayment for those expenses, which they did in this case.

Hempel A/S is a non-sovereign recipient, which is the user of the resources obtained to remediate the contaminated site.

7.8 Costs Affecting Return

The first phase of the remediation project includes an environmental assessment carried out at Hempel's expense in 2008 amounting to NOK 756,321 and remediation in 2009 at a cost of NOK 2.38 million.[37,38]

The second phase of the remediation project includes the establishment of a remediation plan and remediation of the contaminated soil. The remediation costs in this phase are estimated to be NOK 10 million to 15 million (personal communication, Erik Høygaard, chief engineer at NEA, August 21, 2017).

The third phase of the remediation project includes remediation of the adjacent marine sediments. These activities were roughly estimated to cost NOK 150 million to 200 million by Multiconsult (personal communication, Erik Høygaard, chief engineer at NEA, August 21, 2017).

7.8.1 Transaction Cost

Transaction costs arise while buying and selling goods and services, in terms of reaching an agreement. Hempel has taken this case to court several times, as they object that the parent company has any responsibility for the contamination. Legal costs related to these judicial proceedings can be classified as transaction costs.

Hempel objected to the order to investigate contamination at the site and issued a writ to Oslo District Court against the State at the Ministry of Environment (now Ministry of Climate and Environment) in 2007.[39] In the end, the case ended up in the Supreme Court, where Hempel lost the case. Hempel was ordered to pay the Ministry of Environment's legal costs in both Oslo District Court and Borgarting Court of Appeal, amounting to NOK 57,300 and NOK 94,500 respectively.

The Climate and Pollution Agency (now Norwegian Environment Agency) announced a decision on reimbursement of remediation costs from Hempel in 2012.[40] Hempel objected to the decision; the case ended up in Nordhordaland District Court and, after an appeal, in Gulating Court of Appeal, where Hempel lost. Again, Hempel and the Confederation of Norwegian Enterprise (NHO) were ordered to pay the Ministry of Environment's legal cost, amounting to NOK 168,297 and NOK 350,675 respectively for cost occurred in the District Court and Court of Appeal.

In total, Hempel or Confederation of Norwegian Enterprise has paid NOK 670,772 in legal cost for the other party, in addition to its own legal costs. Hempel must also pay interest on overdue payment for remediation activities carried through by the Climate and Pollution Agency.

The remediation project was put out to tender in 2009 (Statens Forurensningstilsyn, 2009). Norwegian regulations require tendering for public projects, in order to minimize public spending. Tendering process are legally complicated. The transaction costs will depend on the requirements, contracts and experience with tendering. As tendering is well incorporated in public institutions and large commercial enterprises in Norway, the tendering process is not expected to impose high transaction costs in this project.

[37] Supreme Court of Norway, Case no. 2009/896 "HR-2010-443-A Hempel I" of 10.03.2010

[38] Gulating Court of Appeal, Case "LG-2013-210482 Hempel II" of 11.11.2014

[39] Supreme Court of Norway, Case no. 2009/896 "HR-2010-443-A Hempel I" of 10.03.2010

[40] Gulating Court of Appeal, Case "LG-2013-210482 Hempel II" of 11.11.2014

7.8.2 Information Costs

The NEA financed the initial remediation using its own capital and demanded repayment from the polluter afterwards. Information costs are related to the process of identifying responsible polluters and the status of the company. In the Hempel case, the source of pollution was clear, which made the information search uncomplicated. Thereafter, to pursue repayment from the polluter, they needed to gather information about the company's existence, possible mergers or split-ups, and their financial status. As the national environmental agency, this information was easily available, and they compelled Hempel to reimburse their costs. The case ended up in court, which probably enhanced the information costs, as they needed to gather more comprehensive knowledge about the legislation and legal definitions of polluters. Information costs are considered to be medium high, mainly because of the court cases.

7.8.3 Costs Affecting Rate of Return

Financial costs are especially important for an investor, as it concerns the opportunity costs when financing this project. As an example, the NEA could have used their funding on other projects that could reduce more damage. Although the NEA had a clue of what the outcome of the lawsuit would be, they could not be completely sure at the time when remediation was conducted.

7.9 Risks for Financing Remediation

There are many risks involved when financing remediation. Here we distinguish between legal, regulatory, social, political, technical and market risks.

7.9.1 Legal Risks

It is useful to divide the legal risks into three parts. The first phase of the remediation, emergency remediation on land, is complete. The second phase, remediation on land is in process and the last phase is still at a preliminary stage.

FIRST PHASE

When the NEA fully financed the first phase of the remediation in 2009 with the intention of recovering the full amount by Hempel A/S later, there were several considerable risks.

The main risk for the NEA was a legal risk in the narrow sense. In 2009, the liability between parent and subsidiary companies in relation to duties deriving from the Pollution Control Act (PCA) was not sufficiently clear. The question had not been sufficiently addressed by the legislator either during the original adaption of the PCA in 1979, or in connection with later additions and changes of the law. Since the relationship between public administrative and corporative law is of a rather complex legal nature, it was not too surprising that it was left to the courts to deal with. The problem for a long time was that the question was not raised directly with regard to the PCA, and thus the solution was open and unclear until the Hempel I and II decisions.

A fundamental principle in Norwegian corporate law, as in most other comparable countries, is the shareholders' limited liability in limited companies. In accordance with this principle, the parent company Hempel A/S should only be responsible for its shares in its subsidiary companies Hempel Norway AS and former Hempel Coatings (Norway) AS. When an obligation from the subsidiary company is transferred to the parent company, the parent company as shareholder becomes liable for more than its shares. Another fundamental principle in Norwegian law is the principle of legality in administrative law, which requires a legal basis for imposing duties on physical and legal persons and requires a certain degree of clarity and foreseeability. Both principles, especially the first, indicated that Hempel A/S could not become liable. Further, this form of piercing through the corporate veil had never been applied by the courts in a similar case. Even the Norwegian Supreme Court stated in the

judgment that the interpretation of the law was hard.[41] For these reasons, it was very likely that the polluter pays principle had to yield in this case, and that the NEA therefore would lose the case with the consequence of bearing the remediation costs in addition to the litigation costs of both parties. In other words, the legal risk in the narrow sense for the NEA was very high.

In the case that liability was established, there were two other risks: first, the risk that Hempel AS would be unable to pay due to lack of financial means; second, the risk that Hempel A/S would cease to exist, either due to bankruptcy or due to dissolution. The Danish Hempel A/S is the main parent company part of the global Hempel Group operating. In 2009, the group operated in more than 80 countries, employed more than 3,800 people and had an annual revenue exceeding EUR 916 million (Hempel, 2009). It is not likely that Hempel A/S would become insolvent, bankrupt or dissolved in the short term. A company of that size would not struggle to capitalize NOK 2.38 million. Thus, these two risks for the NEA were low.

The NEA's contractual and liability risks were primarily related to the tendering process for the remediation project, the contract with the remediating company and potential damages created by the remediating company. A tendering process, including creation and conclusion of contracts, on a project of NOK 2.38 million is of relatively small size and thus of limited complexity. As a result, it created a relatively low contractual risk.

The liability risks from the physical remediation were not negligible since the contaminated site was close to a housing area. Leaks of contaminated waste and accidents during remediation or transport could damage human health and properties in the area. The primary liable subject would be the remediating company. Liability from possible damage could exceed the remediating company's capacity, and if not insured, transferred to the NEA itself. In such a case, these extra costs could not necessarily be recovered from Hempel A/S.

SECOND PHASE

The second phase of the project involves remediation of soil with costs of about NOK 10 million to 15 million (personal communication, Erik Høygaard, chief engineer at NEA, August 21, 2017). Both Hempel A/S and the landowner, Byfjorden Business Park AS, must carry the cost.

When financing the project, the companies faced the same risks as a starting point. However, naturally these risks will depend on the proportion of the project they carry. The legal risks in the narrow sense for the companies will be relatively low. Although there are some uncertain aspects in Norwegian environmental law, as discussed in the Flekkefjord case, these must not be exaggerated. However, there will remain a risk that some requirements, both in regulations and project-specific, will be misunderstood initially, leading to potential changes and costs later.

The contractual risks will be medium. A tendering process of this size always involves some risks. The liability risks are considered as medium. On the one side, the risks increase due to its proximity to the housing area; on the other side, the polluters will very likely be able to recover liability costs from the remediating company in the case of negligence.

THIRD PHASE

The third phase will be of an entirely different dimension since it involves sediments. The costs are estimated to be roughly NOK 150 million to 200 million.

Because of the new Norwegian case law established by the Hempel case and Elverum case (2012),[42] it is very likely that Hempel A/S will have to carry a large part of the costs of the remediation. Based on the same case law and the fact that Byfjorden Business Park AS had to contribute in the second phase of the remediation, it is likely that Byfjorden Business Park AS will have to carry some of the final costs, since it is the landowner.

[41] Supreme Court of Norway, Case no. 2009/896 "HR-2010-443-A Hempel I" of 10.03.2010

[42] Supreme Court of Norway, Case "Rt. 2012 s.944 Elverum Treimpregnering"

The legal risks, in the narrow sense, are the same as in the second phase. The contractual risks will be medium to high, due to the project's size and complexity. A tendering process of this size always involves a certain amount of risk, and it is hard to make a contract of hundreds of pages without flaws. The liability risks are considered as medium. The size and complexity increase the risks for accidents and faults, but the chemicals are not as concentrated, toxic and unstable as, for instance, in the Bonfol case in Section 5.

7.9.1 Regulatory Risks

The regulatory risks in the first phase of the project were low. As an environmental institution, the NEA has good overview of law- and regulation-making processes. In addition, the first phase had a relatively short time frame.

The regulatory risks of the second phase of the project are low to medium, since there might be regulatory changes over the long time frame of the project. However, the risks are mitigated by the general openness and accessibility of Norwegian law and regulation-making processes.

