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**PUBLIC-PRIVATE PARTNERSHIP IN MARINE LITTER WASTE  
MANAGEMENT**

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## ABSTRACT

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<b>Keywords:</b> Public-private partnership, PPP, marine litter, energy from waste, value chain
<p>Marine litter is an international environmental problem that causes considerable costs to coastal communities and the fishing industry. Several international and national treaties and regulations have provisions to marine litter and forbid disposal of waste into the sea. However, none of these regulations state a responsibility for public authorities to recover marine litter from the sea, like they do for marine litter that washes up on public beaches.</p> <p>In a financial evaluation of a value chain for marine litter incineration it was found out that the total costs of waste incineration are approximately 100 – 200 % higher than waste fees offered by waste contractors of ports. The high costs of incineration are derived from the high calorific value of marine litter and therefore a high incineration cost for the waste, and long distances between ports that are taking part in a project for marine litter recovery from the sea and an Energy-from-Waste (EfW) facility.</p> <p>This study provides a possible solution to diverting marine litter from landfills to more environmentally sustainable EfW use by using a public-private partnership (PPP) framework. PPP would seem to fit as a suitable cooperative approach for answering problems of current marine litter disposal in theory. In the end it is up to the potential partners of this proposed PPP to decide whether the benefits of cooperation justify the required efforts.</p>

## TIIVISTELMÄ

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<p>Merijäte on kansainvälinen ympäristöongelma joka aiheuttaa huomattavia kustannuksia rannikkoyhteisöille ja kalastusteollisuudelle. Useissa kansainvälisissä ja kansallisissa sopimuksissa ja säädöksissä on merijätettä koskevia säädöksiä ja ne kieltävät jätteen heittämisen mereen. Mikään näistä säädöksistä ei kuitenkaan aseta viranomaisille vastuuta jätteen poistamisesta merestä kuten on asian laita julkiselle alueelle rantautuneelle jätteelle.</p> <p>Merijätteen käsittelyn arvoketjun taloudellisessa tarkastelussa tuli selville, että jätteenpolton kokonaiskustannukset ovat noin 100 – 200 % suuremmat kuin satamien jäteurakoitsijoiden jätemaksut. Jätteenpolton suuret kustannukset johtuvat korkeasta polttoarvosta ja siten suuresta polton kustannuksesta, sekä pitkistä etäisyyksistä satamien, jotka osallistuvat merijätteen keräysprojektiin, ja jätteen energiahyötykäyttölaitoksen välillä.</p> <p>Tämä tutkimus tarjoaa mahdollisen ratkaisun merijätteen ohjaamiseen kaatopaikoilta ympäristön kannalta kestävämpään energiahyötykäyttöön käyttämällä julkisen ja yksityisen sektorin välistä kumppanuusmallia (Public-Private Partnership, PPP). PPP vaikuttaisi teoriassa sopivalta yhteistoiminnalliselta lähestymistavalta vastaamaan nykyisiin merijätteen hävittämisen ongelmiin. Lopulta on tämän esitetyt PPP:n yhteistyökumppaneista kiinni, mikäli yhteistyön hyödyt nähdään oikeuttavan tarvittavat ponnistelut.</p>	

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## **LIST OF ABBREVIATIONS**

4P	Public-private-people partnership
DEFRA	Department for Environment, Food and Rural Affairs
EC	European Commission
EFF	European Fisheries Fund
EfW	Energy-from-Waste
EU	European Union
FAO	Food and Agriculture Organization
FFL	Fishing for Litter
FFL SW	Fishing for Litter South West
GES	Good Environmental Status
BOT	Build-operate-transfer
BOOT	Build-own-operate-transfer
KIMO	Kommunenes Internasjonale Miljøorganisasjon (Local Authorities International Environmental Organisation)
kWh	Kilowatt-hour
MSFD	Marine Strategy Framework Directive
MJ/kg	Megajoule per kilogram
MW	Megawatt
NGO	Non-governmental organization
NOAA	National Oceanic and Atmospheric Administration
PFI	Private Finance Initiative
PPP	Public-private partnership
PSP	Public sector participation
SME	Small or medium-sized company
UK	United Kingdom
VCA	Value chain analysis

## 1 INTRODUCTION

### 1.1 Background

Marine litter causes on an average 10,000 pounds of financial damage to each fishing vessel on a yearly basis. The damage comes in the form of contamination of catches, broken gear and fouled propellers. (KIMO 2010a, p. 2) Litter in the seas causes costs also in several other ways, such as harm to tourism, direct costs to local authorities and industry, and costs to ecosystem goods and services (Galgani et al. 2010, p. 40). As Sheavly & Register (2007, p. 302) point out, indirect costs of a littered beach can be great especially to communities relying on income generated by seaside businesses, since marine debris discourages people from using the sea for recreational purposes, such as boating, swimming, and just visiting coastal areas in general. Marine litter causes also ecological harm when animals get entangled in debris, such as old fishing nets, or when birds eat small pieces of plastic when they are mistaken for food (Marine Pollution Monitoring Management Group 2002, p. 10).

In this thesis, the definition for marine litter is adopted from the European Union Marine Strategy Framework Directive (MSFD) (2008/56/EC) and is as follows: “marine litter is any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment”. These materials are disposed of either in the marine environment or transported into the marine environment from land by rivers, drainage, sewage systems or wind. Marine litter consists of mostly plastics, wood, metals, glass, rubber, paper and clothing. In this definition semi-solid liquids such as oils are excluded. (Galgani et al. 2010, p. 4)

About 80 % of marine litter comes from land-based sources (Sheavly & Register 2007, p. 302). Large categories of marine litter come from transportation, fishing and manufacturing, so these affiliated industries should take responsibility and give their support in creating effective solutions to the debris problem (Sheavly & Register 2007, p. 304). However, the initial waste producers are in most cases

impossible to find and be held responsible, so costs of waste collection and disposal cannot be charged from them. The state of the marine environment can be regarded as the responsibility of the society as a whole or even a larger international community.

Counties of Devon and Cornwall in South West England are especially concerned by the marine litter problem, because they have a long coastline compared to their land area. Even though marine litter is a global problem and there are international agreements about making actions to prevent marine litter, means to deal with it are mainly local, because the problems caused by marine litter have an effect to the coastal local communities. In this sense, local public authorities need to be involved in taking care of the marine litter problem. There are not enough incentives or private funding available to collect and dispose of marine litter by only private actors. Organizing marine litter recovery could be enhanced through a close cooperation of public and private actors. For these reasons, the framework of public-private partnerships (PPP) is introduced in this thesis.

In South West England there is a project called Fishing for Litter that organizes marine litter recovery from the sea. Fishermen who are taking part in the project collect the litter that gets caught in their nets into hard-wearing plastic bags and bring them to the port. The project organizes further treatment of the litter and the funding for waste disposal.

Because of high concentrations of plastic in marine litter it would be possible to make use of marine litter by converting it to energy by waste incineration and so making use of this resource. Even though a waste incinerator company gains revenues from the produced energy when it is sold to customers, the revenues are not enough to cover all the costs of waste treatment. This is why a waste incinerator cannot organize a marine litter disposal supply chain on its own and make a profit, but needs partners that can provide funding for waste incineration.

MVV Energie is a Germany-based energy company with annual sales of over 3 billion euros and around 6000 employees. Its business portfolio includes electricity, district heating, gas, water, energy-related services and environmental energy. MVV is the third-largest operator of Energy-from-Waste (EfW) plants in Germany. It is constructing an EfW plant in Plymouth, Devon, which could be a part of a partnership for marine litter waste management. The annual burning capacity of the plant will be 265 000 tonnes once it will start operating in year 2014. Waste incineration could be a possible solution for the final disposal of marine litter collected in the Fishing for Litter project.

## **1.2 Goal**

The purpose of this research is to chart the business environment around marine litter in Devon and Cornwall and to consider possibilities of marine litter energy use. This is done by looking for actors in the marine litter business area and finding out about what is being done to marine litter at the moment. The goal is to present a value chain for marine litter recovery and treatment by waste incineration, based on an already existing marine litter recovery project called Fishing for Litter in South West England. This is done by describing a business model on which a public-private partnership between MVV, Fishing for Litter and public authorities could be based on.

The objective of this arrangement would be to reach a better level of sustainability by providing another possibility for marine litter treatment than landfills, which is the current waste disposal method for most of the litter collected in Fishing for Litter. At the time of writing this thesis, the construction of MVV's EfW facility in South West England was only about to be prepared, so the public-private partnership is discussed as a plan.

## **1.3 Research questions and limitations**

This study aims at answering the following research question:

- *How can marine litter recovery for waste treatment be organized?*

The main question is divided into following sub-questions:

- *What is the business environment of marine litter recovery like?*
- *What is the value chain of marine litter recovery and incineration like?*
- *Can a public-private partnership framework be implemented into a marine litter recovery and treatment value chain?*
- *What are the conditions that need to be met for a marine litter recovery and treatment public-private partnership to be successful?*

This thesis concentrates on a marine litter value chain from the initial recovery of litter from the sea until the disposal of the litter in an EfW plant. The geographical focus is South West England, so organizations related to marine litter in South West England are shortly presented.

In the theoretical part of public-private partnerships, the definition of partnership is presented first. The practical literary research of PPP studies is limited to sustainable development and provision of public services. The used literary sources concern the use of the PPP framework in different contexts, conditions for well functioning PPPs, and motives for PPPs.

Different private and public actors concerning marine litter recovery are described. Also the most important regulations and international treaties related to marine litter are presented to show the responsibilities in dealing with marine litter. Beach cleaning operations were also a part of the business environment research to see what are the similarities and differences between activities of marine litter recovery from beaches and the sea. A more in-depth case study was performed on Fishing for Litter South West, which is a project organized for recovering marine litter from the sea.

A value chain for marine litter, starting from its recovery from the sea and ending in its incineration, is presented to give an image of the required steps and activi-

ties involved in marine litter recovery and treatment. Analysis of the value chain is done mostly only qualitatively. The PPP framework is used to lead the study into the theme of collaboration in dealing with a problem that is common to the international community. A plan is made about how the PPP could be implemented into a marine litter recovery and disposal value chain. The implementation of the plan is out of the scope of this study.

#### **1.4 Methods and data**

Research on the business area of marine litter was initially done with searches from recent Internet sources and published literary sources. Reliable sources of information about the marine litter problem and especially about possible solutions for it were found to be scarce. For a more profound understanding of the business area, semi-structured interviews were performed with different levels of public authorities and participating actors of marine litter recovery.

Interview questions varied according to the type of organization in question. The questions can be found in appendices 1 to 4. Questions to Cornwall Council and Torbay Council mostly concerned the responsibilities of public authorities related to marine litter and also with whom and how they are working with to take care of these responsibilities. The discussion with DEFRA (Department for Environment, Food and Rural Affairs) was mostly about the current legislation and the implementation of the Marine Strategy Framework Directive (MSFD). Questions to Fishing for Litter South West and Fishing for Litter Scotland were about how Fishing for Litter is organized and what the waste disposal routes of marine litter are. Also a consultant was interviewed about organizations arranging beach cleaning events and how they work with the public authorities. Based on these interviews and research on international and national agreements and regulations concerning marine litter, the current situation of the business environment around marine litter is presented.

Financial aspects of waste management of marine litter are assessed through a case type research on Fishing for Litter South West, where a value chain for marine litter waste incineration is presented and costs for marine litter incineration and transportation from several ports to the Plymouth EfW facility are evaluated. Financial information was gathered through internal queries at MVV and semi-structured interviews with Fishing for Litter.

Based on the findings from literature about PPP, current business environment and the value chain of marine litter waste management, a plan for a PPP in marine litter waste management is presented. An overview of the structure and contents of this thesis is presented in table 1.

**Table 1.** Structure of this research

<b>Chapter</b>	<b>Content</b>
1. Introduction	Introduction into the marine litter problem. Goal, methods and structure of this thesis.
2. Public-private partnership	Defining partnership and the PPP term. Use of PPP in different areas. Conditions and motives for PPPs.
3. Value chain	Porter's generic value chain. Inter-firm value chain.
4. Current business environment	Marine litter problem, agreements and regulations on marine litter, actors concerned by marine litter.
5. Value chain of marine litter waste management	Marine litter value chain from recovery to incineration. Financial evaluation of transportation and incineration.
6. Public-private partnership in marine litter waste management	A plan for a PPP in marine litter waste management.
7. Results	Fitting of PPP framework for marine litter waste management. Feasibility of incineration as a waste treatment method for marine litter.
8. Conclusions	A summary of the research and its findings.

## 2 PUBLIC-PRIVATE PARTNERSHIP

In this chapter definitions of partnerships and public-private partnerships are presented. Uses of PPP in different areas are reviewed, with a separate chapter for PPPs in sustainable development. Conditions and motives for PPPs are also explored.

### 2.1 Partnership

An ideal type of partnership is a dynamic relationship between different actors. The relationship is based on mutually agreed objectives that are pursued through a common understanding of the division of labor, which depends on the comparative advantages of each partner. A partnership is characterized by mutual influence, synergy, autonomy, mutual respect, equal participation in decision making, mutual accountability and transparency. (Brinkerhoff 2002, p. 21)

		Mutuality	
		Low	High
Organizational Identity	High	2 Contracting	1 Partnership
	Low	3 Extension	4 Co-optation & Gradual Absorption

**Figure 1.** Partnership model (Brinkerhoff 2002, p. 22)

In the partnership model illustrated in figure 1 there are two dimensions: mutuality and organizational identity. Here mutuality means mutual dependence, which includes rights and responsibilities of each partner to others. Mutuality also includes commitment to partnership goals and objectives, and an assumption that the objectives of the partnership are consistent with those of the individual organi-

zations. Partnerships are characterized by equality in decision making, as opposed to domination of one or more partners. (Brinkerhoff 2002, p. 22-23)

The organizational identity dimension in the model refers to what is distinctive in an organization. In order to be successful, it is not important for an organization to maintain its organization systems, but to maintain the organizational identity. For example nonprofit organizations may be able to pursue their missions more efficiently by entering partnerships and strategic alliances and changing in the process. (Brinkerhoff 2002, p. 23)

Organizational identity can be examined at two levels. First, “the maintenance of organizational identity is the extent to which an organization remains consistent and committed to its mission, core values and constituencies”. Commitment to its mission is especially important to nonprofit organizations, because they define the produced value more in terms of their mission than financial indicators. Second, “organizational identity also refers to the maintenance of characteristics – particularly comparative advantages”. This level of organizational identity is closely connected to one primary driver for partnership: accessing key resources that are needed to reach objectives, but which are missing from an organization’s own reserves. These resources can be for example hard resources such as money and materials, or soft resources, such as skills, information, contacts and credibility. (Brinkerhoff 2002, p. 23)

In a relationship where the goals are already in line with the mission and core values of the collaborators, it is easier to reach a high level of organizational identity, since the values of different partners do not need to be adapted to the situation. Core competencies are one reason for choosing certain collaborative partners over others, and that means that there is no need for the partner to change its organizational identity for the sake of the partnership, and organizational identity can be maintained.

The different quadrants are to be seen on a relative scale. Cooperation between actors may have characteristics of each type of relationship, and so would not fit exactly into any of the quadrants. The identification of a relationship within the framework can also change with time. When assessing the organizational identity, the “weaker” partner’s identity is taken under consideration. (Brinkerhoff 2002, p. 24)

The first quadrant in figure 1 represents the ideal partnership, where mutuality and organizational identity are maximized. Only when high mutuality and organizational identity can be identified in the relationship, can it be called a real partnership. The partners are mutually dependent and have shared objectives. (Brinkerhoff 2002, p. 24-25) In a partnership, the power distribution is balanced and decision making is done in collaboration instead of one partner stating the rules for the relationship. Partners have common goals, they are in line with the goals of individual partners, and partners are committed to these goals. Even when joining the partnership, the individual actors maintain their characteristics, such as comparative advantages.

The second quadrant, contracting, represents a relationship where predetermined goals set by an organization are sought in another organization. Also the means to reach the goals are set by the guiding organization, so this type of relationship does not include mutuality. The partners are chosen based on their organizational identity. (Brinkerhoff 2002, p. 25)

The type of relationship in quadrant 3 represents extension, meaning the extension of the more dominant organization. In this kind of a relationship, one organization makes all the important decisions on behalf of the other organizations, and the other organizations are merely following the dominant organization’s lead. The other organizations show very little independent identity. In this model, most mergers fall into this category. Depending on how they are structured, they could also be plotted in quadrant 4. (Brinkerhoff 2002, p. 25)

Quadrant 4 represents cases of co-optation and gradual absorption. The partnership has mutually agreed ends and means, or at least a weaker organization believes that it is in its interest to follow the lead of the more dominant organization. In reality, the weaker organization may compromise its organizational identity, by starting to serve more the dominant partner than its own ends and means. (Brinkerhoff 2002, p. 26)

## **2.2 Definitions of public-private partnership**

Several authors such as Wettenhall (2005, p. 1) and Hodge & Greve (2007, p.545) have pointed out that there are differences inside academia about what can be called as a PPP or even just a partnership (Brinkerhoff 2002, p. 20). Wettenhall (2005, p. 5) writes even that different authors use the same term while they are talking about a different thing, or use a different term when talking about exactly the same thing. For example Koppenjan & Ensenrink (2009) use the terms PPP and private sector participation (PSP) in public projects while talking about the same thing. There is also the question of how deep collaboration is considered as a partnership, since there are a large variety of different kinds of public-private mixes with different amounts of cooperation (Wettenhall 2005, p. 5; Hayllar & Wettenhall 2010, p. 2).

