Systems in Transition: From Waste to Resource

A study of supermarket food waste in Cape Town

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Abstract

This thesis explores the management of supermarket food waste in Cape Town. In doing so it highlights both its underutilisation and its potential transition from waste to resource. Through an extended micro study of a single case study store it traces the management of food waste from the supermarket into the wider systems of waste management in the city. It then explores the barriers and potentials for managing food waste further as a resource. While recycling has increased in the city over the past decade, this thesis demonstrates that at present there does not exist a comprehensive system for the recycling of supermarket food waste, particularly non-edible and animal protein wastes. As a result most of this waste is sent to landfill where it causes environmental damage and endangers human health. Using some of the emergent innovations studies literature on transitions to sustainability as a framework, this thesis explores the complexities of integrating more sustainable systems for managing food waste in the city. It argues the importance of prioritising the recycling of food waste and that a multi-level, multi-stakeholder approach will be needed to operationalise change.

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Chapter 1. Introduction.

Given today's environmental challenges – growing urban populations, the increasing unpredictability of our climate, and pressure on resource flows – it is generally understood that we need to transform our current urban systems to make them more socially just, more sustainable and more in keeping with natural cycles. In many cases, new alternative technologies and/or more sustainable methods for managing waste already exist, yet their integration into the dominant system is often a complex process. Older methods can be firmly embedded in complicated socio-technical systems involving local and global networks of actors and processes. Additionally, newer and 'greener' methods often work differently from current dominant systems and require a number of supportive factors to help them gain a foothold over older, less sustainable but ingrained methods. As Oelosfe and Godfrey, (2009) point out:

> *"Technology solutions to waste management problems offer only part of the solution to sustainable waste management services. Successful implementation of technology is strongly dependent on enabling social, political, and economic environment that is supportive of the given technology."* (Oelofse and Godfrey, 2009:1)

Over the past decade, the field of innovation studies has begun to explore the nature of transitions towards sustainability. Theorists such as Perez (2010: xvii) are increasingly aware, in today's "turbulent times of profound and wide ranging changes," of the imperative "to understand transitions and to know how to influence them". These studies look closely at transitions towards more sustainable systems such as new systems of energy provision, transport and waste management. They explore the factors that enable or hinder the transformation to new systems or 'ways of doing'.

Drawing on that body of work, this thesis is interested in how "transitions involve mutually coherent changes in practices and structures, and because of their multi-layeredness and inevitable entrenchment in society and culture they are very complex*"* (Grin et al, 2010:3). The literature provides an important theoretical base for this thesis as it is interested in the transition of food waste, and specifically supermarket food waste, towards further use as a resource in the city. Using a multi-layered theoretical approach, this thesis aims to gain

better insight into the barriers *to* and potentials *for* operationalising supermarket food waste as a resource in the city of Cape Town.

The management of supermarket food waste is not an isolated process but rather exists as part of a wider set of ideas, systems and practices operating and interacting at different scales. In this study, these fields of intersection include the supermarket, the retailer as a nation-wide system, the city, the national context and wider global dialogue around the use of resources and the need to transition towards more sustainable systems.

Waste management is a vital area of focus in transitioning towards more sustainable cities. More sustainable waste management practices have the ability not only to mitigate the environmental destruction caused by discarded materials, but the potential to turn these 'wastes' into vital resources. As Gasquet explains:

> *"Waste management is one of the major issues of urban engineering for the decades to come. However, it is not just a question of managing waste flows and disposing of unwanted products. We must realise that part of our future depends on this waste: four billion tones are produced each year of which scarcely one-quarter is recovered or recycled at the present time: energy, compost, scrap, cellulose fibres, as many "secondary" materials which can substitute for the raw materials of which we are likely to run short before the end of this century."* (Gasquet, 2009:1).

Following the Industrial Revolution, the use of primary resources and the associated production of wastes grew exponentially (Steel, 2009). While for years this went unrecognized and unaccounted for, in the 1990s issues of waste began to be a matter of escalating concern. As Robin Murray puts it, "from centuries of obscurity the waste industry found itself at the hub of environmental argument." (Murray, 1999: 20). Within the past two decades, solid waste management has become an increasing priority on the global environmental agenda and within governments. Since the 1992 Rio Earth Summit, a watershed for waste-management thinking, and later the 2002 World Summit on Sustainable Development, there has been a marked shift from viewing waste not simply as an environmental and social hazard but recognising its value in the context of increasingly scarce global resources (White et al, 1999:3). Materials once regarded merely as 'wastes' are increasingly being viewed and used differently around the world in an effort to increase the

efficient use of natural resources. Systems of waste management at this time find themselves in a process of transition. Yet, the rate and nature of this change differs greatly from place to place and from waste to waste.

While recycling efforts initially focused mostly on dry materials such as plastics, glass, papers and metals, in recent years there has been an increased focus on organic wastes and, notably, food wastes in many cities. Recent estimates suggest that food production accounts for 17 to 32 per cent of global greenhouse gas emissions (Millstone and Lang, 2008; Lundqvist et al. 2008). In turn, enormous amounts of the food produced at great expense to the environment (for example, through soil depletion, habitat destruction and contributions to greenhouse emissions) is wasted at various stages in the system. At present, much of this wasted food is sent to landfill where mechanisms to reduce, reuse and recycle it are not in place (Stuart, 2009: xix). The most often quoted estimate is that globally "as much as half of all food grown is lost or wasted before and after it reaches the consumer" (Parfitt, 2010: 3065). Landfilling food waste is detrimental to the environment for a number of reasons. It leads to the production of methane, a powerful greenhouse gas, as well as toxic leachate that can contaminate underground water systems, as has already taken place in Cape Town (Swilling, 2006:37). It further leads to the loss of a valuable nutrient source, as food waste entering landfill is essentially lost to "planet trash", unable to be reused, converted to energy or composted (Fehr et al, 2002:247). In Cape Town these negative effects of landfilling food waste are compounded by the looming landfill crisis, whereby landfills are reaching their capacity and there is little 'suitable' new ground on which to build new landfills.

While some food wastes still within their use-by dates can be redistributed, non- edible food wastes need to be recycled. Globally there are many well-developed options and technologies for recycling non-edible food waste on both-small and large scales. For example, on a medium to large scale food no longer suitable for human consumption can be used as animal feed where appropriate, it can be also be composted or anaerobically digested. Using food waste for animal feed could include raw materials such as vegetable scraps or processed food waste materials. This needs to be regulated as it can lead to outbreak of disease if inappropriate foods are fed to animals and has been banned in some countries (See Westendorf, 2000). Composting refers to the biological decomposition of organic matter in controlled conditions which creates a soil amendment. Compost can be made from a variety of organic materials. Most commonly it is used for gardens wastes, wood chippings and other

green wastes but under the correct conditions it can be used to breakdown materials such as animal carcasses, manures and wastewater sludges (Calrecycle). Anerobic digestion (also called Biodigestion) is an ancient technology that has been used to generate energy for centuries. In the 1950's industrial scale anaerobic digestion systems were developd in India for the first time and since this time various systems have been developed yet the principal remains the same (Muller, 200:8). Anerobic digestion refers to the natural process whereby organic matter is broken down by anaerobic bacteria in the absence of oxygen. This process releases a gas which can be used for energy as well as a nutrient rich sludge which can be used for agriculture (Harma et el, 2008: 3). On a smaller scale, earthworm farms or bokashi effective micro-organism (EM) composters are also a popular method for turning food waste into compost. Bokashi or EM composting involves using micro-organisms to speed up the decomposition process of organic material. It also ensures a hygienic product is procured. Earthworms if managed correctly can speed up the decomposition of organic waste and increase the quality of the compost produced (Chaoui et et, 2003).