7.9.2 Social Risks

Social risks associated to this project could be discontentment and objections to the planned and undertaken remediation activities, remediation goals, chosen financial actors, timeline and other factors affecting locals' daily lives and use of property. For instance, the project may affect use of the property during remediation.

This project will remediate the contaminated soil and sediments in three phases. By now, the only objection related to this project has been Hempel's objection to funding environmental assessments and remediation (personal communication, Erik Høygaard, chief engineer at NEA, August 21, 2017). Feedback from others has been positive for both the project itself and the enforcement of the polluter pays principle. A public hearing comment about the remediation plan in 2017 stated the importance of remediation of the adjacent marine sediments, as the remediation plan did not include the seabed (Bø & Bø, 2017).

7.9.3 Political Risks

Political risks arise either on a superior level, such as political instability, or when individual political decisions affect the project. Norway is politically stable. The political environment in Norway consists of many small political parties, which have to collaborate in order to implement their policies. Consequently, there needs to be broad consensus on an issue to change the current policy, which makes major policy changes unlikely.

7.9.4 Technical and Physical Risks

Golder Associates (2017) wrote the remediation plan for the second phase of the project. The main objective for remediating the topsoil is to inhibit important exposure pathways. Covering the ground with asphalt or concrete was not considered a proper solution because the surface will degrade in the tough climate and traffic situation. Another possibility was local cleaning of soil. This is a highly costly solution that requires enormous economic, area and human resources. Excavation and disposal in an approved landfill facility was therefore considered the only feasible option. The remediation plan has been sent out on hearing, and has been received well by all parties, such as neighbours, county authorities and the public road administration (Norwegian Environmental Agency, 2017a).

Furthermore, the runoff sediment traps are to be emptied and disposed in approved landfill facility (Golder Associates AS, 2017). Based on the assumptions of a proper excavation of all contaminated topsoil, the concentrations of contaminants in groundwater is believed to decrease. Environmental monitoring will be carried out 6 and 12 months after remediation.

There will always be a risk of dispersion of contaminants and exposure during the excavation process (runoff, dust); water from precipitation will facilitate surface runoff if not kept sealed. Intermediate storage facilities must be established, and transport must be secured to avoid dust problems. Close cooperation between

environmental consultants and entrepreneur contractors is necessary to secure proper handling of contaminated materials. Masses excavated for external deposition must be transported out of the property directly. When excavation is to take place in areas with higher groundwater level, all pumped water must go through an oil separator and/or sand filter to bind contaminants. Within the excavation areas, a photo ionization detector to detect volatile hydrocarbons must be used to avoid exposure from these chemicals. Measurement of Hg fumes may also be used in areas with high Hg concentrations in soil. Protective gear is crucial for the safety of workers. Watering prevents dust during transport and traffic on site. Emergency preparedness must be induced. When removing contaminated soil from a property, extensive mapping of infrastructure such as roads, underground cables, pipes and sewage systems must be conducted.

7.9.5 Market and Commercial Risks

The landowner rents out part of the property to a blacksmith, a private person fixing cars and as boat storage (Byfjorden Næringspark AS, 2017). Market risks associated with remediation in this project relates to the demand for renting the property, as well as the property value itself. Until the project is completed, the property value may be affected negatively by the project, due to the potential property buyers' fear of having to contribute to the project. However, if the remediation activities are carried out successfully, removing all contamination, the property value may be positively influenced. The revenue streams received from rental of the property cease or decrease during remediation if the activities prevent or hamper other activities at the property simultaneously.

7.10 Lessons Learned

SUCCESS FACTORS

Polluters pay

The main success is that the polluters so far have paid all the costs. Identification of the pollution source and polluter were straightforward, without any doubts related to who contaminated the site.

Clarified liability

The legal system clarified that parent companies can be liable for remediation of sites contaminated by their subsidiaries. If parent companies could become liable even in a limited amount of cases, this would be a radical legal measure to turn the costs from the public to entities that have a direct connection to the polluter.

Public funding facilitated quick remediation startup

The first phase of the remediation project got started relatively quickly, as the NEA had the means to remediate the site and then recuperate their costs.

WEAKNESSES

Litigation was not avoided

The parent company took the case to court twice. The first time was a complaint against the order made by the NEA for the company to carry out environmental assessments on the property and in the adjacent marine sediments.[43] The company lost in all three levels of the Norwegian legal system. The company took the case to court again after the NEA required them to reimburse the remediation costs. Once again, the company lost in court. These legal activities led to disproportionately high legal costs.

[43] Supreme Court of Norway, Case no. 2009/896 "HR-2010-443-A Hempel I" of 10.03.2010

8 Denmark: Clean up of Oil and Petrol Sites

This program concerns the Danish Oil Industry's Remediation Fund (OM) established in 1992 by nine oil companies operating petrol stations in Denmark. The fund financed investigations and remediation of sites previously used for petrol retail. The polluters pay into the fund through a fee based on petrol sales. The oil companies were motivated by corporate social responsibility and the opportunity to create a cost-effective way to implement the polluter pays principle and avoid litigation.

8.1 Background

The energy crisis in the early 1970s led to almost 8,000 closed petrol stations in the decades up until 1990 in Denmark (Oliebranchens Miljöpulje, n.d.a). Environmental assessments revealed the need to clean up the soil beneath these petrol stations, because of oil spills from corroded oil tanks and pipelines. The oil industry had complied with the rules at the time, but the rules were insufficient to avoid contamination. Also, the companies formerly operating the petrol stations had been subject to changes in company structure such as resolution, bankruptcy, mergers and demergers. Similarly, the landowners may not be living or exist anymore (personal communication, Michael Mücke Jensen, Technical and Environmental Manager at the Danish Oil Industry Association, September 11, 2017). The distribution of responsibilities was therefore difficult to determine. This situation had the potential to lead to lengthy and numerous legal processes, involving public authorities, current landowners and the polluting companies in each case.

INNOVATIVE SOLUTION

The Danish Oil Industry Association (on behalf of the oil companies) proposed a voluntary scheme to overcome the difficulties, leaning on collaboration between the Danish Oil Industry Association and public authorities (Oliebranchens Miljöpulje, n.d.a). By the end of 1992, an agreement regulating remediation of closed and soon-to-be closed petrol stations was signed by the Danish Oil Industry Association and several public authorities and associations. Thereafter, all nine oil companies in Denmark reached an agreement regulating the funding and established the OM fund, which was financed by a fee based on sales of petrol. The Danish competition authorities and European Union approved the arrangement in 1994. Distortion of competition was avoided as all the oil companies operating in Denmark were in on the agreement. Through this agreement, the oil companies created a cost-effective way to implement the polluter pays principle and avoid litigation.

SYSTEMATIC PROCEDURE FOR REMEDIATION OF FORMER PETROL STATIONS

The voluntary scheme aimed to investigate and remediate more than 9,800 locations of former petrol stations (Oliebranchens Miljöpulje, n.d.b). This required several tasks to be completed, including: preliminary investigations of the sites, prioritization of sites to be remediated, carrying out remediation, monitoring and approval of the completed remediation. These tasks were distributed between the Danish Oil Industry Association, regional and local authorities, and a council and secretariat formed for this scheme.

The Danish Oil Industry Association formed the Oil Industry's Environmental Pool[44] (Environmental Pool), which manages the investigations, remediation projects and the fund (Oliebranchens Fællesrepræsentation et al., 1992). The Environmental Pool also administered contact with the regions and municipalities during investigations and remediation of the sites, and made recommendations for the prioritization of sites to be investigated and remediated to the Environmental Pool Council Secretariat.

Regional and local authorities could submit proposals for the prioritization of former petrol stations to be remediated (Oliebranchens Fællesrepræsentation et al., 1992). Depending on whether or not the site was registered as a waste depository, regional or local authorities were responsible for the approval of remediation projects and completed remediation, as well as overseeing the work through the process.

[44] In Danish: Oliebranchens miljöpulje

The Environmental Pool Council[45] and Council Secretariat[46] made recommendations to the Danish EPA about the final priority of sites to be investigated and remediated, based on assessments made by the Oil Industry's Environmental Pool and input from the regions and municipalities (Oliebranchens Fællesrepræsentation et al., 1992).

ESTABLISHMENT OF AN ENVIRONMENTAL PRIORITY SYSTEM

Prioritization of sites took place at a national level (personal communication, Michael Mücke Jensen, Technical and Environmental Manager at the Danish Oil Industry Association, September 11, 2017). Initially, the properties were given an environmental score, which determined the order for remediation of the properties (personal communication, Preben Bruun, AC technician at the Danish EPA, September 26, 2017). However, the Environmental Pool perceived that some regions would not prioritized at all if the severity of contamination was the only criteria (personal communication, Michael Mücke Jensen, Technical and Environmental Manager at the Danish Oil Industry Association, September 11, 2017). It would have taken a long time for petrol stations in these regions to be remediated. An environmental priority system was created in 2003 to help to prioritize the remaining contaminated sites (personal communication, Preben Bruun, AC technician at the Danish EPA, September 26, 2017). Each site receives an environmental score based on these criteria:

- The vulnerability of the groundwater
- Whether there is waterworks in the area
- Land use at the time (housing, industry etc.)
- Recipient vulnerability (lakes, rivers etc.)
- Identified contamination on the site

The properties were more likely to get high priority if they recieved high scores (personal communication, Michael Mücke Jensen, Technical and Environmental Manager at the Danish Oil Industry Association, September 11, 2017). Typically, properties located in areas with industry got low scores, while properties with houses nearby got high scores on land use. Similarly, if the groundwater/recipient was the source of drinking water, the properties got high scores, and low scores if it was not used as drinking water. This priority system managed to capture contaminated sites in both urban and rural areas. For instance, petrol stations in cities often got low scores on groundwater, but high scores on land use. Petrol stations in rural areas often got high scores on groundwater and medium-high scores on land use.