PPP can be loosely defined as “cooperative institutional arrangements between public and private sector actors”. A number of authors seem to be using PPP almost interchangeable with the term contracting. Some consider it as a governance tool for replacing contracting for public services through competitive tendering, or as a new word in public management for delivery of public services with the involvement of private organizations, or simply as a new way to handle infrastructure projects. (Hodge & Greve 2007, p. 545)

In public infrastructure, the definition of PPP is quite narrow. In a public infrastructure PPP, common forms of contractual agreements include BOT (build-operate-transfer), BOOT (build-own-operate-transfer), where the project involves

the design, construction, financing, maintenance, and possibly operation of public infrastructure. An arrangement where the public actor sells infrastructure to the private actor and leases it back on a long period (20-30 years) contract is also possible. (Hodge & Greve 2007, p. 546)

The definition of the British House of Commons Library for Private Finance Initiative (PFI) is as follows: “PFI is a form of public private partnership (PPP) that marries a public procurement programme, where the public sector purchases capital items from the private sector, to an extension of contracting-out, where public services are contracted from the private sector“ (Allen 2001, p. 10). It can be argued that the infrastructure PPP projects under the Private Finance Initiative (PFI) in the UK are merely long-term contractual types of arrangements, and not really partnerships (Hayllar & Wettenhall 2010, p. 3), because they are lacking mutuality, as in consistency of partnership’s and organization’s own objectives, in the cooperation.

When assessing these contractual arrangements with the two-dimensional partnership model from Brinkerhoff (2002), they lack mutuality compared to the ideal type of partnerships. In an infrastructure PPP, both the public and private partners have the same goal of providing necessary infrastructure, but for different reasons. The public actors cooperate with public actors because they hope to minimize insecurity of implementation costs (Klijn & Teisman 2003, p. 143) or access resources such as technical expertise of the private partners, and so reach a more cost-efficient solution for the needed infrastructure. The private partners want to provide the needed infrastructure because of their objective to make a profitable business (Koppenjan & Ensenrink 2009, p. 287).

According to Immonen (2011, p. 38), a PPP “is a special type of alliance in which a private firm and public organization co-operate to gain value in public service provision”. PPPs include a variety of different kinds of collaborative arrangements that range from contractual relationships to joint ventures. With PPPs the

role of the public authorities as an organizer, a controller and a regulator of outputs is partly transferred to the private actors. (Immonen 2011, p. 38)

In this study Immonen's (2011) definition of PPP is followed with additions from Brinkerhoff's (2002) definition of partnership. In this definition, private organizations are collaborating with the public sector in providing services that belong to the domain of public service provision. PPP means close cooperation between public and private actors that have common goals for the partnership. The goals of the partnership as well as the means to reach them are commonly agreed on.

In this particular case that is studied, the infrastructure that is needed for waste treatment is already a part of another infrastructure type PPP project and it is left out of the scope of the study. Fields of PPP that are considered relevant to this study are explained in more detail. NGOs are considered to belong to the private sector in this study. In some literary sources they are included in the private sector, while in others they are mentioned as a sector of its own, "the third sector" (e.g. Rosenau 1999, p. 11).

### **2.3 Motives for public-private partnerships**

In partnerships between the public and the private sector, different actors have some generally accepted comparative advantages. National governments can provide some important legal and institutional frameworks for partnership work, a large scale to work in, and financial and material resources. The private sector can provide financial, technical, and managerial resources. NGOs can act as important intermediaries and enhance social mobilization towards local communities. NGOs are presumed to be more flexible and innovative than government organizations, and they can mobilize local resources. Development agencies can have a facilitating role and provide financial and technical support. (Brinkerhoff 2002, p. 24)

The public sector is mostly concerned about public interest and solidarity considerations. The private sector performs better in economic tasks, is more innovative,

is able to replicate successful experiments, and is able to adapt to rapid change. It can also abandon unsuccessful or obsolete activities when needed, and perform complex and technical tasks. (Rosenau 1999, p. 11) The not-for-profit organizations are more successful in areas requiring compassion and commitment to individuals and they are able to excel where extensive trust is required by the clients or personal attention is needed (Osborne & Gaebler 1992, as cited by Rosenau 1999, p. 11).

Public and private sectors have a lot to learn from each other (Rosenau 1999, p. 26). Cooperation between public and private actors can lead to a new product or service, that neither one would have come up without joining their efforts. (Hodge & Greve 2007, p. 546) In the 4P (public-private-people partnership) model when people are added as a third actor, the generation of ideas is increased even more (Kuronen et al. 2011, p. 206). In general, the formation of inter-organizational networks makes joint working possible and promotes the potential for learning and innovation (von Malmborg 2003, p. 134).

In public-private policy partnerships, public actors are taken into providing services that fulfill the requirements set in public policies, such as health care and education (Rosenau 1999, p. 18). The state provides policy relevant services when there is not enough private capital or incentive for the private actors to take action, but the services need to be offered anyway. For example when there were not enough market incentives to develop cleaner and more fuel-efficient cars, the United States government started a partnership with public funding to achieve more environmentally friendly vehicles. (Rosenau 1999, p. 21)

In PPPs with SMEs for sustainable development, there seems to be one main reason to collaborate from the side of public authorities, even when different types of PPP can be distinguished. The public actors wish to support the SMEs in developing their organizational capacities, and to develop the regional structures and the basis for local and regional businesses. As industrial structures are changing and there is less reliability in the traditionally large industries, it is important to en-

courage SMEs to make their business more autonomous and competitive. Environmental performance and quality of the regions are considered to be important indicators of regional welfare in the future, and regional authorities think that private actors must take part in the effort for the vision to become reality. (von Malmborg 2003, p. 140)

SMEs take part in PPPs for sustainable development when there is a short run (1 year) or medium run (2-3 years) potential financial benefit for them. The benefit can appear to them through product development, or as new markets, new suppliers, and new customers. SMEs also find partnerships useful for getting to know new organizations, people, and ways to run a business. Opportunities for increasing their knowledge and broadening their views may encourage companies to take part in partnerships. (von Malmborg 2003, p. 141)

The dominant motives for each actor category to take part in public-private partnerships are closely connected to the “core” objectives of each participating actor. Apart from private actors, public actors do not value the benefits of a partnership based on only their own organization, but the community at large. (von Malmborg 2003, p. 142)

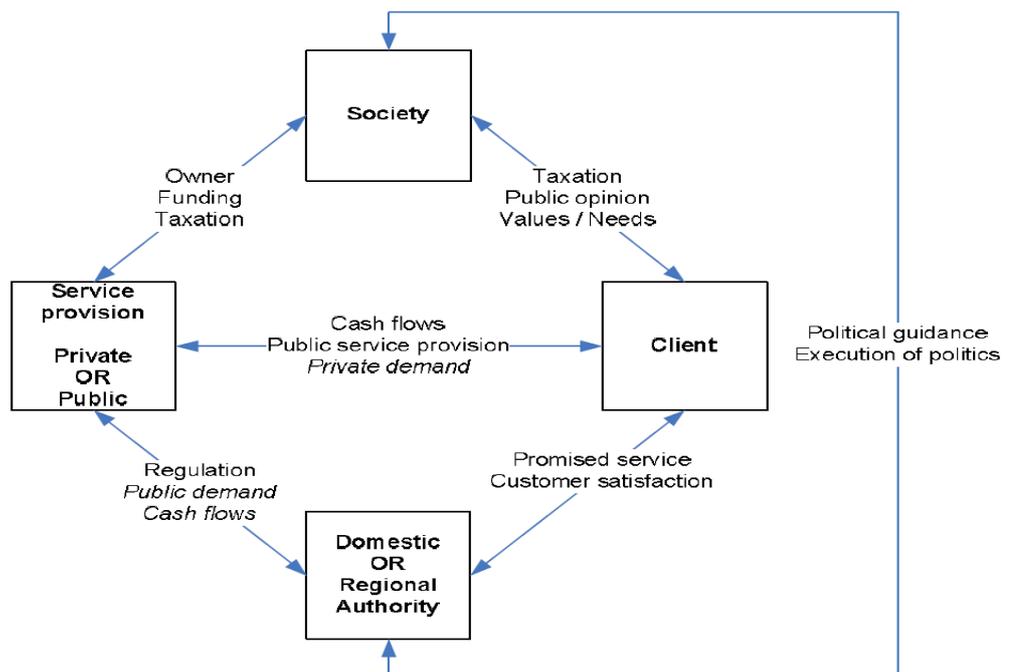
#### **2.4 Use of public-private partnership in different business areas**

Provision of public services can be done by public or private actors. In either case, the service providers are under the same regulations. Domestic or regional authorities are still in some amount responsible for the service provision. They must make sure that the services that fall under the required services of public service provision are offered to the relevant clients. The services are at least partly paid by taxation.

Public-private partnerships have been used in many different areas. In the European Union, PPPs are used in areas such as waste management, transport, water distribution and public health (European Commission 2009). Bagchi & Paik (2001) have discussed aspects such as requirements for PPP in port information system

development. Bridgman (2009) has done a case research on a public-private partnership in housing and employment training for homeless youth. Van Ham & Koppenjan (2002) have studied a public-private partnership in port development.

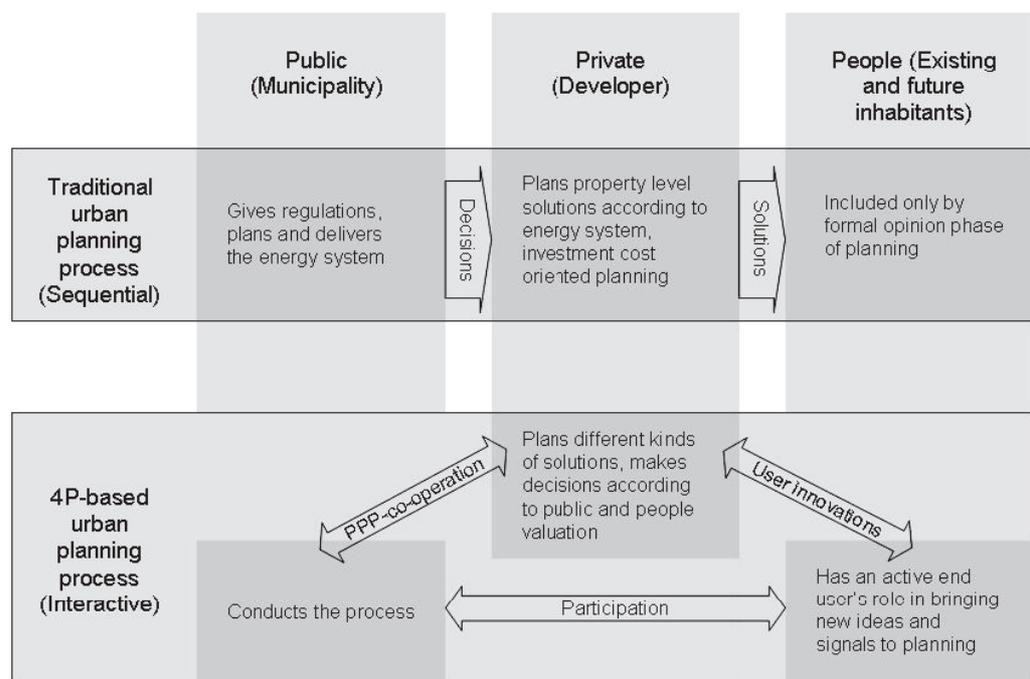
Public service provision is a complex system where service providers, authorities and clients communicate with each other. A simplified visualization of the system is presented in figure 2. In the field of public service provision, it is important to clearly differentiate the roles of the buyer, the client and the supplier. Local authorities need to provide the kind of services that match with the needs of the citizens, who in the end pay for the provided services directly or through taxation. The most important interactions of the model take place between the client and the authority, and the authority and the service providers. (Immonen 2011, p. 19-20)



**Figure 2.** Roles and interactions of actors in public service provision (Immonen 2011, p. 20)

Kuronen et al. (2010) have presented an extended version of the PPP model, a so called 4P model, which stands for public-private-people partnership. The case in question was planning of an energy system as a part of an urban planning project.

In traditional urban planning, information and decision-making go only one way from authorities to project developers and then to final clients (the people). This can be seen from figure 3 where the traditional and 4P planning processes and their most important differences are presented. In the 4P model people are taken into the planning process and add a valuable source for innovative ideas. This way the process is made non-linear and more cooperative instead of a linear one-way process. (Kuronen et al. 2010, p. 204-206)



**Figure 3.** Traditional and 4P urban planning process (Kuronen et al. 2010, p. 206)

PPP can be used to guide urbanization into a more sustainable direction through private sector participation (PSP) in the development, maintenance, and operation of sustainable urban infrastructures. But instead of reaching goals of benefiting both the public and private actors, the benefits can end up being one-sided and the following problems can occur (Koppenjan & Ensenrink 2009, p. 285):

- Long-term indebtedness of municipalities
- Unequal access to services because of high user tariffs
- Poor quality

- Postponement of investments in less profitable project parts
- Contract renegotiation in favor of private providers.

## **2.5 Public-private partnership in sustainable development**

The UN World Commission on Environment and Development defines sustainability as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED 1987). Commonly sustainable development is understood to have three dimensions: environmental, social and economical (Kuronen 2011, p. 20).

Building partnerships for tackling both global concerns such as climate change policy and local environment and livelihood concerns means creating common communication platforms between all parties, so that open communication is possible. Often this means that the actors (investors and citizen groups) need to define their own negotiating arenas instead of accepting usual models such as public consultations with the local government. (Forsyth 2005, p. 438)

In order to address the challenge of sustainable development, control over sustainability issues must be spread to involve not only governments and other public organizations, but private actors (von Malmborg 2003, p. 134) and NGOs (Oteng-Ababio 2010, p. 322) as well. Von Malmborg (2003, p. 137) also mentions that it is important for the actors from both the public and private spheres to have a common view of sustainable development in order for regional sustainable development public-private partnerships to work. In his research all of the respondents from both public and private sides had a common opinion that sustainability issues most probably will be given more attention in the future. The differences between the opinions of local and regional authorities and SMEs (small and medium sized enterprises) came from the importance of different dimensions of sustainable development. In SMEs, the economic dimension was considered the most important, while the environmental authorities highlighted the environmental dimension. Business development authorities on the other hand had views that take

the society and development more into account, but with a focus on economic sustainability and growth. (von Malmborg 2003, p. 137)

Under sustainable PPPs three different kinds of partnerships can be distinguished according to their objectives: corporate environmental management competence, sustainable business development, and community development. In the first partnership type the objective is “to develop and implement environmental management systems and other management tools in the participating organizations” and also to have the opportunity to share experiences and to develop corporate environmental management competence by making contacts with people from other organizations. Sustainable business development type of partnership aims at building organizational capacity through collaboration with joint venture arrangements. Partnerships of the third type, community development, have the development of entire local and/or regional communities as an objective. In this type of partnership the private sector is less involved in comparison to the other types. (von Malmborg 2003, p. 139-140)

Among PPPs for sustainable development there appears to be one main reason for the public authorities to start the partnership. The objective is “to support the SMEs in developing their organizational capacities and simultaneously develop the regional structures to facilitate the basis for local and regional businesses”. (von Malmborg 2003, p. 140)

Partnerships that are initiated and led by private sector actors do not usually require active participation from public organizations. Instead, they act more as sleeping partners and/or funding bodies. When only SMEs are considered, they do not initiate partnerships aiming towards enhancing environmental management, but they do take part in public-private partnerships that are initiated by public actors. (von Malmborg 2003, p. 140)

## 2.6 Conditions for successful public-private partnerships

Conditions for successful PPPs from three different sources are listed in table 2. Von Malmborg (2003) has presented conditions for a regional public-private partnership for sustainable development to reach its goals. These conditions are derived from regional partnerships for sustainable development in Sweden. The conditions are divided to starting and process conditions. The starting conditions, which are the first two on the left column in table 2, are requirements for the partnership to be started in the first place and the latter process conditions need to be met for the project to meet its goals. (von Malmborg 2003, p. 142-143)

The conditions from the three sources of table 2 that resemble or complement each other are horizontally positioned next to each other. They are expressed in different words, but in this context they are considered to mean essentially the same conditions for successful PPPs.

**Table 2.** Conditions for successful public-private partnerships (von Malmborg 2003, p. 142-143; Bagchi & Paik 2001, p. 494; Rosenau 1999, p. 25)

<b>von Malmborg</b>	<b>Bagchi &amp; Paik</b>	<b>Rosenau</b>
Financial aspects are clear to parties involved		
Organizational capability to participate	Network of key groups and individuals	
Bottom-up perspective and realistic objectives	Realistic and commonly accepted vision/objective	Achievable goals
Project competence		
	Strong commitment from the top; leadership	
Mutual trust	Strong participation/trust	
	Shared interests and risks	
	Monitoring performance	Progress is monitored
	Patience	
	Realistic and clearly defined partner role	Clear lines of responsibility
	Evenly distributed ownership	
		Concrete plan from the beginning of the project
		Incentives for partners are established

The first starting condition states that financial aspects of the partnership need to be clear both before and during the process (von Malmborg 2003, p. 142). Deeper collaboration is easier between public and not-for-profit private partners, when the motive for profit is absent. In these kinds of partnerships, more productive and significant forms of partnering are possible, when market considerations are less important. Collaboration becomes slightly more complicated when financial matters are of bigger concern. Conflicts of interest can cause problems and undermine performance. When for-profit private actors are involved, their stockholders' interests come first. This conflicts with the interests of public policy obligations to society. When partnering with not-for-profit organizations, this kind of problems are of smaller importance, but other kinds of conflicts of interest may arise. (Rosenau 1999, p. 26)

In this context, organizational capability means the will to take part in a collaborative project. Private actors who have to invest their time and resources in the partnership are more likely to take an active role in the collaborating project compared to actors that receive external funding for their input. Generally, intra-organizational collaboration is a prerequisite for inter-organizational collaboration. People within an organization need to be able to work together before collaboration can be done efficiently between organizations. (von Malmborg 2003, p. 143) Arranging networks of key groups and individuals (as in Bagchi & Paik 2001, p. 494) is a similar condition for a successful PPP, since it is directly related to collaboration.