Many cities are now realising the value of food waste as a resource and finding ways to integrate its recycling into the urban fabric on a large scale. In Germany, anaerobic digestion (AD) has become a thriving industry while composting is a popular option in other parts of the EU and parts of the United States (US) and Canada. Studies in Israel are looking at ways to link urban organic wastes with agriculture, whereby the agricultural sector serves as an "acceptor for the increasing amounts of waste generated by the city" (Ayalon et al, 2000:6). In the European Union (EU) and parts of the US as well as parts of Asia, organic wastes have been either banned or limited from entering landfills, opening up new avenues for alternative management methods and creating space for the transition of food waste to resource.

In South Africa, although few figures are available, it is estimated that between 40 and 60 percent of waste produced is organic. Of this, a significant amount is likely to be food waste (Greben and Oelosfe, 2009:1; Swilling, 2006:37). In Cape Town in 2004 an estimated 120,000 tons of organic waste was produced, of which only 2% was recycled biologically as an alternative to landfill (Ekelund and Nyström, 2007:26). While it is clear that in many cities wasted food has become a valuable resource for feeding livestock, making compost and producing energy, in Cape Town, and in South Africa in general, food waste is still an

underutilised resource. The lack of specific data on food waste is a further indicator that it is not prioritised as a resource material[1].

Apart from some smaller-scale projects such as worm farms, *ad hoc* use of food for pig feed, or some small anaerobic digesters and composting sites, Cape Town has few available options for recycling food waste no longer fit for human consumption on a large scale such as generated by supermarkets and other members of the food industry. Municipal organic waste drop-off sites do exist, where waste companies are contracted to chip and compost the material, but these only take garden (non-putrescible)[2] waste. One municipal composting site currently sorts the organic content (including food) from a small residential area in the city in order to procure compost. This, however, generates a poor-quality and contaminated 'soil amendment' that is of poor quality[3]. Landfill costs are relatively low in South Africa, making it the most common choice of disposal (although this is likely to change) (Fiehn and Ball, 2005:2; Greben and Oelosfe, 2009:1). Overall much supermarket food waste, apart from some that is redistributed for human consumption through 'food banking'[4] and a fraction that is composted or fed to animals, still ends up in landfills. This food waste could be a valuable resource for the growing number of urban agriculture projects in the city, which often struggle from lack of access to fertile soil and affordable compost. It could also feed into alternative energy projects and help reduce waste to landfill.

In recent years there has been significant development in national and local policy highlighting the importance of reducing waste to landfill[5]. In September 2001, members of government, civil society and business met in Polokwane for the first National Waste Summit. The summit recognised that waste management was a priority and that there was a need for urgent action to reduce, reuse and recycle waste. The summit's stated goal was to "stabilize waste generation, reduce waste disposal by 50% by 2012 and develop a plan for Zero Waste to landfill by 2022" (Fiehn and Ball, 2005:12). Yet, in Fiehn and Ball's (2005)

[1] In the process of conducting interview with the city, waste experts and waste management companies, there was a consensus that 'large' or significant amounts of food wastes is ending up in landfills, yet I was only able to obtain qualitative figures, no publically available quantitative figures exist on food waste landfilled for the city of Cape Town. The
[2]Putrescible waste refers to organic waste with a high water content (http://www.eoearth.org/article/Putrescible_waste).
[3]From an interview with waste management expert.
[4]'Food banking' is a system in which food still edible for human consumption is collected from supermarkets and other food outlets and redistributed within its use-by date to various organisations and urban feeding schemes.
[5]Nationally such policies include: The 1999 National Waste Management Strategy (NWMS); The 2000 White Paper on Integrated Waste and Pollution Management; The 2008 National Environmental Management Waste Act (NEMWA); The 2010 National Waste Management Strategy Draft. In Cape Town such policies include: The 2006 Integrated Waste Management Plan; the 2009 Integrated Waste Management By Law.

review of the state of waste management in South Africa, they identified that this goal seemed ambitious considering the present lack of infrastructure. They stated that a paradigm shift was needed whereby the city truly begins to treat waste and "everything as part of a cycle" (Fiehn and Ball, 2005:12).

While waste policy has been enhanced greatly and levels of recycling have increased, little provision has been made for food waste despite its contribution to environmental degradation as well as its latent potential as a resource. At present, food waste (unless specifically condemned by the health and safety department for hygiene reasons) falls within the category of 'general waste'[6], which includes both wastes from residential and commercial sources (NEMWA, 2008:13; NWMS draft, 2010:85). The lack of an explicit category for food waste undermines its potential value as a resource. For the most part food waste is treated as general waste and not handled separately, but sent as mixed waste to landfill. This lack of definition and specific legislation pertaining to food waste means that generators of waste are not legally required to manage it in a sustainable manner. Where recycling is done it is largely a personal choice, so the chosen methods of waste disposal are often determined by personal agendas such as low cost or internal hygiene requirements.

Recent tentative plans have emerged to ban organic materials from landfill in Cape Town through the pending legislation on landfill criteria[7]. This would put an obligation on generators of organic wastes to find alternative options to landfill. However, in order to ban organic material (of which food waste is a major component) from landfill, alternate systems will have to be developed to cope with the diverted material. Although policy has acknowledged the importance of diverting garden wastes from landfill, at present there is simply nowhere for large quantities of food waste to go.

Furthermore, although food banking is presently able to account for a portion of edible food waste (mostly fruit, vegetables and non-perishables), few options currently exist in Cape Town for foods which are not suitable for human consumption or considered risky due to their potential to cause harm to human health if not handled correctly (such as dairy and meat products). Even if large-scale generators such as supermarkets wish to recycle their food wastes, no options such as large composting sites or anaerobic digestion plants exist in the

[6] Interview with health and safety professional
[7] Interview with waste management employee at the City of Cape Town.

city to manage large volumes of food waste. While some recycling companies with the expertise to oversee the process do exist, at present generators willing to divert food waste on a large scale from landfill would have to develop and fund the necessary infrastructure for recycling food wastes themselves. As waste management is not regarded as a core function of the food industry, as yet it is not a priority on their agenda. Many entrepreneurs developing food recycling initiatives with the potential to compost food wastes, such as composting or AD, are battling with many economic, legislative and social pressures and barriers. On the other hand the Municipal Government lacks the financial and human capacity to implement projects alone and sees such activities as potentially income-generating and thus the role of the private sector[8]. The question of how to move towards sustainable food-waste management in Cape Town invokes many multi-layered questions about the capability and responsibility of different actors in the overall system and how these can be negotiated to create change whereby responsibilities and benefits can be shared.