When the new priority system came into force, an annual quota was calculated based on the remaining properties in each county and the residual maturity (personal communication, Preben Bruun, AC technician at the Danish EPA, September 26, 2017). Each county then chose which properties to be prioritized based on the new criteria, and prepared a remediation plan for the effort in all remaining years until all projects were finished. The annual quota was adjusted if needed, depending on the Environmental Pool's capacity.

At the annual meeting of the Environmental Pool Council, landowners, municipalities and counties could apply for a property to be expedited because of special conditions (personal communication, Preben Bruun, AC technician at the Danish EPA, September 26, 2017). The special conditions were:

- Concrete (relevant) building plans at the site
- Change of ownership could not be completed because of the enrollment in the Environmental Pool
- Special environmental conditions not covered by the prioritizing system
- Special regional conditions that make priority appropriate

[45] In Danish: Miljøpuljerådet

[46] In Danish: Rådssekretariatet

ACHIEVEMENTS

The remediation objective was to eliminate environmental and health risks in relation to current use of the sites and groundwater for drinking water (personal communication, Preben Bruun, AC technician at the Danish EPA, September 26, 2017). In areas categorized as "areas with special drinking water interests," the groundwater must be clean within 100 metres of the contamination. These objectives were met for all remediated sites. The fund closed in 2017 after 23 years of operations (Danish EPA, 2017). The scheme succeeded in reaching their remediation goal. Preliminary investigations of 9,820 former petrol stations have been conducted. Contamination was found at 3,438 sites, which were then remediated. Storage tanks and contaminated soil were removed (personal communication, Michael Mücke Jensen, Technical and Environmental Manager at the Danish Oil Industry Association, September 11, 2017); the contaminated soil was biologically cleaned and deposited.

INSURANCE SCHEME FOR SMALL OIL TANKS

A law that came into force on March 1, 2000 obliges all owners of smaller oil tanks to draw an insurance to cover the removal of contaminated soil caused by discharges from the oil tank or oil furnaces used for heating of private homes (Topdanmark, n.d.). The insurance companies in Denmark discussed how the law could be implemented (personal communication, Michael Mücke Jensen, Technical and Environmental Manager at the Danish Oil Industry Association, September 11, 2017). The oil industry realized that this insurance could be quite expensive and consequently that it would be too expensive to use oil as a heating method. Therefore, the Danish Oil Industry Association proposed an insurance scheme on behalf of their members to automatically include insurance on heating oil delivered to private customers, covering the tank owners' insurance obligation. If a person has a legal oil tank and can document that they bought heating oil from a member company of the Danish Oil Industry Association (or an oil supplier provided by one of the members), the tank owner is covered (Q8 Danmark, n.d.; Danish Oil Industry Association, n.d.).

Through their experience with remediation of former petrol stations, the Environmental Pool had the means to carry out remediation of sites contaminated by private oil tanks (personal communication, Michael Mücke Jensen, technical and environmental manager in the Danish Oil Industry Association [Energi- og olieforum], September 18, 2017). Therefore, it was decided that the Environmental Pool should manage the remediation activities. As the Environmental Pool is not an insurance company, they entered an agreement with the insurance company Topdanmark. Topdanmark is only responsible for the insurance aspects and runs no risk or costs related to the remediation activities (Danish Oil Industry Association, n.d.; personal communication, Michael Mücke Jensen, technical and environmental manager in the Danish Oil Industry Association [Energi- og olieforum], September 15, 2017).

PROCEDURE FOR REMEDIATION OF CONTAMINATION CAUSED BY SMALL OIL TANKS

The municipalities, Topdanmark, seven oil companies and the Oil Industry's Environmental Pool are involved in the scheme (Danish Oil Industry Association, n.d.). When a tank owner suspects damage caused by the oil tanks, they are obliged to report to the municipality. Either the municipality, the tank owner or oil company would then report the suspicions to Topdanmark. The municipality or Topdanmark may choose to take actions to limit potential damage if the contamination threatens the environment. Topdanmark will assess whether the case is covered by the insurance scheme. The Oil Industry's Environmental Pool will undertake investigations and remove the contaminated soil. The oil tank and pipelines will be removed if necessary. When the remediation work is completed, and investigations of residual contamination are conducted, the undertaken work will be reported to the tank owner and public authorities.

ACHIEVEMENTS

The remediation objective was to restore soil and groundwater at the site to the same condition as before the contamination occurred (personal communication, Preben Bruun, AC technician at the Danish EPA, September 26, 2017). All remediated sites have reached this objective. As of September 2017, the Oil Industry's Environmental Pool had managed about 2,000 cases related to damages by private oil tanks. About 50 cases

remain to be remediated. As expected, the annual amount of reported cases has declined considerably over the years (Oil Industry's Environmental Pool, 2013).

8.2 Level of Development

When the Oil Industry's Environmental Pool was established in 1994, Denmark's GDP per capita (in constant 2011 dollars) was USD 36,332. In 2016, one year before the end of the program, it was USD 48,686 (World Bank, n.d.). In both years the general economic development in Denmark was very high.

8.3 Type of Land

The former petrol station sites and small oil tanks were located both in urban and rural areas of Denmark (personal communication, Michael Mücke Jensen, September 11, 2017). Denmark is very flat, with the highest natural point being only 171 metres (Peakbagger.com, n.d.).

8.4 Financial Sources

Both the insurance scheme for private oil tanks and the remediation fund for former petrol stations were paid for by private capital from the oil companies in Denmark. In a way, these could be seen as polluters.

FORMER PETROL STATIONS

The fund was financed by private capital, through a fee based on sales of petrol, at first amounting to DKK 0.05 per litre of sold gasoline (Oil Industry's Environmental Pool, n.d.b). The fee was later changed several times, and was DKK 0.01 per litre of sold gasoline when the collection of funds ended. The oil companies determined the size of the fee based on the Environmental Pool's assessment of necessity to bring in more money (personal communication, Michael Mücke Jensen, September 11, 2017).

PRIVATE HEATING OIL TANKS

Private capital from the oil companies funded remediation of sites contaminated by oil tanks or oil furnaces used for heating of private homes.

The insurance premium is based on the expected remediation costs in total, which then is divided by the quantity of sold heating oil (personal communication, Michael Mücke Jensen, September 11, 2017). Each oil company pays an insurance premium based on their sales of heating oil. The expected total cost was estimated based on the anticipated number of sites contaminated by eligible oil tanks and the associated remediation costs. The insurance covers investigations and remediation of the contaminated site up to about DKK 4.3 million (Topdanmark, n.d.b). The municipality will pay the excess amount. The oil industry has also contributed DKK 28 million in grants for municipal expenses for ongoing cases exceeding the 2011 monetary threshold (Bruun, 2011).

8.5 Financial Actors

The Danish oil companies are the financial actors in both schemes, all of which are commercial enterprises.

Remediation of former petrol stations was paid by the oil companies operating in Denmark at the time of the fund's opening: Dansk Shell, DK-Benzin, Haahr Petroleum Limited, Statoil, Kuwait Petroleum, Norsk Hydro Olie, Olieselskabet Danmark, Du Pont Denmark, Jet and Texaco (Jensen, 2017). The insurance scheme for private oil tanks are paid by Shell, OK, UnoX Energi, Q8, Statoil Fuel and Retail, Carl Jensens Marinelager and Dansk Oliekompagni (Danish Oil Industry Association, n.d).

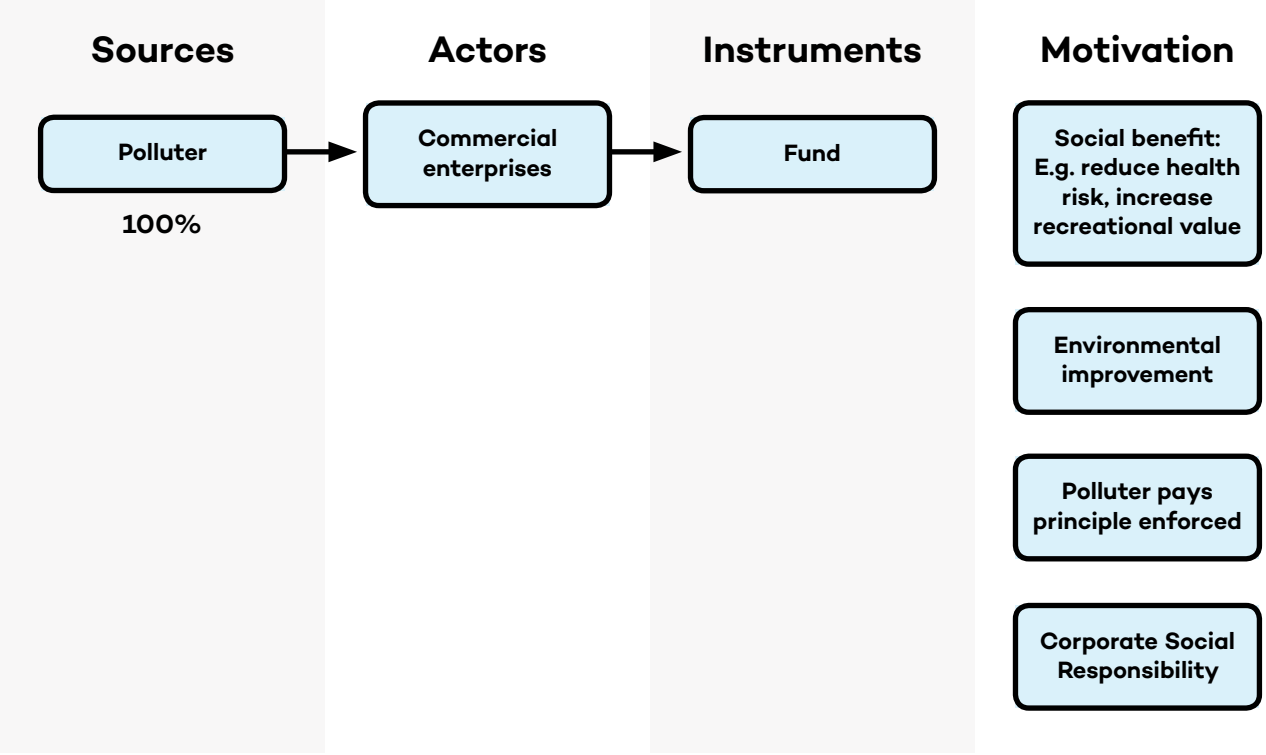


Figure 15. Marked in blue are the types of sources, financial actors and instruments in use in Danish Oil Industry's Environmental Pool, as well as the financial actors motivation to contribute to the project.