In order for partnerships to work, the objectives of the partnership need to be realistic to the participants and reflect their visions. This condition for a working PPP has been recognized by all of the three sources. The perspective of the partnership needs to be set bottom-up instead of top-down, (von Malmborg 2003, p. 143) so that objectives can be realistic and common to all participants (von Malmborg 2003, p. 143; Bagchi & Paik 2001, p. 484). A shared vision of the objective of the partnership is an essential part of the definition of a partnership (von Malmborg 2003, p. 143) and achievable goals must be set (Rosenau 1999, p. 25).

For the project to meet its goals the participants should possess the necessary competencies. If there is a lack of competence, an external actor such as a consultant might be needed to provide required expertise. Project management and leadership are also a part of project competence. (von Malmborg 2003, p. 143) Bagchi & Paik (2001, p. 484) have also mentioned that a coordinator with necessary leadership skills for guiding the process forward is a success factor for a working PPP. The common aspect here is competence in both leadership and actual work.

An important part of a partnership is mutual trust. In Sweden there seems to be a common perception among private actors that the local and regional authorities are not trustworthy as collaborative partners, especially when it comes to environmental authorities. The role of environmental authorities is usually seen more as supervisory, even though nowadays they act also as “support units”, serving both public and private actors. The services they provide include education, guidance on environmental legislation, and recently also as collaborative partners in environmental management. Private actors have trust in public authority departments, such as business development departments, that are often set up by former local businessmen who speak the same language as the private actors. (von Malmborg 2003, p. 144) Mutual trust can be built with collaborative planning and collecting inputs from partners by discussing various issues and solving obstacles together (Bagchi & Paik 2001, p. 492).

When the interests of actors in a partnership are aligned and they have the same objectives, cooperation goes more smoothly than when they have differences in either interests or objectives (Rosenau 1999, p. 22). In the Korean case researched by Bagchi & Paik (2001, p. 491), the government was working on coordinating and unifying the diversified interests of different actors. Patience is mentioned as a success factor, because partnerships require long-term investments and farsightedness from both public and private actors (Bagchi & Paik 2001, p. 484). Both

Bagchi and Paik (2001, p. 494) and Rosenau (1999, p. 25) recognize that clear lines of responsibility need to be set and partner roles need to be clearly defined.

When the objective is to promote market-based services in public service provision, it would be better for the authorities to shape the operation environment so that clear rules for offerings and efficiency targets exist. This could be achieved by subsidies, obligations, and increasing the awareness of people and decision makers about opportunities. (Immonen 2011, p. 93)

### 3 VALUE CHAIN

In this chapter the concept of value chain is presented. First, the generic value chain of a firm, also called as the intra-organizational value chain introduced by Porter (1985), is presented. Then the value chain is considered with a broader view by taking inter-organizational value chains and relationships into account.

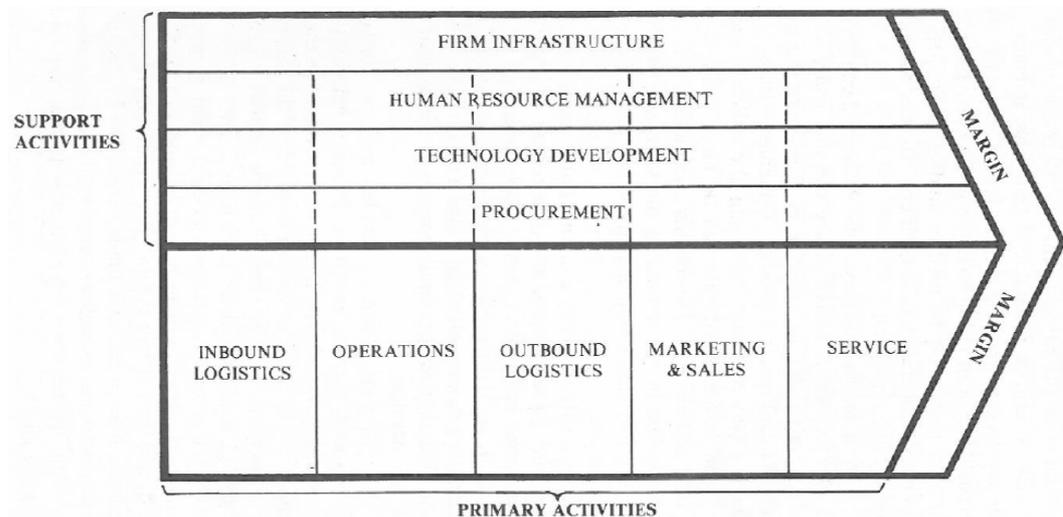
#### 3.1 Value chain of an organization

Porter's value chain is a tool for examining activities that a firm performs and how they interact. Doing this in a systematic way is necessary for analyzing the sources of competitive advantage. In the value chain a firm is divided into its strategically relevant activities, so that the behavior of costs and the existing and potential sources of differentiation can be understood. (Porter 1987, p. 33) The value chain framework can be more easily understood when implemented for companies that produce a physical product, but it can be used for service companies as well.

According to Porter's value chain model, a "firm is a collection of activities that are performed to design, produce, market, deliver, and support its product". These activities can be presented with the help of the generic value chain. (Porter 1985, p. 36) Value chain rather than value added should be used when examining competitive advantage. Value added is sometimes used as a measurement for cost analysis, because it is viewed as "the area in which a firm can control costs". However, value added is not a reasonable basis for cost analysis, since it incorrectly distinguishes raw materials from other purchased inputs that are used in a firm's activities. Also, value added does not highlight linkages between a firm and its suppliers that can provide insight into reducing cost or enhancing differentiation. (Porter 1985, p. 39)

When identifying activities, it is important to separate activities that are technologically and strategically distinct. Value activities and accounting classifications are very often different. Activities with same disparate technologies can be

grouped together, and costs that are a part of the same activity can be separated in accounting classifications. (Porter 1985, p. 39)



**Figure 4.** Generic value chain (Porter 1985, p. 37)

Value activities are divided to primary and support activities, as presented in figure 4. The five primary activities (bottom part of the figure) can be distinguished in a company competing in any industry and they are: inbound logistics, operations, outbound logistics, marketing & sales, and service. Each of these generic activity categories can be divided into distinct activities that depend on the industry the company is in and also the strategy of the firm. Primary activities are the activities that are done to produce the final physical product, to sell it and also to transfer it to the buyer. After-sale service is also included in these primary activities. (Porter 1985, p. 38)

Depending on the company and the industry it is working in, each of the categories of activities can be vital to the competitive advantage of the company, and some categories can be even largely nonexistent. Inbound logistics are activities that are associated with receiving, storing and delivering inputs to the product. They can include material handling, warehousing, vehicle scheduling and returns to suppliers. Operations activities are connected to transforming inputs into the

final product form. These activities can be for example machining, assembly, packaging, equipment maintenance, testing, and printing. (Porter 1985, p. 39-40)

Outbound logistics is a category of activities that is related to collecting, storing, and physically distributing the product to buyers. Examples of these activities can be finished goods warehousing, material handling, delivery vehicle operation, order processing and scheduling. Marketing and sales activities enable customers to buy the product and also persuade them to do so, and contain activities such as advertising, promotion, channel relations and pricing. Service activities provide maintenance or enhancing the value of the product. These activities include installation, repair, training, supplying spare parts, and adjusting the product. (Porter 1985, p. 40)

Support activities (top part of figure 4) are divided into four categories, which are procurement, technology development, human resource management and firm infrastructure. Like primary activities, each of the support activity categories can be divided into distinct activities. Procurement includes activities such as choosing suppliers, procurement of inputs for products, and assessment of supplier performance. Technology development means activities that are related to know-how, procedures or technology that is needed to produce a product. They can be for example different types of design functions, field testing, media research and process engineering. (Porter 1985, p. 41)

Human resource management contains activities that involve recruiting, training, and compensation of personnel. Both primary and support activities are supported by human resource management. Firm infrastructure contains activities like general management, planning, finance, accounting, legal, government affairs, and quality management. Unlike other support activities, infrastructure activities typically support the whole value chain. (Porter 1985, p. 42-43)

When defining value activities, activities with discrete technologies and economics need to be separated. Broad functions should be divided into smaller activities.

Subdividing activities can be continued to increasingly narrow activities that are discrete to some degree. The number of potential activities can be large, because every machine in a factory can be regarded as a separate activity. Basically, activities should be separated from each other if they have different economics, have a high potential impact of differentiation, or represent a significant proportion of cost. (Porter 1985, p. 45)

Everything that a company does should be labeled as either primary or support activities. Deciding on categorization of activities cannot be done totally objectively, so defining of the value chain needs to be done in a way that represents the business the best. Labeling activities can be problematic especially in service industries, where operations, marketing and after-sale support are often closely tied. (Porter 1985, p. 48)

The value chain consists of a number of value activities, but they are not independent of each other. The value chain is a system of interdependent activities that are related by linkages to each other. The way one value activity is performed can have an effect on the cost or performance of another. (Porter 1985, p. 48) Linkages between primary and support activities are more obvious, while linkages between primary activities can be more subtle (Porter 1985, p. 49). For example purchasing higher quality raw materials with a higher cost can reduce costs and increase performance by reducing scrap further in the value chain.

### **3.2 Inter-organizational value chain**

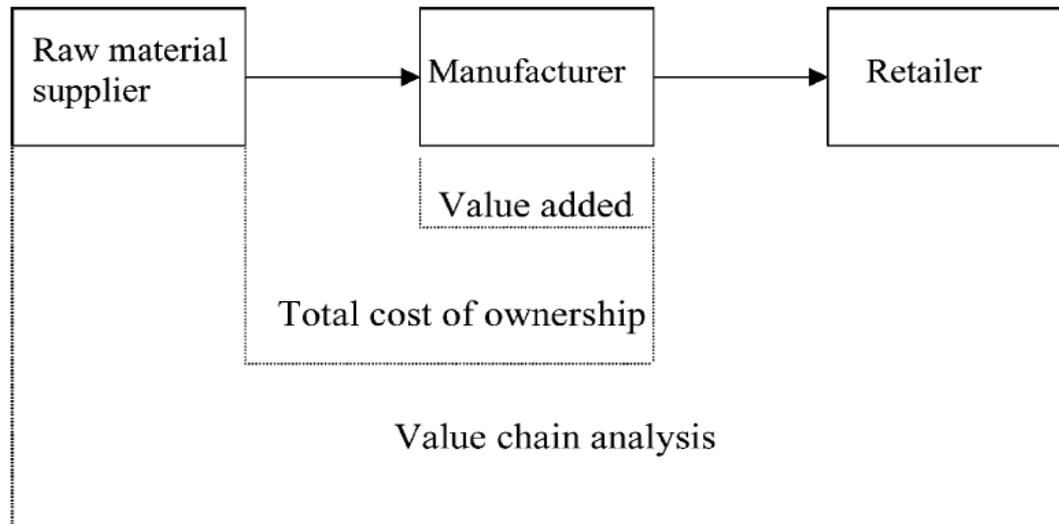
A value chain is a part of a larger stream of activities, a value system. Suppliers do not only deliver a product, but they can also have an influence on a firm's performance in many other ways. After going through a firm's value chain, a product becomes a part of the buyer's value chain. It is possible for a firm to compete in related industries with coordinated value chains by making use of interrelationships. Benefits of broader scope can be exploited internally or a firm can form

coalitions with other firms to do so. Coalitions are long-term alliances such as joint ventures, licenses and supply agreements. (Porter 1987, p. 34)

In a coalition value chains are coordinated or shared with coalition partners. Coalitions involve long-term agreements, which can make it easier to coordinate activities with a partner than with another independent firm. In a coalition, activities can be shared without entering new industry segments or geographic areas. The benefit is that in a coalition it is possible to broaden the effective scope of the firm's chain without broadening the firm. (Porter 1985, p. 57)

Linkages between activities exist not only within a firm's value chain, but also between a firm's value chain and the value chains of its suppliers and channels. These are called vertical linkages, and with them the relationships between the performance of supplier or channel value activities and a firm's activities can be recognized. Vertical linkages can provide opportunities for a firm to enhance its competitive performance, and common benefits can be sought through jointly optimizing the performance of activities or by improving coordination between the value chains of a firm and its suppliers. It is important to notice that these linkages are not a zero sum game where one loses if the other wins, but in such relationships both parties can gain. (Porter 1985, p. 50-51) Al-Mudimigh et al. (2004, p. 310) note that around years 1960 to 1975, vendor relationships were still "win-lose interactions, and many times adversarial".

Porter's (1985) value chain has been further developed and Dekker (2003, p. 2) considers the value chain to be a chain of activities that starts from basic raw materials and ends at the end-customer. Value chain analysis (VCA) is performed by taking into account not only one company, but also its suppliers and buyers, and possibly their suppliers or buyers. In this kind of value chain analysis, interdependencies of activities and costs are sought to be recognized. (Dekker 2003, p. 6) In other words, "VCA is a mechanism that facilitates the optimization and coordination of interdependent activities in the value chain, which may cross organizational boundaries" (Dekker 2003, p. 5).



**Figure 5.** A comparison of the value added, total cost of ownership and value chain analysis concepts for a three-firm value chain (Dekker 2003, p. 6)

The scope of value chain analysis used by Dekker (2003) is presented in figure 5. The objective of the value added perspective is to maximize the difference between the purchasing cost and selling price. An essential downside of analyzing only value added is that it does not provide insight into linkages in the wider value chain and so leaving out possibilities of reducing cost or enhancing differentiation (Porter 1985, p. 39, Dekker 2003, p. 5, Shank & Govindarajan 1992, p. 182). A wider perspective, total cost of ownership, accounts for “costs that are caused by buying at a certain supplier, such as costs of ordering, delivery, quality and administration”, and includes only the buyer’s costs in the analysis without a wider perspective of the value chain. In VCA, activities and costs of other firms in the value chain are included and analyzed and interdependencies of these activities and costs are recognized. (Dekker 2003, p. 5-6) In order to gain and sustain competitive advantage, a firm needs to understand the entire value creation and delivery system and not only the part of the value chain in which it works in (Shank & Govindarajan 1992, p. 180).

VCA can be done by one company “taking an external perspective” or by joint analysis with buyers and suppliers. In order to perform a joint analysis with buy-

ers and suppliers, willingness of cooperation firms is required so that cost and performance information can be shared. A joint analysis leads to a broader scope than internally oriented VCA, because then higher accuracy cost information can be acquired than when the analysis is done with an external perspective by only one firm of the value chain. Buyers and suppliers may agree to a jointly performed VCA if they find that it would benefit them to manage the supply chain more effectively in cooperation with other firms in the supply chain. However, often firms do not take part in jointly performed VCA because of concerns of opportunistic behavior and appropriation arising from sharing sensitive information and joint action in the supply chain. Firms will not agree to exchange private information unless they can be sure that it will not be used against them. (Dekker 2003, p. 7-8) To reduce concerns about the use of sensitive information, clear agreements can be made on how the shared information and the VCA results will be used (Dekker 2003, p. 19).

Al-Mudimigh et al. (2004) use the term Value Chain Management (VCM) when referring to optimization of the value chain. The benefits they mention from implementing VCM are developing the value proposition of the value chain, developing synergy levels and seamlessness between activities, creating customer focus and improved information flow, as well as developing partnerships with suppliers and other stakeholders. (Al-Mudimigh et al. 2004, p. 312) Implementation of VCM requires a clear emphasis on co-operation and collaboration, as well as a new way of behaving regarding sharing of information in order to be effective. This is especially the case in development plans. (Al-Mudimigh et al. 2004, p. 319)

Changes of increasing collaboration have been noticed also in the supply chain research literature. Relationships are becoming closer and more collaborative, and their aims are in improving the competitiveness of the whole supply chain. These changes are initially supported by information sharing. However, cost management tools that cross company boundaries are not easily applied during the early stages of supply chain development. (Chivaka 2006, p. 307) Use of management

accounting tools seems to be preceded by drawing participants of the supply chain together and deploying collaborative practices (Chivaka 2006, p. 310). Factors that enable closer relationships in a supply chain are mostly mutual trust and information flows between firms (Stuart & McCutcheon 2000, p. 40)

## 4 CURRENT BUSINESS ENVIRONMENT

In this chapter the current business environment around marine litter recovery is presented. The chapter includes treaties and regulations regarding marine litter on different levels and actors in the UK who are somehow related to marine litter. The treaties and regulations considered here are international level or national level treaties or regulations. The actors presented are in the UK, with an emphasis on South West England. Fishermen, ports and waste contractors of ports are examined together with Fishing for Litter because in the following chapters they have only minor or inexistent roles in the proposed marine litter waste management PPP. NGOs arranging beach cleaning operations are discussed to show how public authorities are working with them to provide services that are the responsibility of local authorities.

### 4.1 Introduction to marine litter

The total cost of marine litter removal from beaches to coastal municipalities in the UK is approximately 18 million pounds per year, representing an increase of 37 % in the past 10 years (KIMO 2010b, p. ii). Marine litter causes significant costs also for fishing vessels. In Scotland the costs for the fishing fleet are between 11,7 million and 13 million € (£ 9,8 – 10,9 million) and are caused by for example restricted catch due to marine litter, contaminated catch, or fouled propellers and blocked intake pipes (KIMO 2010b, p. iii).