Supermarkets are important players in the food system of any city. It is estimated that supermarkets now control 50% of food retail in Africa and up to 70% in South Africa (Oosterveer et al, 2007; FAO, 2006:12; Patel, 2007; 240; Kirsten and Abdulrahmen, 2008).They are considered "large-scale waste generators" and a site of much surplus and food waste (EPA, 2009). Although most studies on supermarket food waste to date have focused on northern cities, the rapid changes occurring in food-supply chains and the wave of 'supermarketization' in the global South warrants increased attention to this area of study (FAO 2011; Parfitt 2011).

In the past decade, many supermarkets in Canada, the US, EU and Asia have found new ways to recycle their food wastes. In the US, food waste-composting projects have now been implemented by many large chains such as Wal-Mart, Kroger, Whole Foods and Big Y Foods (Biocycle, 2005; Goicochea: 2009; Conolly; 2006). Reports show that these projects are significantly reducing food landfilled, reducing disposal costs and generating profits for the supermarkets involved (EPA, 2009). Such projects can contribute to overall sustainability goals such as 'zero waste' targets, improve corporate image, and help supermarkets extend their supply chain responsibility further, working towards a more integrated supply chain. They also have the potential to help develop infrastructure and contribute significantly to

[8] Interview with solid waste management expert at the City of Cape Town.

regional reductions in amounts of waste sent to landfill. Under the South African Constitution (Act 108 of 1996) waste is considered the responsibility of the government. However, given the government's current capacity and its challenges even in terms of basic service delivery, it seems unlikely that municipalities alone can achieve targets for reducing waste to landfill or optimise waste's hidden resource potential (Engledow, 2010; Oelofse and Godfrey, 2009:2). The recent National Waste Management Strategy Draft outlines the need for a "collective approach to waste challenges and the involvement of a broad range of stakeholders in their implementation" (NWMS Draft, 2010:5). Through more sustainable methods of food waste, supermarkets could play an important role in helping achieve this vision.

Overall, by engaging with the workings of the retailer and working outwards into the management of waste in the city, this thesis hopes to gain an understanding of how practices and ideologies around food waste are constituted at the different scales as well as highlight some of the barriers and possibilities for managing food waste more sustainably as a resource within and beyond the current system. The issue of supermarket food waste is not an isolated case study but part of a wider set of systems and practices in the city. By focusing on the multiple scales affecting the management of food waste as it emanates outwards from the store, this thesis hopes to shed light on this complexity. The supermarket cannot operate without the wider policy agenda and waste framework of the city, so it is important to explore both and the relationship between them.

Focusing on an extended micro study of a single supermarket store within a this complex landscape of enablers and inhibitors of change, allows an investigation of the wider systems and processes affecting the management of food waste and its gradual integration as a resource within the urban environment. The investigation into the chosen store's waste management practices, how these interact with and are informed by broader systems and practices around food waste management in the city, provides a practical point of departure.

1.2. Chapter outline

This thesis is presented in eight chapters. This chapter, Chapter One, introduces the thesis. Chapter Two provides a review of relevant literature. Chapter Three outlines the methodology used for the study. Chapters Four and Five aim to provide a context surrounding the issue of supermarket food waste. Chapter Four looks at changes in waste-management thinking and policy in South Africa since democracy, providing an overview of how policy and practice have shifted over this period. Chapter Five provides an overview of the systems for managing waste in Cape Town. Chapter Six maps the management of food waste in the case study supermarket, giving a systematic outline of the various waste streams and how they are managed. Chapter Seven then explores the framing of food waste by the supermarket and other stakeholders involved throughout its lifecycle. Finally, Chapter Eight explores the management of supermarket food waste through a Transitions lens, using recent Innovations Studies Literature to explore the complexity of transitioning towards a more sustainable system of managing supermarket food waste in Cape Town and the factors that might inhibit or contribute to this . Lastly Chapter 9 provides a conclusion to the thesis.

Chapter 2. Literature Review

This literature review is divided into three sections. The first introduces the literature on Innovations Studies and transitions to sustainability, which provides a useful set of theoretical ideas for this thesis. While this thesis does not rely heavily on Innovations Studies, the field provides a vital theoretical starting point for thinking about the transition of food waste towards resource status in the context of Cape Town. Literature from innovations studies arose to examine the nature of transitions to sustainability and most has focused on northern-hemisphere cases. This thesis draws from various studies and looks at the application of innovations studies in a 'southern' context.

The second part of the literature review moves into the field of waste and sustainability. It aims to map transitions in waste management thinking and practices within a wider discourse of sustainability. The ways in which waste has been thought about, prioritised and managed have transformed greatly over the history of urbanity. This section explores the changing approaches towards the management of 'wastes' from post-industrial linear methods towards more contemporary ideas of cyclical management and using 'wastes' as resources. While initially waste was treated as a nuisance that needed to be removed, controlled and managed (and is still treated this way in many cities) a very different discourse is emerging in which 'waste' is seen more as a resource. This new 'waste to resource' thinking is becoming a vital area of research, not only because of the inconvenience and dangers of excessive waste production, but because the world is running out of finite resources. In this context, wastes are increasingly being assigned significant value. This second section explores some of the interesting theoretical literature which has emerged in recent years around the social construction of waste. Such literature is concerned with how waste as a category changes through time and space, mirroring the priorities and ideas of the time. This body of work is especially useful in Chapter Seven, which looks at the framing of supermarket food waste and the way in which it is perceived and treated throughout its lifecycle by different stakeholders.

The last section of the literature review focuses specifically on food waste, an issue of increasing interest in global literature in recent years. This section looks at how the global literature has largely investigated northern contexts with very little written on southern cities. It argues the importance of this neglected area of study, especially in rapidly changing cities

such as Cape Town which have features of both developing and developed cities, and thus the problems attributed to both, such as high levels of poverty and high volumes of waste generation per capita.

2.1. Transitions to sustainability

Over the past decade, the field of innovations studies has explored in detail the topic of transitions to sustainability. This body of literature brings together related work from disciplines such as science and technology, evolutionary economics and sociology to explore and gain better understanding of the nature of transitions to sustainability. Innovations studies help shed light on "how and why greener production and consumption systems come about or do not, and suggest how these kinds of practices might be accelerated" (Smith et al 2010:2).