8.6 Financial Instruments Utilized

After the initial agreements regulating remediation activities and how they were to be financed, the parties involved established the Danish Oil Industry's Environmental Pool, which could be seen as a fund (Oil Industry's Environmental Pool, n.d.). Both schemes described in this case have utilized this fund as an instrument to remediate eligible sites.

8.7 Financial Recipients

The Danish Oil Industry's Environmental Pool and Topdanmark are the financial recipients for funding through the schemes, both of which is non-sovereign. Funding for remediation of former petrol stations was paid directly to the Environmental Pool, while funding for remediation of private heating oil tanks was paid indirectly to the Environmental Pool by the oil companies through Topdanmark.

8.8 Costs Affecting Return

FORMER PETROL STATIONS

The final costs of this scheme amounted to just over DKK 2 billion (personal communication, Michael Mücke Jensen, Technical and Environmental Manager at the Danish Oil Industry Association, September 15, 2017). Figure 16 gives an overview of the cost distribution of the remediation activities in the period 1993–2010 (personal communication, Michael Mücke Jensen, Technical and Environmental Manager at the Danish Oil Industry Association, September 18, 2017). At the time, the physical activities on most of the remediation projects were about to finish. The accrued remediation costs were about DKK 1.73 billion, and the administrative costs were just below DKK 100 million between 1994 and 2010.

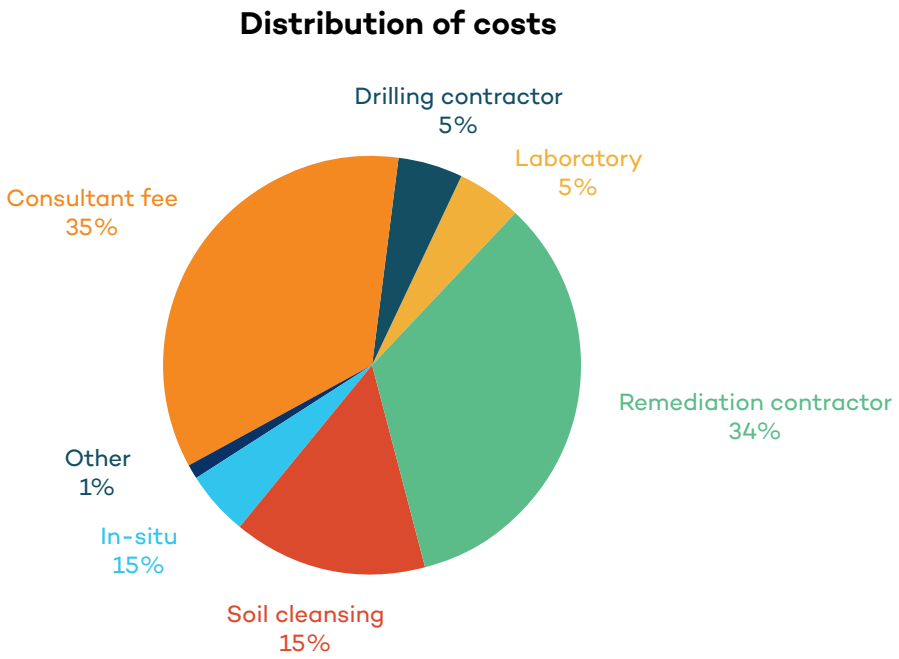


Figure 16. Cost distribution of remediating the former petrol stations from 1993 to 2010.

Source: personal communication, Michael Mücke Jensen, Technical and Environmental Manager at the Danish Oil Industry Association, September 18, 2017

PRIVATE HEATING OIL TANKS

The oil companies paid about DKK 1.3 billion in insurance premiums up until 2017 (personal communication, Michael Mücke Jensen, Technical and Environmental Manager at the Danish Oil Industry Association, April 23, 2018). A portion of these resources was employed to establish an insurance technical reserve, as a buffer to cover fluctuations in remediation costs each year compared to expected costs. Just over DKK 100 million, about 10 per cent of total costs, were administrative costs, while about 80–90 per cent of the total costs were related to environmental assessments and remediation (personal communication, Michael Mücke Jensen, Technical and Environmental Manager at the Danish Oil Industry Association, September 18, 2017). As the nature of these projects was acute damage, the environmental assessments, remediation and reporting to the authorities occurred continuously, which makes it challenging to separate the costs further.

8.8.1 Transaction Costs

The oil industry took initiative with both schemes, and the Environmental Pool managed them on behalf of the oil industry. During decades of managing the schemes, the Environmental Pool became a specialist in the remediation of oil tanks. As all sites were polluted by leakage from oil tanks, the Environmental Pool gained specialized knowledge about the remediation process, possible difficulties and expected costs, as well as the remediation companies operating in Denmark and their strengths and weaknesses. The Environmental Pool also managed contact with the local authorities and the Danish EPA, and learned the procedure and requirements by the public authorities. Hence, they could run the processes more effectively, choose the right remediation company, and foresee complications and costs. These factors lessened the transaction costs. Further, the scheme-specific transaction costs will be discussed.

FORMER PETROL STATIONS

The public authorities perceived the scheme as a good solution to fund remediation projects and simultaneously avoid litigation. The authorities and oil industry had a common interest to enter into an agreement. However, the oil industry would want to remediate at least cost, while the authorities wanted to ensure that any residual pollution would not compromise public health. As a result, there have been a few cases of the local authorities not approving the conducted remediation, with additional remediation conducted (personal communication,

Preben Bruun, AC technician at the Danish EPA, September 26, 2017). Otherwise, the collaboration between the Environmental Pool and public authorities has been good. The transaction costs regarding the former petrol stations are considered low.

PRIVATE HEATING OIL TANKS

The insurance scheme for small oil tanks was initiated by the oil industry after a law that came into force obliged all owners of smaller oil tanks to draw an insurance to cover remediation of discharges caused by the oil tanks. Conflicting interests between the property owner and Topdanmark/Environmental Pool regarding the remediation effort, caused many cases of litigation during the first decade of the scheme (personal communication, Preben Bruun, AC technician at the Danish EPA, September 26, 2017). Then, the Danish EPA published a guide for handling such cases, and the amount of litigation lessened.

There has been media attention given to the conflicts between property owners and Topdanmark/Environmental Pool regarding the remediation efforts, which could have caused skepticism to the remediation efforts of Topdanmark/Environmental Pool. If so, this factor could enhance the transaction costs relating to litigation.

8.8.2 Information Costs

Both schemes support remediation of relatively homogenous sites. As mentioned in Section 8.8.1, the Environmental Pool gained specialized knowledge about the remediation companies operating in Denmark, the procedure and requirements by the public authorities. These factors made the information search easier and less costly. Also, there was no need to gather information about the polluter, whether the polluter existed or not, and the polluter's ability to fund remediation. Therefore, we consider the information costs as low.

8.8.3 Costs Affecting Rate of Return

The costs affecting rate of return are related to the administration of the fund, as well as obtaining funding from the oil companies. The administration costs amounted to about DKK 200 million, which is 6.6 per cent of total costs for both schemes.[47]

8.9 Risks for Financing Remediation

There are many risks involved when financing remediation. Here we distinguish between legal, regulatory, social, political, technical and market risks.

8.9.1 Legal Risks

The OM is funding the remediation projects directly. The fund itself is financed by the Danish oil companies; their contribution is drawn from a "tax" on consumers. The legal risks will be addressed from both the fund's and oil companies' perspectives.

The legal risks for the Danish oil companies derives mainly from the duty to comply with the contract establishing the OM. The contract had detailed regulations about the financing. The main duty of the companies was to pay a monthly fee through a neutral state-authorized auditor based on the company's respective sale of petrol (Oil Industry's Environmental Pool, n.d.). Compliance deficits could lead to liability in accordance with the contract itself, and Danish contract and tort law. However, it is assumed that the compliance is not particularly complicated, and that the legal risks therefore are low.

Since the responsibility for the site remediation and the connected risks are transferred to the fund, the oil companies have avoided litigation in hundreds of cases and connected risks, which was one of the main goals

[47] Remediation costs were DKK 1.73 billion for the petrol stations in the period 1993–2010 and related administration costs were DKK 100 million. Total cost relating to the insurance scheme were about DKK 1.3 billion up until 2017, including just over DKK 100 million in administration costs.

of the voluntary agreement. However, while legal risks were dramatically reduced, it became certain that the companies had to pay. Further, because of the limitations of the environmental liability regime at the time of the operation by the petrol stations (Djurhuus et al., n.d.), Denmark's principle of not using retroactive laws if not absolutely necessary (Ministry of Taxation, 2011, p. 8), and difficulties in establishing liability in the case of merges, dissolutions and bankruptcies, the agreement also means that the companies carry costs that otherwise would have been carried by the public, due to a lack of legal basis for liability.

The legal risks for the OM are the typical risks connected to soil remediation projects. Since the fund was a highly professional and specialized actor with a high number of projects, it soon accumulated extensive experience and competence, and has had good overview and understanding of relevant laws and regulations. In addition, in the 1990s Denmark had a well-developed law and regulation system. The legal risks in the narrow sense are considered low for the OM in general. However, projects' specific risks could vary from low to very high.