According to a survey performed by KIMO on coastal municipalities to which 19 municipalities answered, the mass of litter removed from beaches varied between 1 to 12 000 tonnes, and amounted to almost 22 000 tonnes in total. However, the impact of litter in beaches is not directly related to its mass. The most harmful impact is often the visual impact, as small pieces of rope are very light but have a very high visual impact. (KIMO 2010b, p. 36) In Marine Conservation Society's Beachwatch Big Weekend surveys from years 2006 to 2009 South West England has had the most marine litter items collected per km of beach out of UK regions,

ranging from 3186 items/km in 2006 to 4783 items/km in 2008 (Marine Conservation Society 2011, p. 18).

Marine litter consists mostly of plastics. According to different studies, the proportion of plastic items in marine litter analyzed from beaches, harbors, shoreline, surface waters and the sea floor varies between 60 % and 80 % of total items of marine litter. Usual entering routes for plastic debris are fishing fleets dumping fishing gear and other synthetic packaging material, and merchant ships dumping plastic containers into the seas. Ships are estimated to discard 6,5 million tonnes of plastic per year into the seas. (Derraik 2002, p. 843) According to the National Oceanic and Atmospheric Administration (NOAA 2011a) of the United States, there has not been a comprehensive research done on the total amount of marine debris in any ocean, partly because a standardized marine debris monitoring method is not available.

About 80 % of marine litter comes from land-based sources (Sheavly & Register 2007, p. 302), and the rest comes from dumping of waste into the sea and other activities such as fishing. According to another estimate, recreational fishing and boats are estimated to dispose of approximately 52 % of rubbish dumped in the United States waters. Plastics are also left behind by beachgoers, and they can reach the sea also through rivers and municipal drainage systems. Plastic debris consists of not only larger items of litter, but also from small plastic pellets that are used as raw material for plastic manufacturing, which get into the marine environment through accidental spillage during its transport and handling. (Derraik 2002, p. 843)

Because plastics are buoyant, large amounts of plastic debris can travel long distances before finally sinking to the bottom of the sea, where these sediments can persist for centuries. The vastness of oceans has lead people to dismiss the fact that the increase of plastic debris is an environmental hazard. (Derraik 2002, p. 842) Beaches in the Southern Pacific islands have comparable amounts of marine

litter to amounts in beaches in the modernized western world (Derraik 2002, p. 844), even though they are far away from the original sources of litter.

In the United States there are at least two inter-organizational cooperative projects aiming at reducing the amount of discarded or lost fishing nets in the seas and using them to produce energy. The first one is in Hawaii, where derelict fishing nets are collected from reefs and shores, which are then transported to be chopped by a scrap metal recycling company, and then incinerated in an energy from waste (EfW) facility (NOAA 2011b). The second project is active in several states, providing fishermen a place to dispose of derelict fishing nets that they come across during their fishing activities for no cost, after which they are disposed of in an EfW facility (NOAA 2011c).

A problem with information about marine litter on a certain area such as Devon and Cornwall is that no comprehensive information sources are available. For example amounts of marine litter and its composition are often measured only by the numbers of items instead of by mass. Pieces of information can be found from different sources, but a comprehensive view on marine litter on a certain geographical area is highly dependent on the availability of information.

## **4.2 Marine litter international agreements**

There are several internationally agreed conventions and treaties that regulate disposal of waste into the marine environment. The most important ones are the MARPOL 73/78, the London Convention, several EU directives such as the EU Marine Strategy Framework Directive, the United Nations Food and Agriculture Organization Code of Conduct for Responsible Fisheries, the OSPAR convention and the Global Initiative on Marine Litter of the United Nations Environment Programme. The international, EU and national level regulations are presented in table 3.

**Table 3.** International, EU and national level marine litter agreements and regulations

<b>International</b>	<b>EU</b>	<b>National</b>
International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL 73/78)	Marine Strategy Framework Directive (2008/56/EC)	Transposed Marine Strategy Framework Directive
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (London Convention)	EC regulation on European Fisheries Fund (1198/2006/EC)	Marine and Coastal Access Act 2009
United Nations Food and Agriculture Organization Code of Conduct for Responsible Fisheries (UFAO Code of Conduct)	Directive on the landfill of waste (1999/31/EC)	Environmental Protection Act 1990
Convention for the protection of the marine environment of the North-East Atlantic (OSPAR)	Directive on port reception facilities for ship-generated waste and cargo residues (2000/59/EC)	Urban Waste Water Treatment Act
Global Initiative on Marine Litter of the United Nations Environment Programme	Waste Framework Directive (2008/98/EC)	

MARPOL 73/78 is the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978. The regulations of the convention are aimed at preventing and minimizing pollution from ships. The annex V (Prevention of Pollution by Garbage from Ships) of MARPOL 73/78 prohibits the disposal of plastics in all sea areas, and also some other types of garbage in special areas, to which the North Sea belongs. (IMO 2011a)

The London Convention, meaning the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972, has an objective to “promote the effective control of all sources of marine pollution and to take all practicable steps to prevent pollution of the sea by dumping of wastes and other matter”. The Convention was further modernized with the London Protocol in 1996. The protocol prohibits all dumping of waste, with only some exceptions for possibly acceptable wastes. (IMO 2011b) Its article 5 also prohibits incineration of waste and other matters at sea (IMO 2010, p. 5). Article 14.1 states that “Contracting Parties shall take appropriate measures to promote and facilitate scientific and technical research on the prevention, reduction and where practicable elimina-

tion of pollution by dumping and other sources of marine pollution relevant to this Protocol” (IMO 2010, p. 11).

The Global Initiative on Marine Litter of the United Nations Environment Programme aims at establishing and developing pilot regional activities in regions that are particularly affected by marine litter (UNEP, Regional Seas Programme). The initiative provides a platform for the management of the marine litter problem by establishing partnerships, cooperative arrangements and coordination of joint activities. The main partners include government representatives, the private sector, NGOs and donor agencies and organizations among others. (UNEP 2009, p. 7)

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The OSPAR Convention is the Convention for the protection of the marine environment of the North-East Atlantic which was signed in Paris on 22 September 1992. The EU became a contracting party of the convention with the Council’s Decision 98/249/EC and it came into force in 1997. One of the duties of the commission set up by the convention is to “to draw up programmes and measures for the prevention and elimination of maritime pollution” According to the convention, the parties take all possible steps to prevent and eliminate pollution of the maritime area from land-based sources, pollution by dumping or incineration of wastes or other matter and pollution from offshore sources. (Europa 2006)

Taking care of the marine environment is of increasing importance in the European Union. EU level regulations concerning marine litter are defined in the Marine

Strategy Framework Directive (MSFD) (2008/56/EC). At the moment the MSFD is the most essential regulation concerning marine litter in the European Union, since it clearly states that marine litter is one of the descriptors that determine Good Environmental Status (GES) in the marine environment. The descriptor of GES for marine litter is Descriptor 10 in Annex I and it states that GES is reached when “properties and quantities of marine litter do not cause harm to the coastal and marine environment”. Each Member State is responsible for achieving and maintaining GES in their territory by 2020.

The European Council Regulation on the European Fisheries Fund (EFF) (EC 1198/2006) Article 37 states that: “The EFF may support measures of common interest which are implemented with the active support of operators themselves or by organisations acting on behalf of producers or other organisations recognised by the Member State and which aim, in particular, to: ... (c) remove lost fishing gear from the sea bed in order to combat ghost fishing ... (h) investments concerning production, processing or marketing equipment and infrastructure including for waste treatment”. European Commissioner on Maritime Affairs and Fisheries, Maria Damanaki, has said that “the European Fisheries Fund offers now to fishermen and stakeholders the possibility to develop projects that may contribute to the preservation of the marine environment, such as for instance through ‘fishing for litter’ initiatives” (Damanaki 2011b, p. 3).

Other EU directives that are related to marine litter are the Directive on the land-filling of waste (1999/31/EC), which applies to litter from landfills that enters the seas becoming marine litter, the Directive on port reception facilities for ship-generated waste and cargo residues (2000/59/EC), which addresses different operators that are involved delivery of waste in ports (Janssen 2010, p. 13). The Directive on waste, also called as Waste Framework Directive (2008/98/EC) sets some basic waste management principles requiring that waste must be managed without endangering human health and endangering the environment (European Commission 2012). It also introduces the “polluter-pays principle”, which states

that the costs of disposing waste must be paid by the original waste producer or by the current or previous waste holders

EU directives that are not directly about marine litter, but contain provisions that affect marine litter so they are presented here for completeness. They are (KIMO 2010b, p. 25):

- EU Bathing Water Directive (76/160/EEC and 2006/7/EC)
- EC Urban Waste Water Treatment Directive (91/271/EEC and 98/15/EC)
- EU Environmental Liability Directive (2004/35/EC)
- EU Directive on Packaging and Packaging waste (2004/12/EC).

As a conclusion from the internationally agreed treaties, there is a common understanding between governments and international organizations such as the UN that collaboration is needed in taking care of the marine litter problem. Mostly the regulations concentrate on preventing litter from reaching the marine environment, but some also address the question of what should be done once the damage has already been done and litter is in the marine environment. Controlling that these treaties and regulations are actually followed is however difficult to survey.

### **4.3 Marine litter national regulations**

Because directives of the European Commission are not effective in each Member State directly, they need to transpose the directives into their own national legislation. In the case of the MSFD this means that the determination of GES and associated targets and indicators mentioned in the MSFD will be determined by the Member States themselves. Nevertheless, all EU directives have to be transposed into the national legislation. According to the Department for Environment, Food and Rural Affairs (DEFRA 2010, p. 30), the indicators and targets for GES will be agreed on in the UK by July 2012. Plans for implementation of measures to reach GES are to be ready by the end of 2015 and the measures have to be put into action by the end of 2016 (DEFRA 2010, p. 32).

The MSFD was transposed to the UK legislation as it is and it became law in 2010 and now the actions related to the MSFD are about its implementation. Scotland and Wales have their own administrative bodies that define the appropriate measures for their own coastal waters, but it is still done in conjunction with the central government. A common UK Marine Monitoring and Assessment Strategy has been developed and also in this strategy Scotland and Wales apply monitoring fit to purpose and the appropriate measures with the central government. (Rendell 2012)

The national law in the UK concerning the marine environment is the Marine and Coastal Access Act 2009. It provides a planning system for managing coastal areas. The system aims at securing economic growth, environmental protection and also support for communities. (DEFRA 2011) Marine litter is treated also in the Environmental Protection Act 1990 and the Urban Waste Water Treatment Act (Rendell 2012). The Environmental Protection Act 1990 states that in England the principal litter authorities are county councils, county borough councils and district councils.

According to the current marine litter regulations, litter that is already in the sea is not public authorities' or anybody else's responsibility to be collected. Only litter that washes up on the shores needs to be disposed of by the landowner. (Singleton 2012) The Environmental Protection Act states that local authorities are responsible for keeping land areas clean of litter, but no public authority is responsible for litter in water areas, because the Environmental Protection Act does not apply to areas below the mean high water mark (Rendell 2012).

As a conclusion from international and national regulations on marine litter, there are no responsibilities on the local level for public authorities to organize or support operations to collect marine litter from the sea, unless it washes up on shores. This is the case despite international agreements on dealing with marine litter and the support for initiatives such as "fishing for litter" as mentioned by Member of the European Parliament, Maria Damanaki.

#### **4.4 Waste hierarchy**

Waste incineration is a preferred waste treatment method compared to landfilling. This is stated in the EU legislation where the Waste Framework Directive (2008/98/EC) article 4 states a waste hierarchy that applies as a priority order in waste prevention and management legislation and policy. The preferred order of waste treatment methods in the waste hierarchy is as follows:

1. prevention
2. preparing for re-use
3. recycling
4. other recovery, e.g. energy recovery
5. disposal.

The Waste Framework Directive also determines the definitions for waste treatment methods. The article 3 states that waste treatment means recovery or disposal operations. Recovery means “any operation the principal result of which is waste serving a useful purpose” and annex II specifies that recycling as well as use as a fuel or other means to generate as energy is regarded as recovery. Definition for disposal in article 3 is “any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy”, and annex I specifies that landfill is a disposal method. In short this means that recycling and incineration with energy generation are considered as recovery methods and landfilling as a disposal method.

The EU waste management principles that are closely related to the waste hierarchy are broad guidelines for waste treatment in the European Union. These are (European Commission 2011):

1. Waste prevention
2. Recycling and reuse
3. Improving final disposal and monitoring.

Waste prevention includes improving of manufacturing methods and encouraging people to prefer greener products and less packaging. Materials from the waste that cannot be prevented should be recovered as much as possible, preferably by recycling. EU directives require Member States to include waste collection, reuse, recycling and disposal into their legislation. When reuse or recycling is not possible to be used, which is often the case for marine litter, waste should be safely incinerated, and waste landfill should be used only as a last resort. Both incineration and landfills need to be closely monitored because they have the potential of causing severe environmental damage. Landfilling of certain types of waste, such as tires for example, is banned, and targets have been set for reducing biodegradable waste deposited in landfills. Also waste incineration is strictly regulated, and tough limits have been set for waste incineration emissions. (European Commission 2011)

Because the use of waste landfills as a final solution is the least preferred option, in the UK there is a landfill tax that greatly increases the costs of landfills. The purpose of the tax is to encourage people to produce less waste and to use other waste management options than landfills. The amount of the tax is 56 £/tonne starting from April 2011 and it increases by 8 £/tonne each year at least until year 2014. (Business Link) The landfill tax and its augmentation increase interest towards recycling and waste incineration.

#### **4.5 Fishing for Litter**

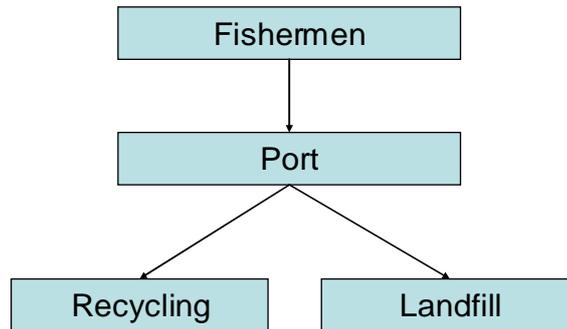
Fishing for Litter South West (FFL SW) is a project in South West England in which local fishermen are collecting litter caught in their fishing gear during their normal fishing activities. The deposit of the litter to ports is done free of charge and the rest of the waste treatment is organized by Fishing for Litter. So far this project has been launched in Scotland, Belgium and the Netherlands. (KIMO 2009b) In the year 2011 a similar project has been started in Heiligenhafen and Burgstaaken, Germany, with the cooperation of Naturschutzbund Deutschland, ZVO and Duales System Deutschland (NABU 2011).

KIMO (Kommunenes Internasjonale Miljøorganisasjon, Local Authorities International Environmental Organisation) is an organization that represents over 120 coastal municipalities in marine pollution issues. The organization was founded because tackling the marine pollution problem requires international coordination. (KIMO, Learn About Us) KIMO works through lobbying, research and demonstrative projects such as Fishing for Litter (KIMO, What We Do).

The previous project of FFL SW period was between years 2008 and 2011, and at the end of the project period it included 110 fishing vessels and 6 ports (Crosbie 2011). It is funded by Cornish Fish Producers' Organisation, Crown Estate, Marine and Fisheries Agency, Duchy of Cornwall, Environment Agency, Esmée Fairbairn Foundation and Natural England (KIMO 2009c). The project had applied for funding from the European Fisheries Fund, but the application was turned down when it did not receive enough support from the deciding board (Crosbie 2012). However, the project has secured funding for another period of 3 years starting from year 2011 (Crosbie 2011).

The fishermen do not receive a financial compensation for their work, because FFL is a project to encourage good practice so it is not seen necessary (Crosbie 2012). In France, financial compensations have been granted from the European Fisheries Fund to provide small scale fishers income from collecting litter and lost fishing gear, especially during spawning times when they are not allowed to fish (Damanaki 2011a).

In FFL SW, the collection of litter has already been organized in six ports in South West England: Appledore, Brixham, Looe, Newlyn, Newquay and Plymouth (KIMO, Participating Harbours). A map of ports in South West England can be found in appendix 6. More ports have expressed their interest in joining the project, but because of limited resources of the project, the amount of ports participating in the project has so far not been increased (KIMO 2011, p. 10).



**Figure 6.** Material flow in marine litter supply chain

Marine litter material flow of FFL is presented in figure 6. As fishermen are doing their normal fishing activities in the sea, litter gets caught in their nets. Instead of throwing it back into the sea, they collect the waste into large hard-wearing plastic bags provided by FFL. When the bag is full, it is brought to port and deposited in a waste container provided to the port by FFL. Ports provide space for the skips in which the marine litter container bags are deposited. They also take care that no other waste is deposited in them other than marine litter by keeping the skips locked at appropriate times (Piper 2011).

Litter collected by fishermen taking part in FFL is recycled when possible. A large part of the waste is not suitable for recycling because it is contaminated by sea growth so the waste ends up in a landfill. The FFL project coordinator analyzes the litter in Newlyn port and collects data on its composition. Metal that can be recycled is separated by the port staff. (Crosbie 2012)

On the EU level it is stated that waste incineration is a preferred waste treatment method when compared to landfilling, even though recycling is higher up the hierarchy. However, recycling of marine litter is often not possible because of its contamination. Therefore, possibilities of waste incineration should be considered.