The innovations literature aims to explore the complex technical and social aspects involved in fostering change towards sustainability. Within this literature transitions are defined as "shifts from one socio-technical system to another," thus involving both technical and social elements of change (Grin et al 2010:11). Socio-technical systems are explained as being constituted by the interactions between technological advancements as well as the social interaction with these. Innovations studies is concerned with these transitions and the complex socio-technical changes and multiple levels of change required to bring them about. As Grin et al (2010) explain:

> *"Transitions involve mutually coherent changes in practices and structures, and because their multilayeredness and inevitable entrenchment in society and culture at large they are very complex." (Grin et al, 2010:3)*

While more sustainable technologies or systems may be possible, their integration with the dominant system depends on complex interactions and mutually beneficial developments (Smith et al, 2010:1-2). As systems are "embedded in societal structures" made up of complex sets of practices and relationships, sustainable systems often have to struggle to gain legitimacy, status and functionality (Grin et al, 2010:3). Exploring the nature of transition and the 'driving forces' or factors that 'enable' or 'disable' transitions has become a popular area of interest in recent innovations literature and within the social sciences (Grin et al, 2010; Smith et al 2010; Perez, 2010; Hekkert et al, 2008; Negro et al, 2008; Negro, Hekkert and

Smits 2007; Markard, 2006; Jacobsen and Sanden 2006; Hekkert and Sarke, 2006; Foxon et al, 2005). As Perez explains:

> *"The hard sciences and engineering are intensely facing the task of developing alternative energies, methods for carbon capture, recycling and other technical ways of facing the environmental challenges; the social sciences must confront the task of understanding transitions and how to influence them."* (Perez, 2010: xv)

In the context of this thesis, this growing body of literature provides a useful set of theoretical and conceptual tools for thinking about current systems of waste management and how 'waste' materials might be transformed towards being used further as resources with a specific context or set of relationships and practices. This thesis draws from two distinct conceptual tools from the innovations literature. One is the Multilayer Perspective (MLP) developed initially by Frank Geels. The other is Negro and Hekkert's (2008) "7 Core Functions" conceptualised in their paper titled 'Explaining the success of emerging technologies by innovation system functioning: the case of biomass digestion in Germany'. These provide useful heuristic tools for thinking about the factors that might shape the transition of supermarket food waste to use as a resource in Cape Town.

The MLP was first developed by Frank Geels in the late 1990s in his search for the factors required to fuel transitions towards more sustainable systems. It evolved out of Geels' exploration of historic transitions towards newer socio-technical systems, for example in the areas of sanitation, mobility, food and waste (Smith et al, 2010: 1-2). The MLP explains that transitions towards more sustainable methods and systems arise from an interrelation of factors at different levels and identifies three important levels at which change needs to happen for a new system to become successful and take the place of or co-exist with the current dominant system (Smith et al, 2010:1). Firstly, there needs to exist a micro-level seed of change in the form of what Geels calls "technological niches". This could be the development of a new sustainable technology such as a bio-digester developed by technicians and entrepreneurs. These technologies or new systems can be difficult to establish becomes the dominant system often works in a very different way; there is much uncertainty about the transition and many barriers to success. Secondly, Geels identifies what he terms "socio-technical regimes", which refers to the current and dominant systems in place that carry out functions such as waste management. In Cape Town the dominant regime or predominant

method of waste disposal is still landfills, while recycling is still at niche level (although gaining legitimacy) and this remains the case for food waste. The dominant socio-technical regimes are well established and 'locked in' to their operational context: they are stable and work within the current societal ideologies, regulatory systems, markets and infrastructures (Grin et al, 2010:18-24). Thirdly, Geels refers to a last layer, the "socio-technical landscape", a "broad exogenous environment" which provides a context for both socio-technical regime and niche-level activities. It is the enabling environment in which conditions can shift over time and which is favourable or unfavourable for the process in transition towards legitimacy. It is made up of a complex of forces such as world markets, globalisation and global environmental concerns and pressures. These influence the level of change on a micro level. In order for new sustainable methods or systems to be successful, the niche level, the socio-technical regime and the landscape levels have to align to provide the space for the new system to flourish.

As Grin et al explain:

> *"Transitions are a co-evolution process that require multiple changes in socio-technical systems or configurations. Transitions involve both the development of technical innovations (generation of novelties though new knowledge, science, artefacts and industries) and their use (selection, adoption)"* (Grin et al, 2010:11).

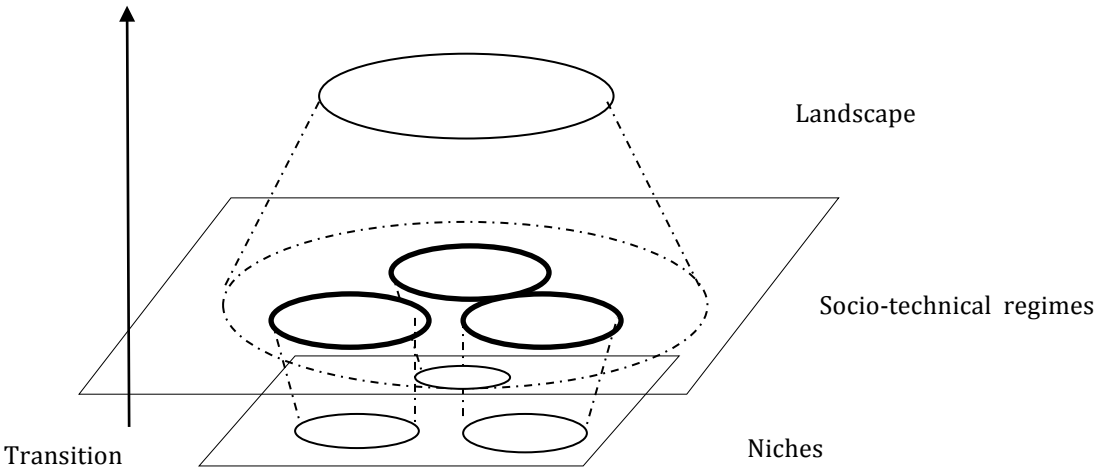

Figure 1: Illustration of MLP nested hierarchy, adapted from Grin et al, (2010:19).

Hekkert et al (2008) in their examination of the success of the German bio-digestion industry, provide a useful set of ideas for thinking about transitions to more sustainable systems of waste management. Within the framework of an innovation systems approach they identify seven core 'functions' (conditions) which helped bring about the success of this new regime in which bio digestion is integrated and functional and without which transformation would have been disabled. Based on Freeman (1987) they define innovations systems as "networks of institutions, public or private, whose activities and interactions initiate, import, modify and diffuse new technologies" (Hekkert et al, 2008:466). They draw on the concept of a Technological Innovations System (TIS) as defined by Carlsson and Stanckewicz (1991:94) as "a network or networks of agents interacting in a specific technology area under a particular institutional infrastructure to generate, diffuse and utilise technology" (Hekkert et al, 2008:467). Using this as a basis for thinking about the nature of the development of new systems (for example, the development of biomass digestion) they define seven core functions needed for change. These include:

1) Entrepreneurial activities[9]
2) Knowledge development[10]
3) Knowledge diffusion through networks[11],
4) Guidance of search[12]
5) Market formation[13]
6) Resource mobilization[14] and
7) Advocacy coalition (creation of legitimacy/counteracting resistance to change).[15]

Hekkert et al (2008) explain that, while they may not all emerge at once, these factors are useful for thinking about the ingredients that shape the success and development of new