Through the 1992 agreement, the OM became the judicial person responsible for the remediation projects, thus the fund faced the same liability risks as a remediating polluter. Liability risks typically stem from negligence of duties as high-level administrator, accidents and damages. Claims of damages are not only possible from contracting parties such as the remediating company and consultancies, but also from third parties such as the local authorities, neighbouring companies and residents. While remediation projects in general are unpredictable and relatively dangerous, the OM focused on the remediation of petrol station sites with primary petrol and oils spills in the soil. The damage potential is considered lower than in the Bonfol case, which involved excavation, transportation and treatment of huge quantities of highly toxic, mixed, unidentified and unstable chemicals and gases. The liability risks the OM faced in general are therefore considered as medium.

The contractual risks came primarily from tendering processes and individual contracts with the different actors. The total amount of money spent was about DKK 2 billion and more than 3,400 sites were remediated, which gives an average cost per project of about DKK 588,235 (Oil Industry's Environmental Pool, n.d.a). With its individual remediation projects being relatively small and uncomplicated, the contractual risks are considered as low.

The main legal risk regarding the insurance scheme for small oil tanks has been the extent of the remediation required (personal communication, Preben Bruun, AC technician at the Danish EPA, September 26, 2017). This uncertainty led to many cases, both for the administrative complaints commission and court cases, in the first 10 years of the scheme. A reason for many cases was that both the landowner and Topdanmark, with their opposing interests, could initiate cases. After an official guideline was published in 2009, the number was greatly reduced. In total, by far most projects went without problems.

Since the criteria for the membership in the scheme were objective, there was not much legal risk. The tank owner is automatically covered if they have a legal oil tank and can document the purchase of heating oil from a member company of the Danish Oil Industry Association (or an oil supplier provided by one of the members) (Q8 Danmark, n.d.; Danish Oil Industry Association, n.d.).

Lastly, the risks connected to the removal of the oil tank are, to a large extent, the same as described above for the remediation of petrol stations sites, just smaller in relation to the smaller size.

8.9.2 Regulatory Risks

The regulatory risks for the OM are low. On the one hand, a large number of laws and regulations are relevant for the fund's projects. On the other hand, the individual projects had relatively short time frames and the law and regulation-making processes in Denmark are open, accessible and well structured. Thus, changes can be predicted to some extent.

Based on the Environmental Pool's experience, there have been some changes in regulations for establishing new petrol stations (personal communication, Michael Mücke Jensen, Technical and Environmental Manager at the Danish Oil Industry Association, September 11, 2017).

8.9.3 Social Risks

Social risks can arise on both the project and program levels. On the project level, dissatisfaction and disputes may arise—for instance, if the project has inadequate remediation goals or methods, or requires resettlement or temporary ceasing of use of the property during remediation. Stakeholders may also be dissatisfied with the time period between when the site is identified as contaminated until it is remediated. The social risk level will vary from project to project, though the schemes are limited to remediation of former petrol stations and private heating oil systems, which means that there are some similarities between the projects. Some of the risks have been materialized, for instance stakeholder dissatisfaction with remediation outcome, as not all contamination was remediated (Andersen, 2004; Christoffersen, 2002). Also, some landowners have been dissatisfied with the time it took before the sites were remediated (Østergaard, 2013).

If left unmanaged, these issues may lead to dissatisfaction with the entire remediation program and injure their reputation. Feedback as described above could also lead to improvements in the program.

8.9.4 Political Risks

As the scheme lasted for over 24 years, some political decisions affected the schemes, both on a superior level and project level. As the schemes were initiated and (mainly) funded by the oil industry, the political risk was limited to the risk that the public authorities could: refuse to approve completed remediation, enhance the requirements for remediation and enhance the monetary threshold in the insurance scheme. For instance, the monetary threshold in the insurance scheme determined the upper limit for remediation costs covered by the insurance company, Topdanmark. The residual would then be covered by the relevant municipality. There was a risk of changes in the monetary threshold. This risk materialized in 2010, when the monetary threshold doubled (Danish EPA, n.d.). Over the course of 24 years, there was also a risk of changes in the acceptable level of pollution, which would affect the required remediation efforts. There have not been any political changes affecting the remediation of former petrol stations (personal communication, Michael Mücke Jensen, Technical and Environmental Manager at the Danish Oil Industry Association, September 11, 2017).

8.9.5 Technical and Physical Risks

Technical and physical risks depend on the remediation methods in use. As we focus on the system as a whole, we will not discuss technical and physical risks. Such risks will vary from project to project.

8.9.6 Market Risks

The main market risk for the oil industry relates to the scheme's impact on oil sales: remediation through the schemes is funded by the oil companies according to quantity sold.

Consequently, parts of the remediation costs will be transferred to the consumers through an increase in sales price of oil. As the sales price of oil increases, the oil companies risk losing customers and thus the source of funding.

8.10 Lessons Learned

SUCCESS FACTORS

Voluntary agreement

This case describes two schemes initiated by the polluters themselves. Their main motivation is probably to avoid litigation and their focus on corporate social responsibility. The schemes ease legal and transaction costs for all parties involved.

Proper instrument utilized

The oil companies assess the need for funding based on recommendations from the Environmental Pool in both schemes and determines the cost share based on quantity sold. As a result, the oil companies pay according to their potential contribution to pollution, and the fund receives funding regularly.

Specialized procedures

The Environmental Pool is responsible for remediation of all former petrol stations and most of private heating oil systems. They develop experience and expertise on remediation of sites contaminated with oil through these projects. As the type of projects is restricted, they can develop procedures that are adapted to this type of remediation projects. Hence, unnecessary paperwork and measures are avoided, which lowers the costs.

WEAKNESSES

Consumers pay

As mentioned, remediation through the schemes is funded by the oil companies according to quantity sold. Consequently, parts of the costs will be transferred to the consumers.

The schemes depend on low remediation costs

To incentivize polluters to take this initiative, the remediation costs cannot be too high, as part of the costs will be transferred to the consumers. As the sales price for oil increases, the oil companies risk losing customers and thus their source of funding.

Limited to individual industries

Voluntary schemes like the ones described in this case are only relevant for some industries, and not as a scheme for all industries in a country. Also, each scheme should be limited to an individual industry.

9 Ginkgo Fund I

The Ginkgo Fund I was a profit fund managed by Ginkgo Management. The fund aimed to acquire a portfolio of environmentally impaired sites (brownfields) in France and Belgium, remediate the land using environmentally sound techniques and then sell the repositioned property to third parties at a premium. In certain cases, the fund maximized its value by participating in subsequent green real estate development projects on the sites. Though the fund is not operative anymore, it might be a good example of a green financing mechanism.

9.1 Background

The Ginkgo Fund I was an eight-year for-profit fund initiated by the banking entity Edmond de Rothschild Group and the environmental strategy consultancy BeCitizen (Farber, 2009). New cost-effective remediation techniques were environmentally proven and enabled remediation projects to be profitable. Ginkgo saw the opportunity to utilize these techniques to develop derelict and polluted properties in attractive areas and benefit from improved property values and strong revenue streams. The fund aimed to acquire contaminated sites in France and Belgium, remediate and then sell them for profit. In some cases, the fund also participated in redeveloping projects on the sites to maximize profit. Their remediation and redevelopment efforts benefited the local authorities, communities and the environment, as they could improve neighbourhoods, raise the property value, support jobs during and post remediation, and reduce health risks and negative effects on the environment.

The European Investment Bank (EIB) played an important role as financier and indicated to other investors that Ginkgo was able to carry out the activities (Farber, n.d.). Thereafter, several public financial institutions invested in the fund, including the French institution Caisse des Dépôts et Consignations (CDC), and the Belgian investment companies Société Fédérale de Participation et d'Investissement (SFPI-FPIM) and Société Régionale d'Investissement de Wallonie (SRIW) (personal communication, Chloé Annino, Ginkgo Advisor, August 29, 2017; EIB, 2011). Ten additional investors also contributed. The Ginkgo Fund I raised capital from vintage year 2010 up until the official closing on March 3, 2012. The goal was to capitalize EUR 100 million and to create a return of 15 per cent (Farber, 2009, p. 15). In the end, EUR 80.8 million was raised in equity investment, but only EUR 63.9 million was called for (personal communication, Chloé Annino, Ginkgo Advisor, April 19, 2018). Total costs were estimated at EUR 200 million (EIB, n.d.a).

Seven contaminated sites were remediated and redeveloped through the fund, amounting to 28 hectares in total (CDC, 2017; Katainen, 2016). Of the remediated sites, 87 per cent were developed for housing, with greater sensitivity to pollution than the remaining 13 per cent, which were developed for commercial, industrial and/or office activities. The Ginkgo Fund was estimated to support 3,901 jobs in project management and construction work. The last projects funded by the first Ginkgo fund are planned to finish in 2020 (personal communication, Chloé Annino, Responsible administrative at Ginkgo Advisor, April, 2018). After the successful closing of the first fund, a second Ginkgo Fund (Ginkgo II) was launched with 2015 as vintage year (EIB, 2016b; Farber, n.d.; Katainen, 2016).

THE GINKGO WAY

The fund is remarkable since it specializes in remediation and development of contaminated land in urban areas. It uses its own teams of experts and senior engineers, and cooperates closely with local authorities, for instance through PPPs (Farber, 2009, p. 9; Ginkgo-advisor, n.d.b). Through a team of highly skilled and experienced professionals, Ginkgo was able to minimize risks and to create profitable projects.

The fund focused on small to middle-sized (1–20 ha) contaminated sites in attractive locations with promising redevelopment potential (Farber, 2009, p. 7, 17-19). The fund aimed to contribute between EUR 5 million and EUR 15 million per project. One or more special purpose vehicles (SPVs) were created for each project, which held their own assets and debts. The fund itself held no debt. SPVs could be leveraged in line with common practice for these types of projects. Further, interest rate risk or currency risk were mitigated through hedging.