Waste disposal in FFL has so far been handled by the same waste companies that are taking care of each port. The waste containers in ports are provided by the

waste company, and the project coordinator contacts them when they are full and need to be emptied. The waste disposal costs are subsidized by the public authorities. Ports have more advanced recycling methods than what is available for FFL, so partnerships are sought in segregation of waste and recycling. (Crosbie 2012)

In Fishing for Litter Scotland there has been an interest towards closer cooperation between the project and waste treatment companies, but so far the waste treatment companies do not take part in FFL in other ways than receiving marine litter in exchange for a fee. Depositing of the collected marine litter causes most of the costs of the project, and the costs are rising because of landfill taxes that are imposed by the government in order to redirect waste from landfills to other means of waste disposal. Waste incineration companies have been reluctant to receive marine litter because of its too high calorific value compared to their usual fuel. The high calorific value is mostly caused by a high concentration of plastics. (Piper 2011)

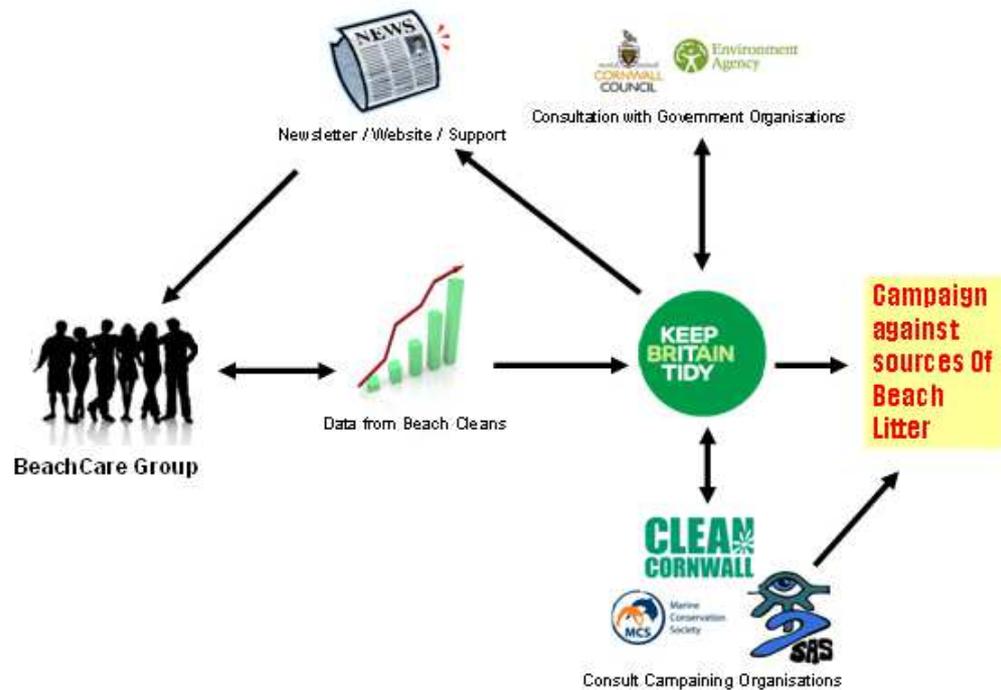
Article 14 of the Waste Framework Directive (2008/98/EC) introduces the polluter-pays principle, stating that “in accordance with the polluter-pays principle, the costs of waste management shall be borne by the original waste producer or by the current or previous waste holders”. The objective of this principle is to have the original polluters accountable for creating waste. The landfill tax aims to the same objective. However, when considering FFL the objective is not reached because the costs of waste treatment and extra costs from the landfill tax fall on the project that is cleaning the marine environment of litter.

#### **4.6 Beach cleaning operations**

Public beaches are mainly cleaned by contractors of the municipalities and voluntary groups. At the moment there are mostly two big organizations that are running beach cleaning programs and get public funding, Marine Conservation Society and Keep Britain Tidy. In addition to them, there are many smaller organizations that engage in beach cleaning. (Singleton 2012) In some municipalities, the

local authorities themselves do not directly clean the beaches, but provide assistance and resources for volunteer groups to do the cleaning (KIMO 2010b, p. 33). However, now the funds for beach cleaning programs are being cut and the organizations are trying to provide the same service with less funds (Booth 2012).

The main options for disposal of marine litter collected from beaches are landfill, recycling and incineration. Many municipalities use a combination of these methods. Landfill is the most common method of marine litter disposal (88,5 % of municipalities), recycling being the second most common method (43,4 % of municipalities). Incineration is used by 17,3 % of municipalities. (KIMO 2010b, p. 36) The use of incineration as a marine litter disposal method is affected by the availability and proximity of waste incineration facilities. As the amount of EfW facilities and the rate of waste incineration for municipal waste in the UK have been fairly low, it is not surprising that only a small part of municipalities inform incineration as one of the waste disposal methods for marine litter.



**Figure 7.** The BeachCare process (Keep Britain Tidy)

BeachCare is a project that organizes litter picking in beaches and is managed by Keep Britain Tidy in partnership with Cornwall Council, South West Water, and

the Environment Agency. The project also monitors the states of beaches, giving a picture of the general state of beaches, as presented in figure 7. Monthly sessions of monitoring gives important information about what factors, such as wind and tide, have an effect on litter levels in beaches. The data is then used in campaigning about the marine litter issue and is also shared with partnering organizations. (Booth 2012)

According to a survey from Marine Conservation Society, sewage related waste such as cotton bud sticks and sanitary towels made up about 7 % of total waste in Beachwatch surveys in 2010. Cotton bud sticks are so small that they go through the mesh screens of most water treatment plants, and make up a majority (60 – 80 %) of sewage related waste found in beaches. (Marine Conservation Society) This kind of information gathered from beach cleaning operations is used for informing the general public about how they should change their behavior to prevent litter from entering the marine environment.

#### **4.7 Public authorities**

Department for Environment, Food and Rural Affairs (DEFRA) is the UK government department responsible for policy and regulations on the environment, food and rural affairs and it is the leading government body in marine litter matters. It was responsible for transposing the MSFD into the national legislation and now it is responsible for its implementation. Adding the MSFD to the national legislation was less about adding new things into the legislation and more about filling the gaps that existed in the legislation before the MSFD. The goal of DEFRA is more about measures to prevent litter from reaching the marine environment in the first place, because about 80 % of marine litter is originally land-sourced. (Rendell 2012)

The goals of Good Environmental Status (GES) stated in the Marine Strategy Framework Directive concerning marine litter are set in qualitative terms because of difficulty in determining an adequately low level for litter and monitoring it in the seas. The marine environment will never get to a state where it is free from

waste, so the goals are set for waste levels that are acceptable. Targets are more helpful when they are set for levels that are clearly decreasing over time, and they can be reached by preventing litter from entering the marine environment. (Rendell 2012)

So far the local or regional authorities have been active in marine litter recovery mostly by arranging beach cleaning operations in public beaches by using contractors and supporting NGOs in their beach cleaning operations in terms of funding, providing vehicles, bin bags, equipment and supervision. (Singleton 2012) The Cornwall Council has also been in cooperation with the Marine Conservation Society by sharing information about marine litter (Sharpe 2012). The Maritime and Coast Guard Agency is responsible for safety of life at sea, so if there are some big items in the sea that cause danger to marine transport, they are assigned to take care of the problem (Rendell 2012).

Cornwall Council has come up with a Maritime Strategy in order to bring together different organizations focusing on coast and marine issues. The Maritime Strategy suggests a development of a Cornwall Maritime Forum that would provide several kinds of services, such as “to create a network of informed maritime stakeholders across all maritime sectors”. The strategy also states that the coordination, development and delivery of the Maritime Forum and its services need to demonstrate cost-effectiveness and partner working (Cornwall Council 2011, p. 19-20)

Devon County Council’s Role and Action Programme 2008-2011 has similar objectives. Partnership working and sharing of resources, expertise and responsibilities are mentioned as ways to achieve added value in the pursuit of objectives related to the marine environment and the action planning process. The actions to be taken must be monitored to justify the expenditure of resources. (Devon County Council 2008, p. 19) In comparison to Cornwall, Devon already has a Devon Maritime Forum which was founded in 2005 and its purpose is to join people and or-

ganizations that have an interest in the coast and seas in Devon (Devon County Council 2008, p. 14).

To conclude, higher level authorities like DEFRA concentrate on preventive measures such as raising awareness of the marine litter problems to the general public and tackling marine litter at source. Raising awareness programs are done in collaboration with NGOs. The local or regional authorities put out reactive measures and support preventive measures with NGOs as well. When interviewing different public authorities, there seemed to be no precise view on what legislation exactly concerns marine litter, but the interviewees did explain what their responsibilities related to marine litter are. Cleaning the sea of marine litter once it is already there does not belong to those responsibilities. Based on the maritime strategies of Cornwall Council and Devon County Council it can be noticed that there is an increasing interest in maintaining and developing the maritime environment by partnerships, sharing of resources and information, and other cost and resource effective means.

#### **4.8 MVV and waste incineration**

MVV has an Energy-from-Waste (EfW) plant under construction in Plymouth. The EfW plant is a part of an infrastructure type of PPP. It is planned to be constructed and in operation in year 2014. The plant will be using municipal solid waste (MSW) as fuel for combined heat and power production.

Waste incineration has both high investment costs per produced MW, and high operational costs per MWh. In Switzerland for example, investment costs are around 1400 € per tonne of annual burning capacity in Switzerland (Lemann 2008, p. 365). Because of increasingly strict environmental restrictions on waste incineration emissions, additions need to be made to the incineration process. These include flue gas cleaning, dioxin and furan precipitation, denitrification and further residue treatment (Lemann 2008, p. 116). Typically flue-gas purification and treatment of residues account for approximately 20 – 40 % and 10 – 25 %, respectively.

respectively, of total investments of a municipal waste treatment plant (Di Chirico 1996, p. 69).

Even though waste is fuel for a waste incineration facility, it does not pay for it, but gets paid for accepting it. The investment costs needed for a municipal waste treatment plant far exceed the income earned from selling produced heat recovered from waste (Di Chirico 1996, p. 68). Without additional revenues in the form of waste fees from waste suppliers, waste incineration is not a profitable business (Lemann 2008, p. 366). High investment and operating costs cause a need for additional income in addition to revenues from sold heat and electricity. Waste suppliers pay the waste incinerator in the form of a gate fee for bringing in the waste to the plant.

As incineration is a form of recovery of waste and landfilling is a form of waste disposal according to the EU Waste Framework Directive, waste incineration should be preferred also in marine litter waste treatment. In order to find out if waste incineration would be a reasonable alternative for marine litter treatment, it needs to be determined if it is financially feasible to incinerate marine litter in an EfW facility that normally uses MSW as fuel.

#### **4.9 Conclusions**

Some conclusion can be made from the current business environment. A stakeholder map of the current marine litter business environment is presented in table 4. One of the biggest problems in organizing marine litter recovery from the sea and its further treatment is lack of resources. Fishing for Litter receives funding and support from the local authorities, but not in the same way as beach litter organizations. Responsibility or the lack of it of public authorities is a major reason for the unequal treatment of beach cleaning projects such as Keep Britain Tidy and marine litter recovery from the sea like FFL. Local authorities have a legal responsibility to keep the beaches clean of litter and they want to keep the coastal areas attractive for tourists who bring money into the coastal communities, but

this kind of a responsibility ends at the high water mark so marine litter recovery from the sea does not belong to responsibilities of public authorities.

**Table 4.** Stakeholder map of current marine litter business environment

Actor	Services provided	Services received/needed
Beach collecting NGO	Organizing beach collection Assisting public authorities in their responsibilities Gathering and sharing marine litter related information	Funding
Litter pickers	Labor	Cleaner environment
Fishing for Litter	Organizing marine litter collection Gathering and sharing marine litter related information	More resources Better waste treatment Partners in waste treatment
Port	Space for litter storage Link to fishermen in the port	-
Waste company	Waste treatment	
Public authority	Waste treatment funding (FFL) Waste treatment (beach cleaning) Support	Responsible for cleaning public beaches
Charity funds	Funding	-

The costs of treatment of waste that is collected from public beaches by these NGOs are covered by local authorities. In comparison, the waste treatment of waste from the FFL project is subsidized by local authorities, but still paid from the budget of FFL. The landfill tax increases the waste treatment costs of FFL. There has been an interest to have waste companies as partners, but so far they have been only disposing of the waste in exchange for a fee. Because ports have better recycling possibilities than what is at the moment available for FFL, there might be a way for both FFL and ports to benefit from cooperating in recycling marine litter. Due to the nature of the marine litter it is often not suitable for recycling and most of it goes to a landfill. As incineration is a preferred method of waste treatment, its feasibility for marine litter treatment should be considered.

There has been a significant rise in total beach cleaning costs during the past decade, but at the same time budgets of beach cleaning operations are cut. This makes it difficult for projects that are needed, but not the responsibility of public authorities, to get funding. The European Fisheries Fund should provide funding for ini-

tatives such as FFL, but its application for EFF funding was turned down. In order to expand FFL SW to additional ports the project would require more resources. A PPP in marine litter waste management could be initiated between MVV and the actors that are already dealing with marine litter in order to answer these problems.

## 5 VALUE CHAIN OF MARINE LITTER WASTE MANAGEMENT

This chapter presents the value chain of marine litter recovery from the sea by Fishing for Litter South West and its treatment by waste incineration in MVV's EfW facility in Plymouth. The primary and support activities of the value chain are presented. Costs of litter transportation and incineration are calculated by combining information gathered from FFL by an interview and information based on projections of how the amounts of litter will change in the following years. Costs of current methods of waste disposal and EfW treatment of marine litter are also compared. Costs of project organization activities of FFL SW are not included in the analysis of the value chain due to lack of access to data.

### 5.1 General

The value chain of beach litter operations is left out of this value chain analysis even though they are also dealing with marine litter so that the analysis can concentrate on one value chain at a time. The value chain presented here starts from marine litter getting picked by fishermen and ends at the incineration of the litter at a waste incineration plant. It is based on the current FFL activities of marine litter recovery and disposal, but instead of port waste contractors, transportation and waste treatment of marine litter would be organized by MVV. The value chain is constructed to give a clear overview of the necessary steps and activities to organize and provide marine litter recovery and disposal services.

Stakeholders of this value chain are:

- fishermen, who are taking part in Fishing for Litter
- ports taking part in Fishing for Litter
- Fishing for Litter project
- EfW facility of MVV in Plymouth.

The value chain of marine litter differs from the physical supply chain. From a supply chain point of view, when fishermen take the litter bags to the port, the

litter is physically at the port, but it is the property and responsibility of FFL. A supply chain of waste disposal differs from a supply chain for producing and delivering products in some essential ways. One main difference is that in a waste disposal supply chain payments go to the same direction as material flows when in a traditional supply chain the material flow goes upwards the chain and payments go downwards the chain. A waste incinerator is a waste disposal service provider and a waste supplier is the customer, so in this supply chain the customer pays the service provider for accepting the delivery of the product.

In a waste disposal supply chain the waste incinerator does not need to make an order to the supplier for a delivery, because the waste incinerator has large enough reserves of other waste for keeping its processes running continuously. So in this supply chain there is no need for organization of precisely timed deliveries, because the waste containers are emptied only once they are full, and so the supply chain is clearly supply-driven.

## **5.2 Marine litter value chain**

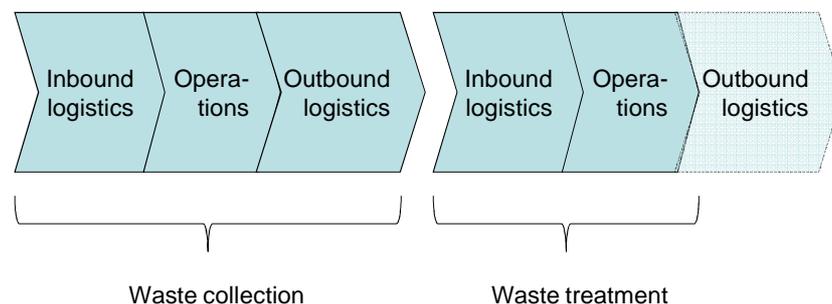
As Porter (1985, p. 34) has presented, by cooperation with partners in a value chain, a firm can broaden its scope without broadening the firm. Once collaboration in marine litter waste treatment would be started, it would be possible to see vertical linkages that exist between the activities of FFL and MVV, and recognize possibilities for enhancing performance. By cooperating with FFL, MVV would be able to spread to marine litter waste management, a new area of business for MVV. At the same time FFL would get an alternative waste treatment method for the marine litter that cannot be recycled.

Compared to how marine litter has been disposed before, organization of marine litter incineration has some essential differences. Waste disposal by conventional means, meaning through port authority waste contractors and in the end into landfills, is convenient because it is the same way that most waste in South West England ports is currently disposed of, so there is no big need to address special or-

ganizational matters. Waste incineration on the other hand needs to be thought through, because it is a new way of handling marine litter in FFL. So in short term, switching to a new way of handling waste would temporarily increase transaction costs because of efforts needed to form new inter-firm connections, but one of the major benefits would be to arrange a more environmentally sustainable disposal method for marine litter.

### 5.2.1 Primary activities

The value chain of marine litter waste management combines two value chains: marine litter collection and marine litter waste treatment. Two sets of inbound logistics and operations, as well as one set of outbound activities are relevant for the marine litter value chain. They are presented in figure 8 and table 5. The operations activities of waste incineration are not discussed in detail because of their complexity and small relevance so they are simplified and mentioned only shortly. The outbound logistics activities such as ash disposal and marketing, sales and service activities are completely left out of this analysis. Compared to the generic value chain, the marketing & sales and service activities of this whole value chain are practically nonexistent because the everyday operations and processes related to marine litter itself do not require these activities.