[9] The presence of entrepreneurs who activate new technologies and systems (Hekkert et el, 2008: 468).
[10] This refers to the commitment to developing new technologies and ideas in the interests of sustainability (Hekkert et al, 2008: 468).
[11] This refers to the exchange and movement of information which shapes the development of new interest and research towards new technologies or systems (Hekkert et al, 2008: 467).
[12] This refers to the setting of criteria or objectives for example by the government to focus on the development of a particular technology or area of technology for example waste to energy projects. This can help gather 'momentum' and interest (Hekkert et al, 2008: 467).
[13] As new technologies need to start out on nowhere they often find it hard to compete with already 'embedded' and existent technologies or systems. In order to get a head start new technologies need often to be supported, for example through incentives or tax breaks. (Hekkert et al, 2008: 467).
[14] This refers to both financial, material and human resources all of which are necessary for the activation of a new technology (Hekkert et al, 2008: 467).
[15] Here (Hekkert et al, 2008) refer to the need for 'creative destruction' i.e. the needing to break down old systems and paradigms and "put new technology on the agenda". This can require the mobilization of interested parties in lobbying and raising the profile of new technologies, and ultimately working towards their legitimization.

systems. Such functions act together to create positive feedbacks or "virtuous cycles"(Hekkert et al, 2008:467). , Hekkert et al show how the success of the biomass digestion industry in Germany was a result of such virtuous cycles or the co-incidence of the seven core functions. Therefore, the transition required commitment from a range of stakeholders including individual entrepreneurs, similar interest groups, financial institutions and governments.

Although conditions in Germany are very different – and perhaps precisely because they are – this case and heuristic framework is an effective point from which to begin thinking about the transition towards food waste's use as a resource in Cape Town. Although this thesis does not focus on a specific technology but rather the development of collections of technologies or systems capable of transforming inedible food wastes into resources rather than landfilling them, the core functions provide a starting point for thinking about the factors that are present or absent in Cape Town. While little transitions literature has focused on southern contexts, this body of writing provides a good set of conceptual tools for this project that is concerned with the complexities around the transition from waste to resource. The next part of the literature review provides an overview of changes in waste management thinking over time and a snapshot of the present in which towards the present where we are starting to move into a paradigm where 'waste' is becoming an no longer a legitimate term.

2.2. Waste a Growing Concern

Recent estimates suggest that if we combine municipal and industrial waste categories we arrive at a global estimate of between 3.4 and 4 billion tons of waste annually or 10 million tons daily (Chalmin and Gaillochet, 2009:11). Given the unreliability of waste data in many countries it is difficult to be precise, yet it is clear that our global generation of waste is growing exponentially and, while most of this is happening in northern cities, cities of the south are catching up. Until very recently waste has been seen as a 'problem' or necessary by-product of urban areas that grew with the growth of cities, their densification and increasing population growth. This was evident as early as 500BC in Athens, when throwing waste into the street was outlawed for the first time and waste was required to be dumped outside the borders of the city (Williams, 2005:1). As cities grew, waste became an increasingly serious problem and a threat to health and 'order', so methods were developed to remove it from sight and harm's way. Since the end of the 18th century and the onset of the industrial revolution, the generation of waste has increased tremendously, not only in scale

but also in variety. With the growing exploitation of natural resources and the increasing complexity of production systems came an increasing amount of discarded wastes. As Chalmin and Gaillochet explain:

> *"The industrial revolution that started at the end of the 18th century obliged mankind to adopt a new rationale – that of exploitation, predatory behaviour and consumption of resources, whether sustainable or not, with no apparent limits. Technical progress enabled to go further, quicker and deeper, adopting a philosophy of discover and exploit. Little by little, resources to be recovered and waste (increasing at a rate equal to that of urbanisation) were seen as pollutants that had to be collected discretely."* (Chalmin and Gaillochet, 2009:7).

Noted by Chalmin and Gaillochet (2009), the dustbin as an everyday artefact of today's world first emerged in the 1880s in Paris as a measure to contain the increasing volumes of unwanted, displaced materials which posed a menace to public health in the increasingly dense city (Chalmin and Gaillochet, 2009:1). Within this context, early waste management practices were concerned primarily with finding ways to remove waste from sight and potential to harm. Organic wastes, which once would have gone back into the earth, in cities became 'matter out of place'.[16]

The transition into a post-Fordist society saw growing varieties of wasted materials. Coupled with escalating consumerism and increasing population growth, this has created an immense waste problem, of which the other side of the coin is the dwindling of global resources (UNEP/IRP. 2010:120).

2.2.1. Sustainable Development and newer discourses on resources and 'wastes'

During the 1980s the rhetoric of sustainable development began to permeate the development arena. Previously, the dominant model of development had been based on linear concepts of development in which society was seen to go through various 'stages of economic growth' and 'third-world' countries needed to 'catch up' with a western model (Baker, 2006:2). During the late 1970s and into the 1980s this model of development was challenged by environmental and other social and political discourses. Not only was this linear western-centric model of economic development a form of domination, it also reduced nature to

[16] This phrase was first coined by Mary Douglas in her 1966 book Purity and Danger.

"merely a natural resource base" and prioritized economic growth over social and environmental well-being. It pushed for economic growth even though "the heightened consumption patterns that it stimulat[ed] ... threaten the very resource base on which the future depends" (Baker, 2006:2). Within such a model, environmental degradation became a necessary externality or inevitability of economic growth (Chalmin and Gaillochet, 2009).

The discourse of sustainable development emerged in opposition to this 'old development' paradigm. It sought new ways to think about development as integrated with the environment rather than in opposition to it. It saw development as happening at the "interface" of social, economic and ecological dimensions, of which all are vital for sustainability (Baker, 2002:2). The term 'sustainable development' was first used in the Bruntland Commission's report *Our Common Future* in 1987, where it was defined as "development that meets the needs of the present generations without compromising the ability of future generations to meet their own needs" (WCED, 1987). From that time onwards sustainable development became an important focus of academic study and policy-making. It marked the beginning of a new set of approaches to the use of resources and thus the beginning of a great shift in waste-management thinking.

2.2.2. Transitions in waste-management thinking

Warnings of the finitude of the world's resources date back to the late 1700s and early 1800s, when Thomas Malthus warned that human population growth would outstrip the earth's ability to support it (Rogers et al, 2006:20). Yet our use of resources has continued to grow exponentially since then. Malthus's view was greatly debated and faded into the background as a focus on economic growth prevailed in the following centuries.

During the 1970s, a time of shortages of oil and other raw materials, Malthus's ideas were reemphasised in *Limits to Growth*, a book written by Donella Meadows and published by the Club of Rome. In 1974 Lester Brown set up the *World Watch Institute*, dedicated to measuring the global use of natural resources, which resulted in an annual *State of the World Series* (Rogers et al, 2006:20). From this time onwards several concepts and models came about, conceptualising a different approach to resource management. They moved away from linear models of resource use and towards more cyclical approaches. Such models looked at the flows of resources at various scales and through various systems. The concept of urban

metabolism, for example, which has its origins in the mid-1960s in the work of Abel Wolman, explores patterns of production and consumption within cities, paying close attention to the flow of "energy, water, materials and wastes into and out of an urban region" (Kennedy et al, 2007:43). Wolman's work highlights the importance of understanding material flows through cities and is concerned with keeping the throughput of materials within the "biosphere's capacity for regeneration and waste assimilation" (Kennedy et al, 2007: 43). This concept and the branching-out of similar concerns began to create a new perspective for thinking about the systemic use of resources (Goodland and Daly, 1996). During the 1990s, both in response to escalating volumes of waste and new approaches to resource use, waste started to become a priority on the global environmental agenda and concepts such as those mentioned above began to be developed further and popularised.