The fund's strategy was to diversify projects geographically and to allocate resources into several projects

(Farber, 2009). Each individual project should demand less than 20 per cent of the total fund, and one country had to take less than 75 per cent of the total investments. Further, the aim was to diversify the real estate portfolio encompassing housing, offices, retail, industry and buildable land, and avoid ethically questionable end-uses. Also, they aimed to ensure that each type of real estate received less than 65 per cent of the fund.

The fund only invested in sites with a pollution record. When it comes to types of pollution the fund focused on chemical and unexploded ordnances; however, it did not exclude any type of pollution in advance (Farber, 2009, p. 7, 21–22). When a potential eligible site was identified, evaluated and selected, the fund attained the relevant property rights by using the SPVs. To minimize risk, only "efficient and proven" remediation techniques were used, thus avoiding experimental methods. Ginkgo aimed to limit environmental liability related to the remediation processes through relevant insurance and guaranteed fixed price contracts. When necessary, monitoring strategies were prepared in connection with the remediation processes.

The fund invested in new projects for a period of four years after its closing in March 2012 (personal communication, Chloé Annino, Ginkgo Advisor, August 29, 2017; Farber, 2009, p. 20). The goal was that projects on average would last for four years from the initial investment to the final divestment. The last projects funded by the first Ginkgo fund are planned to finish in 2020 (personal communication, Chloé Annino, Ginkgo Advisor, April 19, 2018).

9.2 Level of Development

Both France and Belgium are highly developed countries with a GDP per capita in 2012 of USD 41,046 and USD 37,345, respectively[48] (World Bank, n.d.a, n.d.b).

When the fund finally closed in 2012, France and Belgium were still marked by the financial crisis of 2007/08. The unemployment rate was 9.8 per cent in France and 7.6 per cent in Belgium, and on the rise (Statista, 2017, 2018a, 2018b).

9.3 Type of Land

The fund focused on small to middle-sized (1–20 ha) contaminated sites in attractive locations with redevelopment potential (Farber, 2009, p. 7, 17–18). These sites were typically former industrial or military sites located in urban areas with a structural shortage of building land (Ginkgo-Advisor, n.d.b).

9.4 Financial Sources

The major investors in the fund were EIB, CDC, SFPI-FPIM and SRIW, which all are public financial institutions. Their operations are mainly financed by accumulated reserves originating from their investment activities, but the governments could also contribute with capital. The financial sources of the additional 10 investors is unknown.

EIB derives most of their resources from international capital markets, mainly through bonds, but also through its shareholders (EIB, 2015). As of July 2013, 8.9 per cent of the subscribed capital was paid in by the shareholders (EU member states). Thus, the financial source of funding from EIB was investors and general fiscal revenue (from the EU members).

Although CDC is a public institution, the source of its funding is solely accumulated reserves from its own investment activities (Lichwa, 2015). Thus, the financial source of CDC is the investors.[49]

[48] Constant 2011 dollar

[49] Ginkgo (or Biloba) is not listed as "en mission déléguée," but in the "Portefeuille Société d'investissement" in the 2011 SFPI-FPIM Portfolio report, hence it is not funded by the government (SFPI-FPIM, 2011).

In general, the financing source of SFPI-FPIM's activities is their own and project-specific funds given by the government for non-profitable projects with high societal value (SFPI-FPIM, n.d.a). The financial source of SFPI-FPIM's investment in Ginkgo was their own funds, which is to say, private capital from investors.

The financial source of SRIW is mainly accumulated capital from its investment activities, which is to say, private capital from investors. The investment in Ginkgo was financed through such capital. The regional authorities in Walloon could choose to inject more capital in the company, as it did in 2017, which was the first time since 2009 (Lauwers, 2017).

9.5 Financial Actors

The banking entity Edmond de Rothschild Group and the environmental strategy consultancy BeCitizen initiated the fund, which is managed by Ginkgo Management (EIB, 2016a; Farber, 2009).

The major investors were the following public financial institutions: EIB, with EUR 15.6 million (EIB, 2016a); CDC, with EUR 15.6 million; and SFPI-FPIM and SRIW each with EUR 5 million in equity investments (personal communication, Chloé Annino, Ginkgo Advisor, August 29, 2017). In addition to the major investors mentioned, there were 10 other investors. EIB's contribution was crucial to giving other investors confidence to get involved, due to the credibility of EIB's due diligence assessment of Ginkgo (Farber, n.d.). The projects funded by Ginkgo did not receive public funding or subsidies, besides the equity investments (Ginkgo-advisor, n.d.a).

The following section gives a short description of the investors.

EUROPEAN INVESTMENT BANK (EIB)

EIB is run by the members of the European Union (EIB, n.d.b). It is a policy-driven bank that provides finance and expertise for sustainable investment projects, including infrastructure, climate and environment. More than 90 per cent of the projects are located in Europe, but EIB also support projects in the rest of the world.

CAISSE DES DÉPÔTS ET CONSIGNATIONS (CDC)

CDC is owned by the French government and has the mandate to perform activities in the public interest on behalf of the government. Among other roles, it manages savings funds and retirement plan programs, and provides financing for development projects (Lichwa, 2015).

BELGIAN FEDERAL HOLDING AND INVESTMENT COMPANY (SFPI-FPIM)

The Federal Government of Belgium is the sole owner of SFPI-FPIM (SFPI-FPIM, n.d.b). The company has two main purposes: to act as the government holding company and to act as an investment company. SFPI-FPIM owns companies such as Brussels Airport Company, the Congress Palace, Brussels Airlines and the National Lottery among others. In terms of investments, it focuses on profitable, socially relevant projects in real estate, infrastructure and networks, international investments and innovation. In the case of non-profitable projects with high societal value, the government can order SFPI-FPIM to invest, but the government takes on all costs associated with the investment.

THE REGIONAL INVESTMENT COMPANY OF WALLONIA (SRIW)

SRIW was formed in 1979 by the government in Belgium (Dangoisse & Vagman, 1997). It is a public limited company owned by the Walloon Region of Belgium (98.66 per cent) and Belfius (1.34 per cent) (Merveille & Chmielewski, 2011).[50] The Walloon Region is authorized to entrust SRIW with tasks, according to the program decree of February 23, 2006 (Labille, n.d.). It aims to facilitate economic development in the Walloon region, through equity investments and long-term loans to companies working on industrial or service projects.

[50] At the time of funding Ginkgo, Dexia was the minority shareholder of SRIW, which later on was sold to the Belgian state and changed its name to Belfius (Reuters, 2012).

OTHER INVESTORS

Besides the major investors, there were 10 other actors investing equity into the Ginkgo Fund (personal communication, Chloé Annino, Ginkgo Advisor, August 29, 2017) (see Table 8).

Table 8: Ten additional equity investors in the Ginkgo Fund I, besides the four major investors

Investors	Short description
APICIL Prévoyance	APICIL Prévoyance offers insurance and pension plans for employees of VSEs and small and medium-sized businesses (APICIL, n.d.).
Caisse de Prévoyance des Agents de la Securité Cociale et assimiliés (CAPPSA)	Pension institute in France (CAPPSA, n.d.).
Mutuelle Épargne Retraite Prevoyance CARAC (MERP CARAC)	A savings, retirement and provident mutual insurance company (MERP CARAC, n.d.).
Cattolica Assicurazioni	An Italian insurance and bancassurance group (Cattolica Assicurazioni, n.d.).
Chambre de Commerce et de l'Industrie de Paris (CCIP)	A regional chamber of commerce and industry, representing the interests of businesses in Paris (CCIP, n.d.).
Caisse Centrale de Réassurance (CCR)	A reinsurer company, owned by the French State (CCR, n.d.). It provides its services to both the public and private sector.
Les Associations Mutuelles Le Conservateur	A mutual company that provides investors with the opportunity to invest in collective life savings associations (Le Conservateur, n.d.).
Quadia	Quadia is a private company investing equity, venture capital and venture debt in projects and companies (Quadia, n.d.a). They focus on investment themes such as energy efficiency, environment, sustainable food and urbane infrastructure, among other (Quadia, n.d.b).
MICIL	(no information found)
CTBR Holding Limited	(no information found)

Source: personal communication, Chloé Annino, Ginkgo Advisor, August 29, 2017

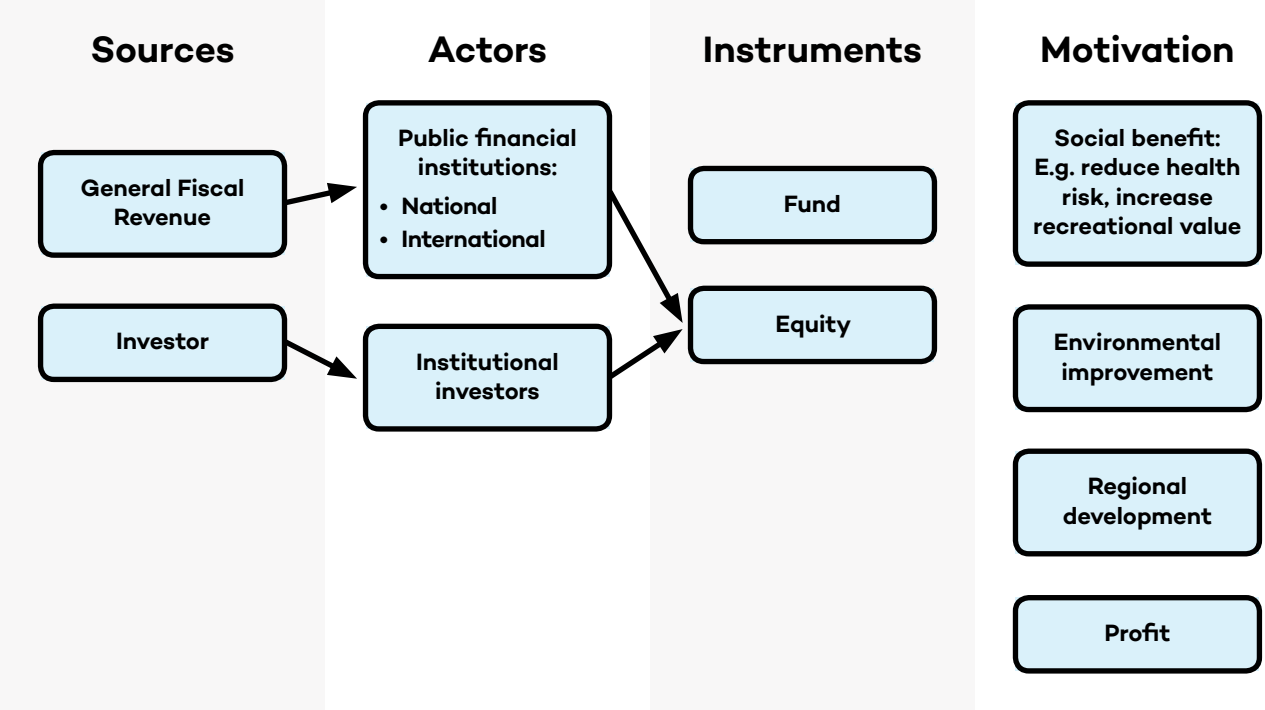


Figure 17. Marked in blue are the types of sources, financial actors and instruments in use in the Ginkgo case, as well as the financial actors motivation to contribute to the project.