**Figure 8.** Primary activities of marine litter collection and disposal

**Table 5.** Primary activities of marine litter disposal value chain

Activity category	Activity	Responsible
Inbound logistics	Fishing for litter	Fishermen
	Taking litter to port	Fishermen
	Placing bags to keystone	Fishermen
	Moving bags to container	Port
Operations	Separation of metal from litter	Port
	Surveying consistency of litter	FFL
Outbound logistics	Ordering emptying of container	FFL
Inbound logistics	Organizing transportation	MVV
	Receival at incinerator	MVV
Operations	Mixing of waste	MVV
	Incineration	MVV

The first inbound logistics activity, litter collection from the sea, is done by fishermen during their normal fishing activities. The waste is collected from fishing nets into large hard-wearing plastic bags provided by FFL. The waste comes mostly from the bottom of the sea, because most of the vessels taking part are trawling vessels (Piper 2011).

When a litter bag is full, the fishermen take it to the port and leave it at the quayside. The fishermen do not do any segregation of the waste, because it is thought that it would be too much trouble for them, especially so because they are doing litter collection out of their own good will without a compensation for their effort. Ports provide space for a waste container and port staff moves the litter bags to the container. The port staff also recovers metal to be recycled from the litter. (Crosbie 2012) In FFL Scotland the port staff analyzes some of the waste (Piper 2011), but in FFL SW it is done by the FFL project coordinator (Crosbie 2012).

Once a container is full, the FFL project coordinator would order the emptying of the container from MVV. Organizing transportation for marine litter, such as arranging vehicles for litter retrieval and planning routes would be the responsibility of MVV. Transportation would be organized with the help of a subcontractor. The litter would be received and weighed at the incineration plant, after which it would be deposited in a waste bunker and mixed with municipal solid waste be-

fore incineration. Then the litter would be incinerated, producing electricity and heat through a combined heat and power production process.

### 5.2.2 Support activities

Table 6 presents the support activities of the marine litter waste management value chain. Human resource management activities such as organizing labor and recruiting fishermen are done by FFL. At the moment there are three people working in the ports because having additional man power in ports and good relations to the fishing fleet is important (Crosbie 2012). This activity group also contains educating fishermen and other stakeholder groups about the effects of their activities to the marine environment. Technology development activities would be shared by FFL and MVV and include know-how and procedures of performing marine litter waste treatment activities. FFL has the know-how of organizing marine litter recovery and MVV has the necessary technology and know-how to incinerate waste. A research should be done on the calorific value of marine litter in order to determine a suitable gate fee for marine litter.

**Table 6.** Support activities of marine litter disposal value chain

Activity category	Activity	Responsible
Procurement	Procurement of litter bags	FFL
	Port relations	FFL
Technology development	Determining a gate fee for marine litter	MVV
	Sharing information	FFL/MVV
Human resource management	Recruiting fishermen	FFL
Firm infrastructure	Finance	FFL
	Government affairs	FFL/MVV
	Public relations	FFL/MVV

Infrastructure of this value chain is owned by different parties. The fishing vessels are owned by the fishermen, waste containers by MVV or a transport company employed by MVV. The waste incinerator is owned by MVV. FFL staff organizes the finance, such as budgeting and securing funding of the project. Funding is mostly provided by public authorities and charitable trusts, but a sponsorship from MVV can also be possible. Maintaining government and other stakeholder affairs

also belongs to infrastructure activities. These relations are the responsibility of FFL, but MVV could also take part in them and possibly make gathering funding easier when there is also a large company behind the project. When waste disposal matters become a smaller concern to FFL due to closer cooperation with a waste treatment company, resources can be released for other activities.

### **5.3 Transportation**

Because gathering external funding is difficult and time consuming, cost optimization should be pursued in order to use the funds of the project efficiently. Cost optimization could include organizing transports efficiently. If the transport costs from a port to the incineration plant would be too high, then disposing of marine litter can be done by the waste treatment contractors of the port in question as has been done before.

An advantage for an EfW plant in Plymouth is that it will be fairly close to many ports in Devon and Cornwall. At the time when it is put into operation, it will be the closest incinerator to all the ports west from Plymouth. As one of the ports participating in FFL is situated in Plymouth, the transport costs are minimal. Transportation costs for a round trip from Plymouth to the ports where FFL is currently active and two ports (Padstow and Ilfracombe) to which FFL could be extended are presented in table 7. Index figures are used to preserve confidentiality. The basis for the index figure is the transport cost for Brixham which is approximately 54 kilometers away from Plymouth. Costs included are fuel, driver salary and social costs, as well as costs of vehicle purchase, maintenance and insurance. The labor costs of the driver include a round trip, a 30 minute loading time at the port and a 15 minute unloading time at the EfW plant. Approximately 1,5 tonnes of litter are transported on each trip.

**Table 7.** Ports, distances and transport costs

<b>Port</b>	<b>Distance, km</b>	<b>Total costs of a round trip, index figure</b>
Plymouth (Sutton)	3	26
Looe	37	74
Brixham	54	100
Newquay	82	141
Appledore	97	163
Newlyn	128	208
Padstow	89	151
Ilfracombe	125	204

The transport costs limit the distances from which it would be reasonable to transport marine litter to be incinerated in Plymouth. Costs of transport from Newlyn, which is the largest port in FFL and accounts for a large portion of the collected litter, are over twice of those from Brixham. When FFL will be expanded into additional ports in South West England, it would be optimal to prefer ports that are situated near the waste incinerator to minimize transportation costs. Due to other factors however, ports near Plymouth are not a priority when planning an expansion of the project. Nearby ports such as Teignmouth, Torquay or Dartmouth do not have trawling vessels that are the primary target of FFL, or their amount is too small compared to some other ports (Crosbie 2012).

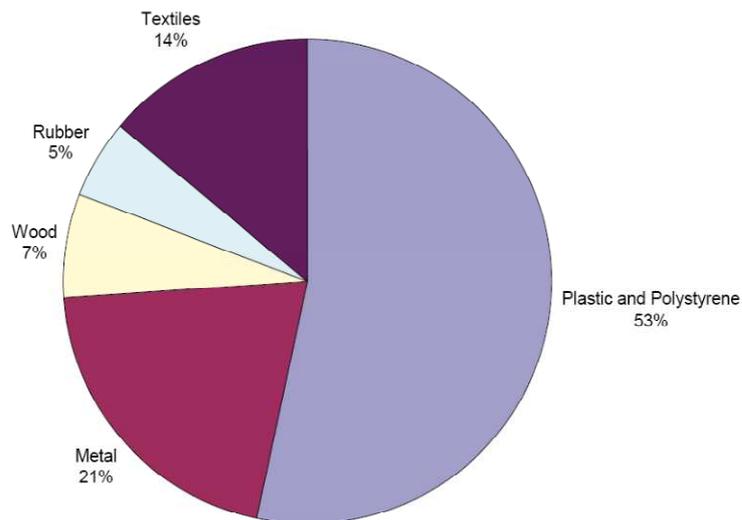
#### **5.4 Gate fee**

When MVV receives the litter at the EfW plant, it gets paid in the form of a gate fee according to the weight of the load. A gate fee includes all the costs from waste incineration, as well as a profit margin. The gate fee includes investment and operational costs such as plant investment, operation and maintenance, and depositing of ash, among others. A gate fee is calculated based on the calorific value of waste, which depends on the composition of the waste.

The composition of the marine litter collected in Fishing for Litter has been evaluated by amounts of items and by total weight. Any assessment of weight-composition of different categories of waste has not been done, because it would

cause too much extra work and also the weight of different items changes according to how much they have absorbed water into them. (Piper 2011) As time passes and water vaporizes, the weight of the waste material changes, which can possibly change the weight ratio of different materials in the waste. This means that a weight composition analysis performed at an earlier stage of marine litter supply chain could provide different results than another analysis performed at a later stage of the supply chain.

Plastic does not absorb water into it, so the water content of litter is probably low unless it has much seaweed or other growth that can absorb water attached onto it. Because of long times between emptying the waste containers in ports, water has time to vaporize by itself, reducing the water content of litter. Even if marine litter would contain much water, it does not prevent it from being incinerated. Municipal solid waste (MSW) can contain up to 30 % water in weight, but this extra moisture is handled by drying the waste first, after which it behaves similarly to coal or wood (Lemann 2008, p. 147).



**Figure 9.** Categories of marine litter by number of items (KIMO 2009a, p. 11)

As can be seen from figure 9 the concentration of plastic items in marine litter is more than half. Incineration of marine litter is possible in an MSW incineration

plant if it is mixed into a much larger amount of MSW. In order to confirm the calorific value of marine litter a test sample of marine litter should be evaluated for its calorific value. With an exact calorific value, a proper gate fee, and so financial feasibility of marine litter for incineration, can be determined

Calorific values from MSW samples from year 2001 (Lemann 2008, p. 78):

- Plastic                    34,6 MJ/kg
- MSW                        13,2 MJ/kg.

Because the consistency of marine litter by mass percentage is not known, the calorific value needs to be evaluated. The calorific value of marine litter is assumed to be in between the calorific values of plastic and municipal solid waste, around 25 MJ/kg. As a result, the gate fee for marine litter would be higher than for MSW. The reason for this is how the gate fee is calculated from the burning capacity of an EfW plant. The plant has a certain capacity for the produced incineration heat. For a certain produced heat, less waste can be incinerated if the calorific value of the waste is high. So the implication for marine litter is that it will receive a high gate fee because it contains so much plastic and has a high calorific value. The gate fee that was calculated for marine litter was about three times the gate fee for conventional waste that will be burnt in Plymouth.

## **5.5 Cost comparison of waste disposal methods**

Fishing for Litter South West collected 11,5 tonnes of marine litter during year 2011 in Newlyn, Appledore, Looe and Newquay (Crosbie 2012). In Scotland the FFL project is much bigger and the amount of waste collected has been considerably higher: 360 tonnes of waste have been collected between 2005 and 2010 in FFL Scotland, in which 18 ports are taking part (KIMO 2011, p. 3). In Scotland, the collected litter has contained much more industrial type of heavy waste, while in South West England there have been many plastic materials and also the recycled metal has not been weighed, since it is collected by the port staff before

measuring the total mass of waste (KIMO 2011, p. 12). For these reasons the waste amounts in South West have been so much smaller than in Scotland.

In FFL Scotland there have been efforts to get waste companies more involved, but with little success. A reason for reluctance of waste incineration companies to receive marine litter is the high concentration of plastic, which causes a too high calorific value for the waste. Some of the marine litter collected in FFL can be recycled, but a majority of it ends up in a landfill. (Piper 2011)

In this calculation mass flows of waste from each port, transportation costs from these ports, and the proposed gate fee per tonne are taken into account. The calculations are presented in table 8. The figures are a percentage of the waste fees of port waste contractors, 100 being equal to a waste fee of one tonne. An additional cost would come from acquiring or leasing waste containers for the ports, because currently they are provided by the port waste contractors. The current expected amount of waste collected in FFL is around 100 tonnes for a project period of three years, and it is divided to ports according to the number of participating vessels in each port. The litter amounts for Padstow and Ilfracombe are estimated. In case the amount of waste collected increases substantially, the maximum acceptable amount of sponsorship should be considered.

**Table 8.** Costs of marine litter incineration

Port	Transport cost per tonne, %	Total cost per tonne, %	Sponsoring per tonne, %
Plymouth (Sutton)	14	201	101
Looe	43	230	130
Brixham	54	242	142
Newquay	83	271	171
Appledore	88	276	176
Newlyn	116	303	203
Padstow	82	269	169
Ilfracombe	111	298	198

As the current costs of marine litter treatment in FFL are much lower than its treatment by incineration, it is clear that waste incineration is not a viable option

for FFL if a gate fee calculated with normal methods would be charged. Without taking into account a subsidy from the public authorities for the waste treatment costs, the evaluated gate fee and transportation costs are approximately 100 – 200 % higher than the price for waste treated by port waste contractors. The difference of costs can decrease in the following years due to increases in the landfill tax. Instead of completely dismissing the possibility of EfW use of marine litter, accepting marine litter to be incinerated at the EfW plant with a lowered gate fee could be regarded as a sponsorship. The amount of this sponsorship can be calculated as the difference between current waste fees per tonne and the gate fee calculated from the calorific value of marine litter including transportation costs from ports to the EfW plant.

If marine litter incineration is inspected from a profit-making point of view, it is clear that the costs of incineration would be higher than those of conventional waste treatment methods of FFL. Both transportation costs and the gate fee for the waste are high when compared to the total cost of waste fees that the waste contractors of ports offer to FFL. Transportation costs are high because the biggest and most active ports of FFL are far away from the EfW facility and the gate fee is high because of the high calorific value of marine litter. Even when taking only the gate fee into account, the incineration costs are higher than the fees of port waste contractors.

As has been pointed out by Dekker (2003, p. 7), performing value chain analysis externally is less precise than internal VCA. Even though information about the current FFL project was provided, not all data was available for precise calculations. Because some pieces of information were unavailable, they were evaluated according to best knowledge. For example the collected litter amounts per port were estimated based on how the number of ships in FFL was divided between the collaborating ports. Total costs of incineration in year 2014 when the Plymouth plant will be in operation were compared to current waste treatment fees. Regardless of small differences between the evaluated and true values that were used for the calculations, it is clear that costs of incineration exceed the costs of landfilling.

## **6 PUBLIC-PRIVATE PARTNERSHIP IN MARINE LITTER WASTE MANAGEMENT**

In this chapter a plan for a public-private partnership in marine litter recovery and waste incineration and connections between actors of this partnership are explained. First the PPP is presented as a whole, and later the individual actors and their part in the partnership are discussed separately.

### **6.1 Objective**

Diverting waste from landfill is an EU level objective. The public authorities in the UK are applying this policy on the national level with for example the landfill tax. Providing alternative solutions of waste treatment for waste recovered from the sea is important, because landfilling is the current main waste treatment method of FFL. Recycling cannot be considered as the only alternative option, because much of the recovered litter is contaminated by sea growth so it is not fit for recycling. EfW should therefore be considered as a possible and more sustainable alternative to landfilling as a waste treatment method for marine litter. A ratio of diverted waste from landfills could be set as an objective. Finding and developing best practices of marine litter waste management could be considered as an objective for networking.

Because marine litter recovery and waste treatment is not worthwhile through private funding only, and reducing the amount of marine litter in the marine environment is in the interest of the coastal communities, collaboration between private and public actors could be possible. A lack of profit potential makes gathering funds one of the main purposes for pursuing PPP between actors dealing with marine litter. In Sweden EU structural funds have been used for funding PPPs of sustainable development (von Malmborg 2003, p. 139) and they can be a possible source of funding also for this PPP. Naturally a partnership must benefit all parties and there should be a common understanding that marine litter recovery from the sea is needed. Benefits of the PPP that are sought by partnership working are re-

source efficiency and sharing of information, as mentioned in the marine environment strategies of Cornwall and Devon councils.

Marine litter causes fishermen costs when machines get clogged by debris floating in the sea and extra working time of fishermen is consumed when the nets need to be cleaned from litter that gets tangled in them. Through the Fishing for Litter project the fishing industry is in an ideal position to be a part of the solution instead of being a part of the marine litter problem. Feedback from the fishermen towards FFL has been almost completely positive. (Crosbie 2012)

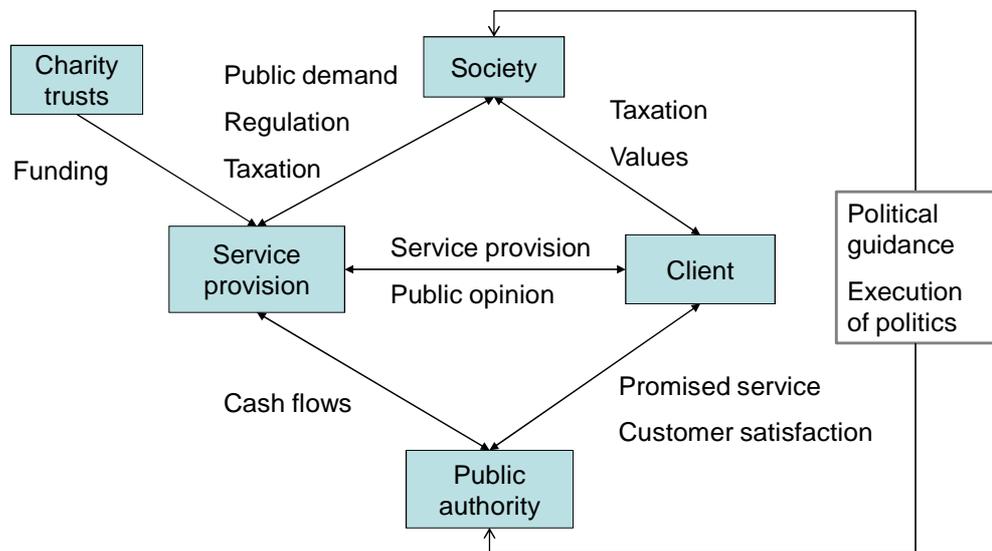
An important objective of FFL is changing attitudes of stakeholders connected to the marine environment. By taking part in FFL the fishermen realize that they have a responsibility over the marine environment in which they are continuously working in. Previously some fishermen might have been doing waste recovery from the sea spontaneously, but then they had to bear the costs of waste disposal themselves. (Crosbie 2012)

In von Malmberg's (2003, p. 139-140) categorization of different PPPs in sustainable development, this PPP in marine litter waste management does not exactly fall into any of the three types of partnership. The closest one would be the sustainable business development partnership, which is aiming at building organizational capacity through collaboration. The most significant difference between this PPP in marine litter waste management and von Malmberg's definition for a sustainable business development PPP is that a formation of a new business enterprise is not necessary. Also the PPP in question has not only public actors and a private company, but also a project like FFL.