The Rio 1992 Earth Summit, or United Nations Conference on Sustainable Development, was an important watershed for waste-management thinking and placed waste firmly on the global environmental agenda for the first time. The Agenda 21 stipulated the need to work towards "minimising wastes", "maximising environmentally sound waste reuse and recycling" and "promoting environmentally sound waste disposal and treatment" (Cooper, 2002:326). It also brought forth the concept of Integrated Waste Management (IWM) as an objective to be adopted. The concept of Integrated Waste Management proposes that a variety of solutions are needed to work towards more sustainable waste management solutions, rather than one centralised system. Inherent in this concept is the idea that such solutions need to be suited to the overall context or region in which they are applied. IWM takes into account the entire waste system, including the various waste streams, their collection, and suitable methods of treatment, in relation to economic, social and environmental objectives (Cooper, 2002: 326; Williams, 2005:336).

After Rio 1992, a model called the Waste Management Hierarchy (WMH), which was first introduced by the European Community (EC) in 1975, became widely accepted and adopted by many countries as the "keystone" in their policies on waste (Cooper, 2002:326). The hierarchy model provides a simple vision for the reduction, reuse and recycling of waste in which only "unavoidable waste" is discarded (See Figure 2) (Oelosfe and Godfrey, 2008:242). Today the WMH is globally regarded as a vital conceptual and practical tool. It provides the basis for current waste-management strategies in many cities and underpins South African waste-management policy (IWM Policy, 2006:8). The US Environmental

Protection Agency (EPA) has also expanded this to create a Food Waste Management Hierarchy, which is explained later in this chapter.

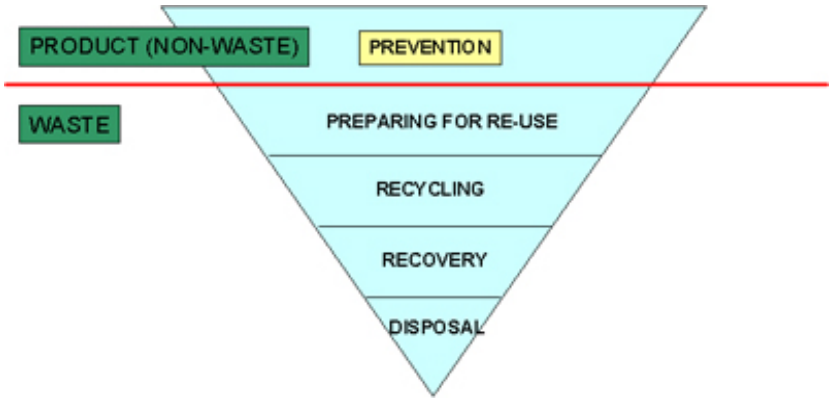

Figure 2: Waste Management Hierarchy Diagram Taken from European Commission on Environment website[17]

In 2002, ten years after Rio 1992, waste management continued to be a prominent topic at the World Summit for Sustainable Development (Feihn and Ball, 2005:2). Over the past two decades, solid waste management has become an increasing priority on the global environmental agenda. A variety of theories, models and concepts have emerged for thinking about wastes in a more integrated way and ultimately as resources. Literature on waste has grown, broadened and deepened in many directions and within a variety of disciplines including chemical and industrial engineering, environmental science, sociology, psychology and anthropology. While early studies centred on dealing with the materiality of waste within a growing awareness of its threat to environmental and physical health, over time the focus has broadened. Literature on waste has expanded to look not only at technical issues of waste but also the ideological systems that support its production and its treatment in different places. Studies on waste management have increased greatly in both number and scope (Gille, 2010:1049).

2.2.3. Systems-based approaches for the management of resources and wastes

For many years after the Industrial Revolution waste was seen as a necessary externality of economic growth and production systems. More recently, it has been increasingly recognised that waste should be considered in a more systemic manner within production systems

[17] http://ec.europa.eu/environment/waste/framework/index.htm

(Cooper, 20002:326). At the Rio Earth Summit, the International Solid Waste Association (ISWA) produced a report on waste management as part of a series of reports on *Industry as a Partner for Sustainable Development*, drawing attention to the need for industry to rethink its use of resources, its treatment of waste and its role in working towards sustainable development (Cooper, 2002:326). Stakeholders and investors have also become more interested in this, adding pressure for change (Wolford, 1995). As a result, many companies are researching and incorporating more sustainable management approaches into their systems.

While it is only in the past decade that industry has really started to incorporate these ideas into their supply chains, they began to filter into literature as early as the 1970s in concepts such as Life Cycle Analysis (LCA) and Integrated Supply Chain Management (Seuring, 2004). LCA emerged in the mid-1970s as a method for thinking about the environmental consequences associated with products throughout their lifecycles. LCA maps the environmental impacts of a product from design to disposal. It has since become a vital concept for investigating and designing sustainable supply chains. Integrated supply chain management, which emerged in the late 1970s and 80s, developed out of LCA but took the concept further. It investigated the connections between industry and material flows with the wider context, engaging with ideas of actor-network theory and how systems are constituted out of dialogues with different actor interests, policies and actions (Seuring, 2004:311).

In recent years, discourses for thinking about the cyclical management of resources and recycling of wastes within industrial systems have developed into a number of models, concepts and fields. Examples include industrial ecology, cleaner production, reverse logistics, closed-loop supply chains, and zero waste to landfill. Although these have different applications and scales of operation, they all speak to the need to move away from linearity and towards the circular, integrated systems found in nature (Seuring, 2004:307/406, Smith et al, 2010:13).

The idea that nature knows no waste and that we need to work towards creating production systems that are modelled on natural systems has become a vital objective, despite sometimes being criticised for being unrealistic and unachievable (Ayres, 2004)[18]. The conceptual

[18]Ayres warns against what he calls "attractive analogy between nature and industry" because, firstly, he explains that there are key differences and, secondly, he disagrees that there are no wastes in nature (Ayres, 2004:425).

linking of natural systems with industry has shaped thinking around the flows of materials and production of wastes within our current supply chains and production systems and has encouraged development of the concept of sustainable development (Seuring, 2004).

This interest in shifting from end-of-pipe approaches towards cleaner production systems has been a prevalent theme in literature since the 1990s, developing into what Smith terms a "new cleaner production paradigm" (Smith et al, 2010:3). The concept of cleaner production has been adopted by countries and industries as an objective. Cleaner production calls for a "shift away from end-of-pipe" management systems to more integrated technologies and methods of operation. This included conserving and recycling raw materials and energy, eliminating toxic chemicals and reducing the quantity and toxicity of emissions and wastes generated during production (Wang, 1999:438). In the book *Cradle to Cradle***,** William McDonough & Michael Braungart (2002) coin the terms "cradle to cradle" and "waste is food", illustrating that in nature there is no such thing as 'waste' as everything feeds into another process as food. Thus, there should be "no throwing-away" of resources as everything is part of a cycle. Consequently "waste, and hence pollution, are products of bad design" (Fiehn and Ball, 2005:12).