9.6 Financial Instruments Utilized

The initiative takers utilized a fund and equity investment to remediate and redevelop contaminated sites in France and Belgium.

An SPV for each selected contaminated site was created (Farber, 2009), which then acquired the property or property rights. Ginkgo aimed to work closely with local authorities, for instance through PPPs on the project level. Although the Ginkgo Fund itself did not hold debt directly, the SPVs could hold debt.

9.7 Financial Recipients

According to the EIB, the financial intermediary is Ginkgo Management Sarl, which is one of the shareholders in the Ginkgo Fund (EIB, n.d.a). Other shareholders have invested equity directly into the Ginkgo Fund (Farber, 2009). The Ginkgo Fund then distributes the resources to several SPVs in France and Belgium.

The financiers would have to consider the Ginkgo Fund's ability to choose promising projects, in order to ensure that the recipient will manage the funds well. As SPVs have been established for each project, to conduct remediation and develop the estate, the financiers would also consider the commercial risks and revenue profiles of the SPVs.

9.8 Costs Affecting Return

According to EIB (n.d.a), the estimated total costs were EUR 200 million.[51]

Farber (2009) provides an overview of the projected costs of projects in Burcht (Belgium) and Satory (France). These function as examples of the cost distribution within remediation projects funded by Ginkgo (Table 9).

[51] Accrued costs, revenue and cost distribution have not been officially confirmed by Ginkgo management; therefore, we have displayed estimated costs for the fund in total, and for two projects as an example.

Remediation efforts counted for 7–8 per cent, land acquisition for 5 per cent, redevelopment for 74 per cent, operating expenses (OPEX) for 14–15 per cent, and the gross margin over 26 per cent.

Table 9: Projected costs for two projects, one in Satory (France) and one in Burcht (Belgium).

Projected costs	Satory (France)	Burcht (Belgium)
Land acquisition	5.0%	4.5%
Remediation	6.6%	7.8%
Redevelopment	74.0%	73.8%
OPEX	14.5%	13.9%
Total revenue	GBP 10.9 million	GBP 30.9 million
Total costs	GBP 8.4 million	GBP 24 million
Gross margin	30.4%	26.4%

Source: (Farber, 2009)

The Ginkgo Fund mitigates environmental risk by the use of insurance or fixed price (Farber, 2009).

9.8.1 Transaction Costs

Transaction costs occurred on both the system and project levels for the Ginkgo Fund. On the system level, transaction costs occurred while negotiating with potential investors about their share and rights. None of the investors hold the majority of shares. The involvement of EIB indicated that the Ginkgo Fund was promising and well managed, and therefore had the potential to manage the funds well (Farber, n.d.). The Ginkgo Fund's governance structure consisted of a general partner board, investment committee and supervisory committee, who had specific criteria related to the choice of projects to be funded (Farber, 2009).

Raising funding from other investors became easier because of EIB's involvement. Also, Ginkgo's business idea was in line with investment strategies in several public financial institutions, such as CDC, SRIW and SFPI-FPIM. The governance structure and specific criteria made the site selection process straightforward. Therefore, we consider the transaction costs for matters relating to the system as low.

On the project level, Ginkgo acquired the properties directly or through PPPs (Farber, 2009). It collaborated with local authorities and developed the properties in line with the adopted or soon to-be-adopted official urban development plan.

The transaction costs that occurred on the project level related to acquiring properties, hiring architects and remediation and construction companies, obtaining building rights and the like. As Ginkgo aimed to collaborate with the local authorities and develop properties in attractive locations that were contaminated, obtaining building rights was quite straightforward. Negotiation with construction companies and architects was similar to ordinary development projects. However, remediation projects are often considered as risky, and the

negotiation with remediation companies could be demanding in regard to price and the remediation company's responsibility. Fixed prices could increase the costs relating to negotiation with the remediation companies, while proper insurance could lessen these costs. Ginkgo mitigated remediation risks through fixed price or proper insurance (Farber, 2009).

With these factors in mind, we consider the transaction costs to be low to medium.

9.8.2 Information Costs

Information costs arose both on the system and project-specific levels, during the search for potential investors, construction and remediation companies, and potential projects.

INFORMATION COSTS ACCRUE ON THE SYSTEM LEVEL

Ginkgo had a list of investment criteria that the projects had to fulfill to be classified as qualified for funding from the Ginkgo Fund. Some of the criteria—for instance, size (1–20 hectares), location and existing pollution record—had the potential to make the search for promising projects easier and therefore less costly (Farber, 2009). The project managers searched for polluted estates through official databases of polluted sites, such as BASOL, OVAM, IBGE and WALSOL. Also, Ginkgo had some criteria for prioritizing projects, such as upper limits for number of projects in each country (75 per cent), capital spent on each project (20 per cent of the fund) and projects in each type of redevelopment purpose (65 per cent).

To assess the potential projects for the Ginkgo Fund, there was a need for information about the attractiveness of the location, redevelopment potential and demand, financial return, timing, risk assessment, sustainability and technical feasibility (Farber, 2009). There were four phases in the investment appraisal process, where promising projects were transferred to the following phase. The fund collected information from public entities, authorities, industry, strategic partners in the environmental and real estate sectors, conferences and networks, as well as actors in the financial sector and stakeholders.

The Ginkgo Fund has simplified and systematized the process of retrieving information through the criteria they set and by dividing the process into four phases, which reduced information costs. Nevertheless, there was still need for a substantial amount of information about each project. Initially, more than 100 projects were suggested and assessed; approximately 40 projects went through to the next level (Farber, 2009).

PROJECT-SPECIFIC INFORMATION COSTS

Ginkgo aimed to establish PPPs to work as a catalyst for public remediation projects. Also, by partnering up with local authorities, Ginkgo acquired knowledge about the local situation, in terms of attractive locations, demand for housing, shops, offices, tourism infrastructure and the like, as well as local companies that could undertake high-quality remediation and construction. The collaboration eased the information search and related costs.

The private limited company Ginkgo Advisor Sàrl was appointed as the investment advisor for projects funded by Ginkgo, and held expertise on environment, financing, environmental legislation and remediation technology. Although each project was organized in separate SPVs, and in principle each had to gather information on their own, the investment advisor provided necessary information. Consequently, information costs were reduced, compared to a situation without these advisors. Nevertheless, as the projects were scattered throughout both France and Belgium, information costs were incurred related to project-specific searches for remediation and construction companies.

9.8.3 Costs Affecting Rate of Return

The costs affecting rate of return are related to the administration of the fund and the investors' alternative cost, which is the return on best alternative investment.

9.9 Risks for Financing Remediation

9.9.1 Legal Risks

When it comes to the Ginkgo Fund as a whole, the legal risk is characterized by its size and complexity. A number of SPVs were established in different countries. These SPVs had to be contractually linked to the fund. Investors from different countries were involved in the funding. Consequently, in addition to EU law, there were a number of legal risks linked to corporate law, tax law and public regulations in the relevant countries. Further, there were contractual risks linked to each individual contract. While the application of an SPV structure reduces legal risks, it does not make the fund invulnerable. Negligence can be followed by liability and, in severe cases, a possible piercing of the corporate veil can even disregard the SPVs limitation of liability.

When it comes to specific remediation projects, the risks are in essence the same as in the other projects described. An individual project size raging between EUR 5 million and EUR 15 million is in itself relatively large and complex, thus generally leading to a medium risk. The liability risks linked to the remediation process were reduced through insurance policies and guaranteed fixed price remediation contracts, especially to limit environmental liability (Farber, 2009, p. 22).

9.9.2 Regulatory Risks

Considering the time aspect, as mentioned previously, the Ginkgo Fund had its vintage year in 2010 and the last projects are at this time expected to end in 2020 (personal communication, Chloé Annino, Ginkgo Advisor, April 19, 2018). The goal was that individual projects would last an average of 4 years from the initial investment to the final divestment. While the regulatory risks for the Ginkgo Fund as a whole mainly stem from national and EU regulations, the individual projects are mostly affected by local regulations. In the EU, planned changes in the regulatory framework, especially when it comes to changes or the adaption of new directives, is normally publicized long before adaption. While an abrupt and substantial tightening of the environmental standards when it comes to remediation goals linked to contaminated soil could make the fund unprofitable, this is unlikely to happen without some planning and transition time. The regulatory risks for both the Ginkgo Fund as a whole and for the individual projects are considered as medium to low.

9.9.3 Social Risks

There will always be some social risks in remediation and development projects. These could materialize if the project violates land titles or rights, causes resettlement or leads to disputes arising because of differing opinions of the project's objectives, outcome or remediation efforts.