## **6.2 Cooperation and partner responsibilities**

Stating which actor would actually be the initiator of this PPP is not simple. Collaboration has already been going on between FFL, fishermen and ports, as well as between FFL and public authorities. However, the relationship between these

actors has not been called as PPP nor does it qualify as such in the current form. The current relationship between FFL and public authorities does not qualify as a “true” PPP because it is missing mutual dependence, mutual commitment to goals and equality in decision making. FFL is more dependent on the funding of public authorities than the public authorities are dependent on the services that FFL provides. If commitment of the public authorities to the project would increase as is presented here, the collaboration could be regarded as a PPP.



**Figure 10.** Roles and interactions of actors in waste management of marine litter as public service provision (adapted from Immonen 2011, p. 20)

In figure 10, the roles and interactions between the service provider, the client, the public authority, the society and charity trusts are presented in private service provision of public services. For simplicity and clarity, FFL is considered to provide the whole set of marine litter recovery and treatment of services. As (Immonen 2011, p. 19) has mentioned, it is important to differentiate the roles of the buyer, the client and the supplier in the field of public service provision. In this case, the end client is the people who are in interaction with the marine environment, such as tourists, fishermen, and people who are using beaches for recreational purposes. To generalize, the client is in the end the general public. In this

kind of service provision the client does not directly pay for the services, but indirectly through taxation.

In a project like Fishing for Litter, there would be little direct interaction between the clients, i.e. citizens who are in contact with the marine environment, and the service provider unless fishermen were not counted as clients. But when fishermen belong to the client group, they are actually providing a part of the service themselves. In beach cleaning operations people are similarly offering their time to organize beach cleaning events and collect litter, so the public authorities are left with supporting these operations and handling the waste treatment. Even with beach cleaning operations arranged by NGOs that make public beach cleaning less dependent on public funds, the costs of beach cleaning to public authorities are substantial, as has been mentioned earlier. A major difference between litter recovery from the sea or beaches is that the public authorities are required to provide the beach cleaning service by law, in this case the Environmental Protection Act 1990, but the service of FFL does not belong to responsibilities of public authorities.

From FFL's point of view, cash flows are one-sided (towards FFL), but come from several sources. Indirectly the public authority subsidies come from the clients in the form of taxation. A part of the funding is also provided by charitable trusts and other organizations.

FFL seeks to affect public opinion and especially the attitude of fishermen about marine litter. In a democratic state the public opinion and values of the people should affect the government and regulations, such as those on marine litter. Political guidance and execution of politics on the other hand have an effect on public demand of marine litter recovery services, because if marine litter recovery from the sea is regarded as an important way to reduce levels of marine litter and a way to reach GES, there would be more public demand for FFL services. This might also lead to better access to public funding.

The major stakeholders presented (public authorities, FFL, MVV) do not have the necessary resources to provide the whole set of services needed to run marine litter collection and disposal on their own and therefore collaboration between actors is needed. FFL is the most central and possibly the most important actor of this PPP, since it is already organizing the most important functions of marine litter recovery and disposal, such as external funding, participation of fishermen and ports, and waste disposal in cooperation with port waste contractors.

MVV will have the necessary infrastructure for waste treatment, but it does not have a working system for marine litter collection. Also it is missing a necessary trust element to organize marine litter recovery in cooperation with fishermen. In the beginning of the research of this study, a mechanical method designed only for marine litter collection was considered as an option. A process designed purely for marine litter collection without any other purpose would most probably be too expensive compared to its benefit to be realized, especially so when funding for a project where marine litter recovery is done by fishermen for free is complicated to arrange.

The public sector might be able to organize marine litter recovery by itself, if it would be interested in providing such a service with public funds. However, for providing the whole set of services of marine litter recovery and treatment the public sector would most probably need to get the required expertise from the private sector. In that case it would actually no longer be providing the service itself, but partnering with the private sector or at least outsourcing the services to the private sector.

The motives for partnering in marine litter waste management are related to services that each of the discussed actors need and the other actors have, and the comparative advantages of public and private actors. MVV as a private actor can provide technical resources (Brinkerhoff 2002, p. 24; Rosenau 1999, p. 11) and FFL as a non-profit organization can act as an intermediary and enhance social mobilization of the fishing community resources (Brinkerhoff 2002, p. 24). The

private sector in general is considered to be more flexible and innovative than the public sector (Brinkerhoff 2002, p. 24), and the formation of inter-organizational networks increases the potential of learning and innovation (von Malmborg 2003, p. 134). Best practices of marine litter waste management could be sought by working together with beach cleaning operations.

In table 9 the services provided and needed by each actor in the marine litter waste management PPP are presented. The actors and the services they provide and need from the partnership are discussed in more detail according to each actor in their own chapters. Ports and fishermen are addressed together with FFL.

**Table 9.** Responsibilities of actors of a PPP in marine litter waste management

<b>Actor</b>	<b>Services provided</b>	<b>Potential benefits</b>
Fishermen	Labor	Cleaner environment
Fishing for Litter	Central organization of project Trust element	More resources Better waste treatment Long-term partners
Port	Space for short-term storage Link to fishermen in the port Better recycling methods	-
MVV	Technical expertise Organizing transportation Sustainable waste treatment Sponsorship Networking	Expansion to a new business area Promoting MVV's presence in the region
Public authority	Funding Regulations Support through port authorities	Cleaner environment
Charity funds	Funding	-

### 6.2.1 Public

Public actors represent the people that are the end customer of the services that are provided by this PPP. Treatment of marine litter in a sustainable way by recovering energy from it is in the interest of public authorities. Naturally the best situation would be if education and preemptive measures would stop litter from entering the marine environment in the first place, but because entering of litter into the

marine environment happens regardless of efforts to stop it, marine litter needs to be collected and disposed of in a sustainable manner.

The public sector needs to provide citizens with certain services, but it does not necessarily have to own or operate the necessary facilities to provide these services. It can order the services from private actors, and it makes most sense in areas where either the service provision or the infrastructure required for the services provided requires specialized expertise and a considerable amount of funding.

The public actors are expected to partially finance the necessary operations, as has been done so far. Marine litter recovery and treatment benefit public authorities by providing the general public cleaning services of the marine environment. At the moment public authorities are not playing a great role in the current FFL project other than providing funding. Through port authorities they could encourage more fishermen in their region to take part in FFL. In the beginning of FFL SW, DEFRA was an important source of support, but longer term support would be beneficial also in the future (Crosbie 2012).

Public authorities do not seem very enthusiastic about marine litter recovery from the sea for EfW use. According to the DEFRA representative, FFL is less about targeting litter and more about affecting fishermen to act responsibly. The focus is on finding out why existing measures are insufficient, closing the gaps and taking measures at the source of the marine litter problem. A “joined up approach is needed to get the messages to the public” with schemes such as Love Where You Live and Keep Britain Tidy. The objective of these schemes is to change people’s actions and make them more aware of the marine litter problem. (Rendell 2012)

One role of the public sector, meaning the local, regional and national authorities, is to create and implement regulations by which the actors need to play. In marine litter management DEFRA is the main regulatory authority. The MSFD has been transposed into the national legislation and the implementation plans are led by

DEFRA. DEFRA is “looking at what management measures are currently in place in the marine and terrestrial environment in order to ensure a joined up approach to addressing the issue is taken” (Rendell 2012). An interactive instead of a top-down regulation implementation process (Kuronen et al. 2010, p. 205-206) is needed. KIMO, the upper level organization behind FFL, has been a major stakeholder in development of the MSFD on the EU level (KIMO, What We Do), and this kind of cooperation should continue and be present also on the local and regional levels.

### **6.2.2 Fishing for Litter**

During the first project period of FFL SW there has been some organizational learning about initiation and managing the FFL project. Even though the template of FFL had been well tested already in Scotland, starting the FFL SW project in six ports at once was “too much too soon”. More time should be reserved for each port before starting the project in the next one. Still, the amount of participating vessels was reached. The target for the amount of collected litter was overestimated for the first project period, partly because the waste is different from that of FFL Scotland and the collected metal is not included when the mass of the waste is measured by the waste contractors. (Crosbie 2012)

In addition to targets of collected litter and participating ships, changing attitudes has also been an objective of FFL. To have the biggest effect for the limited resources that are used, the project is started in the biggest fishing harbors and the most eager fishermen are contacted first. (Crosbie 2012) The benefit for the fishermen themselves is to clean the environment which they are constantly dealing with.

The organization of marine litter recovery and treatment require skillful organization, which is not done by charity workers only. FFL requires workers that can work on the project at least part-time. This creates a need for greater external

funding, because the activities of marine litter collection and disposal are not financially self-sustainable.

Bottlenecks of FFL are mostly limited resources. Because of limited time of part-time workers and limited resources, networking with other organizations dealing with marine litter has been a low priority. In the past two years FFL has attended two summits on marine litter in Cornwall and Dorset. If there was more time available for the project, it would not be used for networking but getting more fishermen into the project. FFL has been looking for long-term support and long-term project partners. If there was more support and funding, the project could get up and running a bit sooner in additional ports. Expanding the project to additional ports requires more resources and at some point the project would need a full-time project coordinator. (Crosbie 2012)

There are problems related to acquiring funding for each project period separately. At the moment FFL has secured funding for a period of three years between years 2011 and 2014. Applying for funding for a project period of three years takes about six months, because securing funding even for a simple project is complicated and takes a lot of time. (Crosbie 2012) During a financial crisis budgets are being cut even from beach cleaning (Booth 2012), even though they provide a service that helps coastal communities keep their beach cleaning costs down, so it can be difficult to secure funding from public funds.

An objective of DEFRA is to implement the polluter-pays principle into everything it does (Rendell 2012). However, when considering FFL and the landfill tax that it will finally end up paying, the polluters are not the ones who pay, but the project that is cleaning the sea from litter. The landfill tax is a burden and KIMO has been trying to get an exemption for FFL from it, but so far it has not been granted (Crosbie 2012).

There are plans of extending FFL SW into more ports during the next project period that starts in 2014, but for that the project needs additional funding. When the

extension is considered, concentration is on bigger ports. Smaller ports are numerous but very demanding because they do not have a large waste collection potential in these less intensive port areas. (Crosbie 2012)

The ports have more advanced recycling methods than what is provided in FFL SW (Crosbie 2012), so cooperation could be sought in segregation and recycling of marine litter by planning how the efforts of ports and FFL could be combined in waste recycling.

The 4P model of Kuronen et al. (2010) can be applied to marine litter management to some extent. In marine litter waste management the third P in 4P, meaning the people, are in this case the fishermen. They take an active role in recovery of marine litter, since they might be the stakeholders who are the most affected by the litter. People taking part in beach cleaning operations can also be thought to belong to the third P in 4P, since they are actively participating in providing public services. They could also be a source for innovative ideas in developing marine litter management.

It is beneficial to have a non-profit organization organizing marine litter recovery in order to gain the trust of the local people, especially fishermen. Fishing for Litter has a close relationship with fishermen, which makes them feel that cleaning the marine environment of litter is a common cause. As mentioned in the project report of Fishing for Litter Scotland (KIMO 2009a, p. 9), coordinating the project locally was an important factor in enhancing credibility and reputation in the eyes of stakeholders, especially so in the early stages of the project.

One of the most important advantages of FFL in organizing marine litter recovery is credibility. FFL is on the same wave length with the fishermen taking part in the marine litter recovery project. Without a common understanding between fishermen and FFL of the necessary means to protect the marine environment, recruiting fishing vessels to the project would be more difficult. In the partnership, FFL has an important role in handling the connections to the ports and fishermen.

Trust is an important factor in building and maintaining relationships, especially so when the fishermen do not receive a financial compensation for their effort.

### **6.2.3 MVV**

The key resource that MVV has is the necessary infrastructure to provide the service of marine litter incineration. MVV would also provide the waste containers for each port either directly or through sub-contractors. Constructing an EfW facility is in itself a large project that requires resources that few actors are able to provide. Sophisticated technical expertise is required for operating EfW plants, especially when regulations for emissions are being tightened.

Transportation of marine litter and its incineration at the EfW facility would be organized by MVV, as has been explained in chapter 5. Overall costs of marine litter incineration are higher than the waste treatment fees of the current waste contractors. For this reason the fees for FFL would need to be set lower than what would be profitable. The difference between marine litter incineration and the current waste disposal fees could be considered as a sponsorship for FFL, as is presented in chapter 5.

With EfW MVV would be offering FFL a more sustainable waste treatment method than landfilling. By broadening its service offering to incineration of marine litter, MVV is able to expand to a slightly new business area. Marine litter is waste, but its management is close to environmental management. Partnering with and sponsoring FFL would also promote MVV's presence in Devon and Cornwall. In addition to waste treatment and/or sponsorship, MVV could also provide FFL with connections to other organizations or being an important player in Plymouth and Devon, it could influence politics to get public authorities more engaged in the FFL project. Even though at the moment there is no profit potential in incineration of marine litter, in the future there might be potential for new business around marine litter treatment if policies regarding marine litter would change.

### **6.3 Linkage to conditions for successful public-private partnerships**

As mentioned by von Malmberg (2003, p. 143), it is important for the participants in a partnership to have a common view on what needs to be done. A common view is also closely related to shared interests (Bagchi & Paik 2001, p. 494) and the mutuality dimension of Brinkerhoff's (2002, p. 22) definition of partnership. At least in FFL Scotland there is a view that EfW is a preferred option for marine litter waste treatment when compared to waste landfill (Piper 2011). In FFL SW there is no clear goal of diverting marine litter from landfills to EfW use (Crosbie 2012). On the national level there are objectives of diverting waste from landfills by increasing the share of other waste treatment methods. Introducing and constantly increasing the landfill tax is one of the measures that the UK government has taken to reach those goals.

Collaborating is less complicated when there is no motive for profit and partnering can be more productive if financial aspects do not need to be intensively considered (Rosenau 1999, p. 26). The relationship between fishermen and FFL is simpler when monetary matters do not need to be considered and organized. However, arranging the overall funding of this PPP is problematic. Financial matters come into play when the question of who pays for the waste treatment of marine litter collected in FFL is addressed. The public authorities pay a part of the waste treatment costs as a subsidy, but the rest of waste treatment costs are an issue. It should be considered from which ports it is reasonable to transport marine litter to be incinerated in Plymouth without making the costs rise too high.

Objectives of the partnership should be kept realistic and defined from a bottom-up perspective (von Malmberg 2003, p. 143; Bagchi & Paik 2001, p. 494; Rosenau 1999, p. 25). FFL has already set goals for amounts of participating vessels and collected litter in the project, but additionally the amount of diverted waste from landfills should be set as an objective. Diversion from landfilling can be arranged by increasing the rates of recycling and incineration. As costs of transport cause a large part of the total costs of marine litter treatment by incinera-

tion for marine litter from the furthest ports, it makes more sense to bring marine litter to the MVV EfW facility only from the closest FFL ports, so total diversion from landfill is not a realistic objective. With longer distances also CO<sub>2</sub> emissions of transportation rise.

Partners are supposed to have clearly defined responsibilities (Bagchi and Paik 2001, p. 494; Rosenau 1999, p. 25), which have been explained broadly in this chapter. In order to start this PPP and put this plan into action, the responsibilities should be defined in more detail in a concrete plan (Rosenau 1999, p. 25) and the responsibilities should be agreed on with contracts. Actors should also have evenly distributed ownership of the partnership (Bagchi & Paik 2001, p. 494) in order for them to really be called partners and have a say in decision-making.

After each project period a final report is produced to present the achievements of the project during the period. This is already a measure for monitoring performance, one of the conditions for a successful PPP (Bagchi & Paik 2001, p. 494; Rosenau 1999, p. 25). A very sophisticated and time consuming method for performance measurement such as activity based costing or a balanced scorecard is not possible to be used because of limited managerial resources, but the success of implemented changes in waste treatment methods should be followed and their actual and planned costs should be compared.

Partnerships require patience and farsightedness from private and public actors (Bagchi & Paik 2001, p. 484). This PPP cannot truly be started before the EfW facility of MVV is constructed in year 2014. Also the effect of this PPP can be seen only over a long period of time.

As von Malmberg (2003, p. 142) has presented, financial aspects should be clear for a PPP to work properly. Funds of FFL are secured for a project period of three years at a time. All the financial transactions are made through FFL, so the financial aspects of the cooperation should be agreed on between FFL and each individual partner. Costs of waste treatment services have been discussed in a finan-

cial analysis of the waste incineration part of the whole marine litter value chain analysis, but they need to be discussed further in detail. For a more precise cost comparison of current and planned waste treatment methods more information would be needed. Trust is an important factor together with sharing information in enabling closer relationships (Stuart & McCutcheon 2000, p. 40).

Von Malmberg (2003, p. 142) and Bagchi & Paik (2001, p. 492) have found trust among partners to be an important factor in the success of PPPs. An important sign of building mutual trust is sharing information. In an interview it came up that FFL would like to get more information about implications of waste treatment by incineration (Crosbie 2012). Even though waste incineration needs to meet stringent environmental regulations which are followed by government officials, waste incineration faces opposition from some public groups in the UK. The general public might need to be assured of the environmental impacts of current waste incineration technology before FFL would accept waste incineration as a waste treatment method for its marine litter.

The partnership must have all the necessary competencies (von Malmberg 2003, p. 143), otherwise there would be a need to take additional actors into the partnership. Adding more partners might make organization and communication more complicated between partners, because a simple organizational structure is easier to manage than a complex one. FFL already has a project coordinator who is able to organize necessary collaboration between necessary actors. The actors of this PPP have the necessary competencies to provide all the necessary services of marine litter waste management.

According to von Malmberg (2003, p. 143) the partners must have organizational capability to participate and intra-organizational cooperation must work before inter-organizational cooperation can be done efficiently. All of the aforementioned actors in the planned PPP are already doing some inter-organizational cooperation to reach the goal of their own organization, so this condition for a work-

ing PPP is already fulfilled. A working network of key groups (Bagchi & Paik 2001, p. 494) has already been organized by FFL.