2.2.4. From waste to resource in a world of finite resources

Although the drive towards more integrated waste-management systems may initially have arisen out of a concern about pollution and its effects on environmental and human health[19], over the past decade this had become equally weighted by the recognition of dwindling resources and the need to conserve resources and decouple waste production from economic growth, as well as the rise in value of 'waste' materials (UNEP/IRP, 2010).

> *"Wheat and corn prices are way up. Overall, world commodity prices have risen by a quarter in the past six months. So what's the meaning of this surge? Is it speculation run amok? Is it the result of excessive money creation, a harbinger of runaway inflation just around the corner? No and no. What the commodity markets are telling us is that we're living in a finite*

[19] "The Industrial Revolution obliged mankind to adopt a new rationale, that of exploitation, predatory behaviour and the consumption of resources, whether sustainable or not, with no apparent limits. Gradually waste became regarded as pollution and had to be collected, hidden or buried, with minimum impact on the environment" (Chalmin and Gaillochet, 2009:1)

world, in which the rapid growth of emerging economies is placing pressure on limited supplies of raw materials, pushing up their prices.[20]" (Krugman, 2010).

Awareness of and studies on resource-finitude have increased greatly since the beginning of the 21st century, affected by a series of resource shocks and crises and the uncertainty of changing climates. The concept of rarity, a once-understood concept blurred by industrialization " suddenly returned to centre stage" of our concerns (Chalmin and Gaillochet, 2009:1) due to the rate of population growth growing consumerism warranted by increased standards of living. Waste has become an interesting focus, because where once it was seen as an externality it now has the potential to play a vital role in the global economy. As Chalmin puts it, "ignored or left on the shelf for many years, the waste economy is now called on to play a fundamental role in the resources rationale of our planet in the 21st century"(Chalmin, 2009:5).

Recent studies have shown that markets in secondary resources (i.e. re-used and recycled materials) have started to become more robust (Chalmin and Gaillochet, 2009). Increasing energy prices have also created a favourable space for the emergence of alternative technologies and increased interest in waste-to-energy projects (Chalmin, 2009:5). Wastes are increasingly being viewed as potential resources; our relationship with wastes is changing. Today waste management is no longer about controlling and hiding waste but about integrating it into our systems. Sustainable methods such as reuse, recycling, incineration with energy recovery, composting and anaerobic digestion are increasing in popularity globally (Williams, 2005:367). Sustainable waste management is also becoming viewed as a vital area of focus for the mitigation of climate change. While the waste sector itself is not considered a priority or large-scale contributor to climate change (generating an estimated 3 to 5% of total anthropogenic emissions in 2005) we can indirectly reduce emissions in other emission-intense sectors by reducing, recovering and recycling waste (UNEP, 2010:10).

As illustrated above, many shifts have occurred in models of waste management. These new models for thinking about wastes and the use of resources are vital, but another set of literature has emerged which argues the need to take our thinking further. This literature is concerned with the social construction of waste, the relationship between waste and society.

[20]Krugman. P, The finite world The International Herald Tribune) Tuesday, December 28, 2010

Social studies on waste argue that in order to transform our unsustainable systems to ones more in keeping with nature's cycles and the earth's resource capacity we need to understand our relationship with the socially constructed category 'waste'.

2.2.5. The social construction of waste

Fagan (2002) has argued for a need to increase the attention paid to waste within social theory. Critiquing sociology's linear approach to the study of production systems, he described social theory on waste as a 'lost continent', a long way behind studies concerned with production and consumption in "terms of analysis and understanding" (Fagan, 2002:np; Fagan, 2003:67). In the decade following this observation, studies within the social sciences have explored more closely actor and societal relationships with what is categorised as 'waste'. Such studies have shown that the treatment of waste is embedded in societal perceptions of what waste *is* (Fagan, 2002; Gille, 2010; Davies, 2008; O'Brien, 2007). Zsuzsa Gille argues that "waste itself, its production, consumption, its circulation and metamorphosis is constitutive of society" (Gille, 2010). Waste in a sense becomes the opposite of what is valued in a given society. Thus, under "contemporary capitalism's logic of increasing production and consumption" waste and wasting become a by-product and "environmental externality" (Fagan, 2003:69). This is what Streusel (1999) refers to as a "throwaway culture", which replaced a previously different "culture", one "grounded in re-use and a philosophy of waste not, want not" (Fagan, 2003:69).

As many authors point out, there is no universal definition of waste. Waste varies over time and from country to country, and even within each specific definition there exists a degree of uncertainty or ambiguity. All definitions of waste require a level of subjectivity, opinion or perception. Various authors have argued the importance of the way in which waste is defined and the impact that a definition can have over the management of a material, and the resultant implications of this for the operationalisation of a material as a resource (Gourlay, 1992; Bontoux and Leone, 1997; Pongrácz et al; 2004; Oelofse and Godfrey 2009; Bulkeley and Gregson, 2009; Gille, 2010).

Gourlay (1992) talks of surplus material rather than waste, explaining that this "broad definition" allows for the perception that it might be used again and not merely discarded. Oelofse and Godfrey (2008) apply this idea to policy, arguing that the word 'waste' itself,

and the way it is defined in policy inhibit a paradigm shift in thinking about how we can manage it as a resource (Oelofse and Godfrey, 2008:242). They compare different waste-management strategies in the EU, Singapore, New Zealand, Taiwan, the United States and South Africa and examine how different ways of defining waste in policy contribute to how it is handled in practice. Pongrácz et al (2004) argue that definitions of waste can impact "on its ownership and management". They point out that definitions of waste often accept or label materials unnecessarily as legitimate ones to be thrown away. These definitions then feed into policy and legislation, informing or solidifying practice for the (mis) management of a resource. In this way, definitions can side-line or undermine the potential for a 'waste' material to be viewed as and transformed into a resource (Pongrácz et al, 2004:142). Pongrácz et al argue that the categorization of materials as wastes keeps them unnecessarily in a static place of usability: the fact that they have never before been assigned a use does not mean that they cannot have one (2004:141, 151). Similarly, Oelofse and Godfrey (2008), in their study of the consequences of definitions of waste in South Africa, conclude that poor definitions inhibit the realization of the Waste Management Hierarchy and thus impinge on the realization of sustainable and integrated waste management (Oelofse and Godfrey, 2008:104).

Key authors on the social construction of waste argue that we need to think beyond the technical solutions to implementing more integrated waste management to try to understand how society relates to waste and how this relationship can shift so that wastes come to be seen more as resources (Strausser, 1999; Gille, 2002, Gourlay, 1992, Pongrácz, 2004). These ideas are important in thinking about the operationalisation of food waste as a resource in urban areas. While food waste would once have been recycled as animal feed or into the soil for agriculture, in urban areas and within modern food systems it has come to be seen as a problem. While shifts to using food waste as a resource need technological solutions, they also require shifts in how it is perceived and valued.