Ginkgo applied established and efficient remediation technologies to remediate the sites and aimed to avoid landfilling to relieve environmental NGOs and the community's fear of insufficient remediation. Their remediation efforts were related to the end-use of the site. Sites developed for housing had stricter remediation goals than those developed for commercial, office or industry activities. This could trouble environmental NGOs and the community, based on the assumption that the sites could be rezoned on a later basis. However, as mentioned, 87 per cent of the properties were developed for housing and consequently applied strict remediation efforts. Ginkgo also excludes projects with an ethical or morally questionable end-use, such as enabling work on weapons and ammunition, gambling, tobacco or actions that violates human rights, animal protection and the like.

To qualify for funding by Ginkgo, the project development plan had to comply with official urban development plans and be approved by local authorities, which increased the likelihood that the project fit into the area and simultaneously fulfilled a demand for the planned end-use. These factors also lessened the risk of community dissatisfaction with the project outcome. We consider the social risks as low.

9.9.4 Political Risks

The Ginkgo Fund is mainly financed by policy-driven institutional investors. Thus, the financial foundation for the Ginkgo Fund was, in its starting phase, quite vulnerable to change in political prioritizing. While the remediation of contaminated sites is hardly seen as a controversial issue that would be marginalized in political compromises, it is perhaps slightly more controversial whether an institutional investor should invest in housing projects. However, once the public institutional investors have bound themselves through contracts, the risks should be greatly reduced. It is likely that the Ginkgo Fund, and thus also the other investors, through contracts with the investors are legally protected against a political decision to withdraw the funding. Since the project is not seen as controversial the political risk is considered as low. However, as mentioned under regulatory risk, an abrupt decision of tightening environmental standards when it comes to remediation goals could negatively affect the project.

9.9.5 Technical and Physical Risks

Technical and physical risks depend on the remediation methods in use and site-specific factors. As we focus on the system as a whole, we will not discuss technical and physical risks. Such risks will vary from project to project.

9.9.6 Market and Commercial Risks

Market risks include the risk of negaive changes in property value, revenue stream and demand for the redeveloped land, buildings or infrastructure. In general, there are several reasons redevelopment projects could experience such negative changes. For instance, the property value could be affected by the fear of residual contamination that could harm human health or the environment. It could also be affected by circumstances in the neighbourhood, changes in the economy (i.e., recession), or the supply of similar redevelopments that fulfill the demand for such estates.

The Ginkgo Fund aimed to finance remediation projects that had a clear commercial benefit, with high demand for the real estate after remediation. To achieve this, Ginkgo chose projects in attractive urban areas. Redevelopment projects in such areas may be less exposed to changes in demand caused by recession. The demand for the real estate after remediation is key to ensuring adequate revenue streams and property value. If the redeveloped estates are in more attractive areas than similar estates, they may be chosen over other estates. This is especially important in times when supply fulfills the demand for such estates. Therefore, by choosing projects in attractive urban areas, Ginkgo lessened the risk of negative changes in demand, revenue streams and property values.

Ginkgo redeveloped their properties conforming to the official urban development plans, which has its benefits. The local authorities have assessed the needs in the area and created a deliberate plan or strategy for the area. Consequently, Ginkgo was able to plan a redevelopment project that would fit well into the area and meet the demand. Also, Ginkgo avoided unpleasant surprises, for instance adverse placement of infrastructure or other buildings that could lessen the property value, revenue streams and demand.

Another measure to reduce the market risks was to diversify the redevelopment projects. Ginkgo aimed to diversify projects both geographically and through type of real estate (Farber, 2009). In the end, six out of seven projects were developed for housing purposes (CDC, 2017). Thus, the real estate portfolio could hardly pass as diversified, in terms of different types of redevelopments.

To further mitigate the risk of changes in demand, Ginkgo urged the SPVs to await the construction phases until they achieved presale of the developed site or otherwise mitigated the risks. Ginkgo aimed to carry out the projects in four years from initial investment to final sale, which also lessened the risk of not finding suitable buyers who would purchase the estate for an acceptable price.

Lastly, the property value could be affected by detection of contamination or common knowledge of contamination at the site. In the case of Ginkgo, the properties had to be listed as polluted in an official

database for polluted sites to be qualified for funding. Although contamination was detected prior to the involvement of Ginkgo, the property value could still be negatively affected by knowledge of contamination. The main reasons would be the fear that contaminated substances could still be present that could harm human health and the environment and that the buyers would become responsible for remediation in the future.

9.10 Lessons Learned

SUCCESS FACTORS

Profitability

Soil remediation projects can be profitable for its investors.

Public institutional investors mobilized private capital

The trust and quality of the investment by public institutional investors seems to enhance the mobilization of private capital.

Specialization

The professional management of the fund leads to accumulation of specialized competence and experience, increasing efficiency.

Risk diversification strategy

The risk diversification strategy applied minimizes risks and enables the fund to be profitable even if single projects turn out to be unprofitable.

WEAKNESSES

Large amount of initial financial capital required

Initially huge amounts of financial capital are needed by institutional investors to create the trust that mobilizes other investors.

Limited field of application

The method can only be applied in urban areas with relatively attractive property sites and for sites that do not need extraordinary remediation. In rural areas and otherwise less attractive locations, and in cases were remediation would be extremely expensive, the method is not profitable and thus financial capital cannot be mobilized from investors.

10 Conclusion

This report has presented several financing instruments that have been applied in the context of remediation and provided case study examples from different parts of the world where these instruments are used.

An important lesson that can be learned from this report is that, though the case studies were examples of remediation projects or programs, it must be emphasized that there is no uniform approach to financing remediation. Both the costs of remediation and the financing instrument(s) to be applied are highly case specific.

Despite the lack of a uniform approach to financing ecosystem soil remediation, a number of general reflections can be made. When ecosystem degradation is partly caused through contamination from industrial activities, the polluter pays principle should be applied and the polluters should be held liable for the contamination. Rather than awaiting expensive litigation processes, however, there are indications that industry prefers an approach based on the idea of shared corporate responsibility where the different polluting actors together finance the remediation of contaminated sites. Superfund, Bonfol fund, and the Danish Oil Industry's Remediation Fund have all illustrated this approach.

Where remediation is expected to provide stable revenue streams after remediation, private investors might be interested in investing in the remediation of the area. Bonds have become a popular green finance instrument and are relatively low risk for investors, yet only if the restored area will eventually result in revenue streams. When green bonds are endorsed by the state, they will have a similar level of risk as the government bond.

Some remediation projects do not offer any clear commercial opportunities and will not necessarily result in any revenue streams after restoration. These projects therefore require more public funding and philanthropic contributions. Both PPPs and crowdfunding may be effective financing avenues in these circumstances.

In sum, there is no uniform approach, and actors and institutions are recommended to apply a financing mechanism that is the best fit-for-purpose for the planned remediation project, taking into account case-specific circumstances, including socioeconomic context, income potential, complexity of pollution and time frame.

Financing soil remediation projects can be challenging since they often require vast amounts of financial capital, and the remediation process itself is often complicated, long lasting and risky. This report has addressed different approaches to financing soil remediation, through a systemic perspective in the Superfund, Clean Michigan Initiative, Denmark and Ginkgo Fund I cases and through a project-specific perspective as in the Bonfol, Flekkefjord and Hempel cases. The report indicates that the different approaches have their own strengths and weakness and that the methods have their different fields of application.

The Ginkgo Fund I is an example where the trust and quality of the investment by public institutional investors seems to enhance the mobilization of private capital. The professional management of the fund leads to accumulation of competence and efficiency. The risk diversification strategy applied reduces risks and enables the fund to be profitable even if single projects are unprofitable. However, the Ginkgo Fund I method has its limitations. Initially, huge amounts of financial capital are needed by institutional investors to create the trust that mobilizes other investors. The method can only be applied in urban areas with relatively attractive property sites and for sites that do not need extraordinary remediation projects. In rural areas and otherwise less attractive locations, and in cases were remediation would be extremely expensive, the method is not profitable, and thus financial capital cannot be mobilized from investors.

When it comes to funds that aim at remediation of a very large number of sites over a long time period, we find that continuity of the funding is important for the success of the fund. After the Superfund lost its relatively stable input from special taxes on polluting industries in 1995, the fund had to compete more directly with other sectors in federal budget negotiations. The total funding declined and projects were delayed. In Michigan, the funding from the Cleanup Michigan Initiative bonds ran out in 2017 with more than 7,300 sites left in need of remediation. In contrast, the Environmental Pool in Denmark, partly funded by customers, reached their goals by conducting 9,820 preliminary investigations of former petrol stations and remediating all 3,438 sites

where contaminated soil was found over a period of 23 years. Even though we did not cover the Swiss OCRCS-Remediation Fund extensively in this report, this fund is also financed through a tax on polluters and thus has a stable funding base.

Stability in itself is an advantage in the same way it is an advantage for a business. Activities can be planned with less uncertainty and there are fewer resources wasted in frequent budget negations with the legislator. While this can be achieved with regular and fixed grants by the public, the Denmark case shows what is possible with a special fee that is supported by the industry itself.

Similar to the Denmark case, the Ginkgo case also indicates that the most successful projects involve some form of collaboration between public and private actors. Instead of spending resources and time on litigation, more resources are saved for remediation when the parties collaborate. The Denmark case was also special because it directly diffused the costs to a large group without trying to hold the specific site owner or operator directly liable for the costs. The major advantage was that they could avoid litigation almost entirely. However, this is only feasible when the sites and the remediation costs are homogenous, such as petrol station sites or private oil tanks for heating purposes. Across and between different industries, the size and complexity, and thus the costs of remediation, vary a lot. In this case, it may be perceived as unfair if the authorities do not hold the polluters directly liable.

The Bonfol case has shown that the polluting companies' reputations can be a very strong incentive for paying for the remediation, especially if it is a large corporation that is well known and the case attracts media attention. This is a form of social pressure that may help authorities implement the polluter pays principle.

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