## **7 RESULTS**

In this chapter the findings of this study are discussed. As far as the author is aware, there have been no similar studies so far combining public-private partnership and marine litter waste management. One of the main objectives of this research was to gather information about the business environment of marine litter waste management.

### **7.1 Current business environment**

The main research question was how marine litter recovery for waste treatment can be organized. It was divided into four sub-questions, the first of which was what the business environment of marine litter recovery is like. Marine litter is regulated by several international, EU level and UK national level treaties and regulations. In the EU the most central regulation concerning marine litter is the Marine Strategy Framework Directive and its descriptor 10 for Good Environmental Status that especially states a descriptive objective for amounts of litter in the marine environment. The national legislation does not however state a public authority that would be responsible for taking action and recover marine litter from the sea as is the case for litter that washes up on public beaches.

In South West England there is a project called Fishing for Litter South West (FFL SW) that is organizing marine litter recovery from the sea with the help of fishermen. Beach litter, which is a sort of marine litter, is collected from public beaches by either contractors assigned by the local authorities or NGOs organizing litter picking events. Public authorities are supporting Fishing for Litter South West and beach cleaning operations differently. Litter collected from beaches by NGOs such as Keep Britain Tidy is treated by public authorities whereas FFL SW organizes the waste treatment and gets a subsidy for a part of its costs. Landfill tax is a burden to FFL SW and a lack of resources is keeping the project from expanding into additional ports. Expanding the project into other ports would require more resources in terms of funding and manpower, because at the moment the

project coordinator is working on the project part-time and recruiting fishermen to the project requires effort.

The waste hierarchy described in the EU Waste Framework Directive states that recycling and waste incineration should be preferred methods of waste treatment over landfilling. Diverting marine litter from landfilling should be pursued also in marine litter waste management, which is the reason why the economical feasibility of marine litter incineration was examined.

## **7.2 Marine litter incineration value chain**

The second research sub-question was what the value chain of marine litter recovery and incineration is like. This value chain and its primary and support activities were presented based on the current activities of FFL SW, but waste treatment operations of port waste contractors were replaced by EfW treatment by MVV.

Marine litter can be incinerated in a municipal solid waste incineration plant when it is mixed into a large quantity of other waste. Because of the high calorific value of marine litter and the limited tonnage that can be burnt in the incinerator, the gate fee for marine litter would be about three times higher than for the conventional waste burnt in the incinerator. The gate fee for marine litter is considerably higher than the fees of currently used waste disposal methods in FFL SW. These conclusions are based on an evaluation of the calorific value of marine litter, so the real calorific value should be measured in order to get accurate results about differences in waste treatment costs of marine litter incineration and landfilling.

Transport distances between ports and the EfW facility of MVV in Plymouth further increase the difference between costs of incineration and landfilling. Even though at the time when the construction of the EfW facility will be finished it will be the closest waste incinerator to ports west from Plymouth, the transport costs would still be considerable when compared to total waste treatment costs offered to FFL by the current waste contractors.

Trust is needed for sharing cost information along the value chain in order to perform accurate value chain analysis. Not all of the information that was requested from FFL was provided so some pieces of information were evaluated according to best knowledge. A full cost analysis of the value chain was not possible to be performed because of lack of information about activities involved in FFL SW and their costs. Also basing the calculation of the gate fee for marine litter on assumptions of the mass consistency of the waste caused some inaccuracy. Nevertheless the results of cost calculations are considered precise enough to make conclusions about the economical feasibility incineration as a waste treatment method for marine litter.

If profit requirements are set aside, MVV could cooperate with FFL by incinerating the marine litter and consider the difference between profitable waste fees and fees that FFL is currently paying to waste contractors as a sponsorship. A participating sponsorship would also increase the depth of collaboration between MVV and FFL and bring it closer to the definition of partnership.

### **7.3 Fitting of public-private partnership framework**

The third research sub-question was if the public-private partnership framework can be implemented into the marine litter recovery and treatment value chain. An important part of answering this question was to first define what can be meant by PPP. It was found out that the term PPP can be understood in several ways. In this research PPP is regarded as close cooperation between public and private actors in providing services that belong to the domain of public service provision, whereas often the term PPP is used in building and operating public infrastructure.

The fourth research sub-question was about what conditions need to be met for a marine litter recovery and treatment PPP to be successful. This study shows that PPP is a suitable framework for marine litter management in theory. The conditions for successful PPPs found from literature have acted as guidance when mak-

ing a plan for a marine litter waste management PPP and they can be found from the current marine litter management operational environment. There needs to be a common view between actors that increasing EfW use of marine litter should be a goal for the partnership. Also the financial aspects need to be clear before starting the partnership. Trust is an important factor in enabling close relationships and information should be shared for making informed decisions.

There seem to be motives for each actor to be a part of the marine litter waste management PPP, but the motives for participating might not be important enough to officially initiate the partnership. The question whether there is enough interest for public authorities to increase their participation in marine litter recovery from the sea remains open. When interviewing different public authorities, it became apparent that they are not responsible for marine litter that is in the sea as they are for litter that washes up on public beaches. Also on MVV's side it will be considered in the future whether the benefits of engaging in non-profitable business such as promoting the company's presence in South West England will equal the required efforts.

Research is being done on the marine litter problem, but viable solutions for collecting litter from the sea seem to be scarce even if external funding for organizing and effort from voluntary workers are taken into account. Neither public nor private actors alone can solve the problem of marine litter without joint efforts. Collaboration of public and private actors is needed for developing preemptive measures to keep marine litter from entering the marine environment and corrective measures to recover waste that is already in seas and beaches. Citizens play a big role in recovering litter from the marine environment, even though they are in a way not really a part of either public or private sectors. Their participation in marine litter recovery contributes greatly to resource efficiency of marine litter waste management.

#### **7.4 Suggestions for further research**

As the calorific value of marine litter is not known and it is an important factor in determining the costs of waste incineration, it should be found out by performing a study on a waste sample of marine litter. Also developing recycling methods of marine litter by collaboration with ports should be examined. Possibilities of EfW use of marine litter collected from beach cleaning operations could be studied. This matter was not included in this study because litter from beaches is disposed of by local or regional authorities instead of a centralized fashion by organizations arranging beach cleaning operations. Because implementation of the presented PPP is out of the scope of this study, future research areas could include the follow up and performance measurement of this partnership if it is initiated. Organizational research could be made in the form of an evaluation of collaboration practices between different marine litter related organizations, because they have similar goals but still work separately.

## 8 CONCLUSIONS

In this study the current business environment concerning marine litter has been examined. Marine litter is an international environmental problem. It causes considerable costs to the coastal communities and the fishing industry. Marine litter is covered by several international and national treaties and regulations. The most important regulation of these is the EU Marine Strategy Framework Directive (2008/56/EC) and it is transposed into the UK legislation as it is. It introduces the Good Environmental Status (GES) qualitative measure for the marine environment and that has marine litter as one of its descriptors. The directive states that EU Member States should have reached GES in their waters by year 2020.

On the EU level according to the waste hierarchy that is stated in the Waste Framework Directive (2008/98/EC) recycling and incineration are to be preferred as waste treatment methods over waste landfilling. As diverting waste from landfills is also encouraged with the landfill tax that is currently being raised every year until 2014, diverting marine litter from landfills to recycling and incineration should be sought also in marine litter waste management.

Responsibility of local authorities in treating marine litter is limited by the high water mark, which means that public authorities do not have a responsibility of recovering marine litter from the sea. Non-governmental organizations such as Keep Britain Tidy are working together with public authorities in cleaning up beaches of litter and in these beach cleaning operations the collected litter is treated by the authorities. In comparison, Fishing for Litter South West organizes its own waste treatment and pays a part of its costs with a subsidy from the public authorities. In order to expand Fishing for Litter South West to additional ports, additional resources are needed. In Fishing for Litter there has been an interest to get waste treatment companies as partners, but so far no partnerships have been made.

With literary research on public-private partnerships it has become clear that the PPP term can be understood in many different ways. In this thesis it is defined as partnering between public and private actors in providing public services. The definition of partnership, motives for partnering between public and private actors and use of PPPs in different business areas have been discussed. Special attention has been paid to conditions for successful PPPs that have been used as guidance when planning a PPP for marine litter waste management.

Possibilities of MVV to engage in marine litter waste treatment in its Energy-from-Waste (EfW) facility in Plymouth have been considered with the public-private partnership (PPP) framework. Research on marine litter recovery from the sea was based on an already functioning project, Fishing for Litter South West, in which fishermen are collecting litter during their normal fishing activities and deliver it to port for further treatment.

The frameworks of a value chain of a single organization and inter-organizational value chain have been presented. Analysis of the generic value chain of an organization covers only one organization, but other actors upwards and downwards the supply chain can be taken under examination with inter-organizational value chain analysis.

Primary and support activities of marine litter waste incineration have been described with an inter-organizational perspective of a value chain from recovery of marine litter from the sea by Fishing for Litter until the EfW facility of MVV in Plymouth. Economical feasibility of transporting marine litter from ports taking part in Fishing for Litter into the EfW facility for incineration has been examined. The calorific value of marine litter was estimated to be approximately 25 MJ/kg, compared to 13 MJ/kg for municipal solid waste. The gate fee for marine litter would be approximately three times the usual gate fee for municipal solid waste due to the high calorific value of the waste. Depending on the port, the total costs of transportation and incineration of marine litter would be 100 – 200 percent more expensive to Fishing for Litter South West than if the waste was disposed of

by port waste contractors by landfilling. If MVV would accept the waste to the EfW facility anyway and Fishing for Litter South West would pay the same amount to MVV as to the port waste contractors, the difference of these waste contractor fees and total costs of incineration could be regarded as a sponsorship.

As a solution to diverting marine litter from landfills, problems of lacking resources of Fishing for Litter South West and to increase public authority participation, a plan for a PPP in marine litter waste management was presented. The plan was partly based on literature research findings on conditions for successful PPPs. The goal of the partnership would be mainly to provide energy recovery from waste an alternative for waste landfilling as a waste treatment method of marine litter. Services provided by each actor to the partnership and services received from the partnership were presented.

PPP seems to be a fitting framework for marine litter waste management in theory. However, the motives for the presented marine litter waste management PPP might not be important enough for initiating the partnership. Collaboration is nevertheless required in tackling the marine litter problem. Resource efficiency is needed in marine litter waste management and participation of citizens in marine litter recovery is an important part of it. Best practices in marine litter waste management should be sought by collaboration between actors.

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### **Interviews**

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Rendell, Jamie. 23.1.2012. Policy Advisor. Department for Environment Food and Rural Affairs.

Booth, Amanda. 26.1.2012. Regional Director until 2007. Keep Britain Tidy South West.

## APPENDICES

### APPENDIX 1 / 6: Interview questions to Fishing for Litter South West

Crosbie, Sarah. 29.11.2011. Project Coordinator. Seafood Cornwall Training Ltd

- Is the Fishing for Litter project still going on in South West England? Until when?
- What do you do with the collected litter?
- In what way are the public authorities involved, other than funding?

Crosbie, Sarah. 1.2.2012. Project Coordinator. Seafood Cornwall Training Ltd

- What services do you offer concerning marine litter?
- What is innovative in Fishing for Litter?
- What other organizations are concerned about marine litter?
- Do you think that energy from waste is a reasonable way to make use of marine litter?
- Previous project period
  - o Any other objectives than collected mass and participating ships?
  - o What did you learn from the previous project period?
  - o Comparison of processes to and learning from Scotland?
- Current system
  - o What are the responsibilities of public actors concerning marine litter?
  - o What kind of collaboration exactly have you been doing with public authorities regarding marine litter, if any? With whom and how?
  - o Are you getting enough support from public authorities?
  - o How could public authorities be made responsible or taken more into the current FFL system?
  - o What are the bottlenecks of current operation?
- Waste
  - o How are the disposal routes for marine litter organised?
  - o What was the total amount of waste during previous period?
  - o How often are the waste skips emptied?
  - o How much waste in a container (tonnes)?
  - o How much waste per port?
  - o How much are the costs for marine litter waste disposal?
  - o How much are the costs of waste compared to the whole project budget?

(continues)

(Appendix 1 continues)

- Ports
  - o Is port staff taking part in organizing waste treatment?
  - o Which Plymouth port is in FFL?
  - o On what basis were the cooperative ports selected?
  - o Have you planned on expanding the project to other ports?
  - o Why is the amount of ports six and not more during this period?
- From which actors are you most dependent on? Funders/ports/fishermen/waste company?
- Scale of funding related to Fishing for Litter? What is included in the budget?
- Is Fishing for Litter getting financial support from the European Fisheries Fund?
- Is there a possibility of giving the fishermen a financial compensation for their time and effort?
- How could MVV be involved in Fishing for Litter?

**APPENDIX 2 / 6: Interview questions to KIMO UK / Fishing for Litter Scotland**

Piper, Tom. 16.12.2011. UK coordinator. KIMO UK

- What is the role of ports in Fishing for Litter?
- How does Fishing for Litter secure funding?
- Have waste companies been involved in Fishing for Litter projects?
- How is waste treatment arranged in Fishing for Litter projects?

### **APPENDIX 3 / 6: Interview questions to previous Regional Director of Keep Britain Tidy**

Booth, Amanda. 26.1.2012. Regional Director until 2007. Keep Britain Tidy South West.

- BeachCare was initially started by whom?
- Are there networks of marine litter organizations?
- How are the public authorities taking part in organizations such as BeachCare?
- Does the local authority dispose of the waste collected in the BeachCare project and pay for the disposal?
- What are the regulations related to marine litter?
- Which private organizations are dealing with marine litter?
- Do they work together with public authorities?
- How are they working together with public authorities?
- Which public authorities are they working with?
- What is done to the litter after its collection

#### **APPENDIX 4 / 6: Interview questions to public authorities**

Rendell, Jamie. 23.1.2012. Policy Advisor. Department for Environment Food and Rural Affairs.

- What are DEFRA's duties related to marine litter
- What are the regulations regarding marine litter?
- What is the transposing process of the Marine Strategy Framework Directive like?
- Which authority is responsible for taking care of the marine environment according to the Marine Strategy Framework Directive?
- Do you already know how the GES for descriptor 10 for marine litter will be measured?
- How is the "polluter pays principle" taken into consideration?
- Is there any authority that is responsible for marine litter and its quantities in the sea?
- Which organizations are related to marine litter?
- What are the preferred waste disposal routes for marine litter?
- What needs to be done to marine litter?

Singleton, Derek. 18.1.2012. Resort Services Manager. Torbay Council.

- How is your work in your position related to marine litter?
- What kind of actions are you doing against marine litter?
- How much litter is collected in beach cleaning activities?
- What are responsibilities of Torbay Council related to marine litter?
- Which organizations are taking care of marine litter?
- Are you cooperating with some organizations in order to deal with marine litter?
- Is there a network of organizations who are doing beach cleaning or are they doing it separately?
- What are the regulations regarding marine litter?
- Are you developing marine litter waste management or planning to develop it in the future

## **APPENDIX 5 / 6: Project brief**

### **Introduction**

I am a Master of Science of Industrial Management student at the Lappeenranta University of Technology in Finland. As a part of my studies I am preparing my Master's Thesis at MVV Umwelt in Mannheim, Germany. The main topic of my Thesis concerns cooperation in marine litter management, and for this research I am looking for public and private actors who are interested in dealing with marine litter or who are dealing with it already.

### **Study on a public-private partnership concerning marine litter**

Goal of the project: A cooperation strategy for developing a marine litter recovery and treatment supply chain  
Geographical area: South West England (Devon and Cornwall)

### **Background of study**

Marine litter causes severe damage to wildlife in the marine environment. The damage can be done in the form of entanglement (by e.g. old fishing nets, also called "ghost fishing") and ingestion (birds mistaking plastic pieces for food). Marine litter causes damage to tourism, direct costs to local authorities and industry, and costs to ecosystem goods and services. Indirect costs of a littered beach can be great especially to communities relying on income generated by seaside businesses, since marine debris discourages people from using the sea for recreational purposes, such as boating, swimming, and just visiting coastal areas in general.

Marine litter is a global problem, but means to deal with it are mainly local. The initial waste producers are in most cases impossible to find and held responsible, so costs of waste management cannot be charged from them. The state of the marine environment can be regarded as the responsibility of the society as a whole or even a larger international community. In this sense, the public authorities need to be involved in taking care of the marine litter problem. Also, organization of marine litter recovery could be easier through closer cooperation of public and private actors. This way the private sector can be a part of achieving the goals of Good Environmental Status (GES) of the marine environment mentioned in the Marine Strategy Framework Directive (Directive 2008/56/EC).

### **Purpose of the project**

The purpose of this study is to find possibilities of cooperation for increasing the amount of recovered litter by expanding the collection network with cooperation of public and private actors. The first step is to find out which organisations are working in the area of marine litter and if they would be interested in a partnership for developing a marine litter treatment supply chain. A secondary objective is to make a preliminary cost evaluation on different stages of marine litter management.

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(Appendix 3 continues)

**Research goal**

The scientific objective is to find out if the framework of public-private partnership can be applied to a marine litter recovery and treatment supply chain. The fitting of the framework and willingness of different actors to take part in a partnership combining marine litter recovery, transportation and treatment are to be evaluated with interviews.

**Request for participation**

For this study I wish to conduct a series of interviews with different organisations about their willingness and other thoughts on a possible public-private partnership for marine litter recovery and waste treatment. I hope that You would be able to make some time for an interview. Interviews are intended to be taking place during the latter half of January 2012. A preliminary set of questions will be provided to the participants before the interview.

Kind regards,

Tapio Hyvönen  
Master's Thesis student

## APPENDIX 6 / 6: Map of ports in South West England