2.3. Focusing on Food Waste

It is estimated that up to half of the world's food is lost before it reaches the consumer (Lundqvist et al, 2008; Parfitt, 2010; Parfitt and Barthel, 2011). This is estimated to be about 1.3 billion tons of food annually throughout the food supply chain at various stages from 'farm to fork' (Gustavsson et al, 2011:2). The issue of food waste is an important area of

focus for a multitude of social, economic and environmental reasons. Over the past decade, interest in and literature on food waste in cities has proliferated greatly. Most has emerged from European, American and Asia, where food-waste recycling is more widely practiced, documented and incorporated into policy. There are few studies on food waste in Africa and little available research or data on food waste in Cape Town (Fuedy et al, 1999:136). There is also a lack of attention to food waste in new South African waste policy, where it is mentioned only briefly, and the infrastructure and associated systems to manage food waste sustainably in the city are limited. While recycling of other types of waste has increased greatly in the City of Cape Town in recent years and some smaller-scale initiatives for food waste have emerged, the recycling of food waste on a large scale is limited and as yet there is little research that explores why this is and how it can be changed. Stewart (2009) speaks of how "the world's mountain of surplus food is currently a liability – but is also a great opportunity" (Stuart, 2009: xix). As explained above, food waste can be extremely hazardous if sent to landfill. Yet it can also be an extremely valuable resource. This duality makes it an important area of focus for research.

2.3.1. Food loss vs. food waste

While *food loss* and *food waste* both refer to the "decrease in edible food mass" throughout the supply chain, they are often distinguished from each other in the literature by the place in the food supply chain where the loss occurs (Gustavsson et al, 2011:2). Food loss refers to "food losses (that) take place at production, post-harvest and processing stages in the food supply chain" (Gustavsson et al, 2011:2). Food waste generally refers to "losses occurring at the end of the food chain" such as in the retail and final consumption stages, often relating to retailer and consumer practices and behaviour (Parfitt et al, 2010: 3066). Both food waste and food loss mean that food never reaches human consumption even if it is diverted to other uses once 'lost' (Gustavsson et al, 2011:2).

When the Food and Agriculture Organization (FAO) was created in 1945, reducing food loss was part of its mandate (Parfitt et al, 2010:3065). While some studies were conducted in during the 1940s it was not until the 1970s that an interest in food loss and food waste increased in the literature. In 1974, at the FAO World Food Conference, a target was set to reduce post-harvest food loss by 50% by 1985 and a Special Action Program for The Prevention of Food Losses was established. Yet it was never recorded that this target was

achieved and, given the dearth of data available on food loss and wastage even today, it was unlikely that it was possible to ascertain waste quantities at all (Parfitt and Barthel, 2011:13). During the 1980s The Special Action Plan for the Prevention of Food Losses conducted some research, initially on grain losses but growing to cover other food types during the 1990s (Parfitt et al, 2010: 3066). Yet, overall, the literature on both food waste and food loss appears to be isolated and fragmented. Where it does exist, most of the pre-1990 studies focus on either the United States or England and on domestic food waste, while some studies look at converting food wastes to animal feed.[21]

During the 1990s larger-scale studies began to be conducted with an increasing attention on the subject of post-harvest food loss due to spoilage, processing, insects, rodents and other factors (Dunphy, 1995; Cottee and Webster, 1997; Scott Kantor, 1997; USDA 1999; WRI, 1998). These were framed in relation to the problem of world hunger and how reducing food waste and improving redistribution could help solve this problem[22]. There was also an interest in how reducing food wastes could lessen the urgent need to increase food production and agricultural yields (WRI, 1998-9).

Yet it is only since the early 2000s that the subject of food *loss* and particularly food *waste* has really begun to gain momentum in both academic and popular literature. While some literature has focused on developing countries, most of this research focuses on Europe, America and parts of Asia. The next part of this review focuses on the framing of food *waste* in this literature, and how little such literature exists in the southern context, despite its growing significance.

[21] See for example (some articles which were not accessible have been located via other studies): Gillies. M. T, 1978, Animal feeds from food wastes, Food technology review; Roy. R. 1976, Wastage in the UK's food system. London. Earth Resources Research Publications; Dowler, 1977, pilot survey of domestic food wastage, Human Nutrition 31, 171-80.Wenlock. R and D. Buss, 1977 wastage of edible food in the home, a preliminary study. Journal of Human nutrition. 31; Adelson, S. F. 1961 Household records of foods used and discarded, US American dietetic association. Gallo 1980, National food review Consumer food waste in the united states. National Food Review; Gadre. S van and M Woodburn, 1987, Food discard practices of households, American Dietetic Association; National Research Council, 1983, Underutilized resources as animal feedstuffs, NRC; Ledward.D ,1983, Upgrading wastes for feeds and food, Oxford.

[22]Dunphy.J 1995, Food banks fight against hunger and wastage in Europe, Federation Europeenne des Banques Alimentaires; Cottee, P and J.Webster, J, 1997, Waste not want not: report on surplus fresh food in the food industry. Crisis. London; Scott Kantor. L et el, 1997, Estimating and addressing Americas Food Losses, Food Review. USDA, 1999 Food Recovery and Gleaning Initiative, A citizens guide to food recovery. UDA Report; World Resources Institute, 1998-99, Disappearing food; How big are postharvest losses? Available online at: http://www.fao.org/News/FACTFILE/FF9712-E.HTM.

While literature specifically on food *waste* began emerging in the 1970s (mostly in the United States and the England)[23] it is only in the past decade or so that it has gained increasing attention both in academic and popular literature (Stuart, 2009, Steel, 2009, Bloom, 2009). As yet, most of this research on food waste has focused on Europe, America and Asia, with less focused on the global South and southern cities. Where studies exist in Africa or other 'less developed' contexts, the focus is generally on food losses (during farming, production and transportation stages) (See Figure 3). This focus can be attributed to the idea that it is in these stages that the majority of food is lost in less developed countries because they lack the infrastructure, management systems and capital to prevent such losses in the food chain. This view is highlighted in the FAO's 2011 report on 'Global Waste and Food Loss', in which it is stated that;

> *"The causes of food losses and waste in low-income countries are mainly connected to financial, managerial and technical limitations in harvesting techniques, storage and cooling facilities in difficult climatic conditions, infrastructure, packaging and marketing systems"* (Gustavsson et al, 2011:v).

By comparison the report states that;

> *"The causes of food losses and waste in medium/high-income countries mainly relate to consumer behaviour as well as to a lack of coordination between different actors in the supply chain. Farmer-buyer sales agreements may contribute to quantities of farm crops being wasted. Food can be wasted due to quality standards, which reject food items not perfect in shape or appearance. At the consumer level, insufficient purchase planning and expiring 'best-before-dates' also cause large amounts of waste, in combination with the careless attitude of those consumers who can afford to waste food."* Gustavsson et al, 2011:v)

As illustrated above, "a contrasting situation" is often depicted in literature between the food-waste patterns of developed and less developed countries or cities. In this depiction, in developed countries food waste arises at the consumer and retailer stage while in less developed countries it arises mainly post-harvest (Parfitt and Barthel, 2010: 3). While there is some truth in this idea, such a framing may also obscure the fact that there are other realities

[23] Roy. R. 1976, Wastage in the UK's food system. London. Earth Resources Research Publications; Dowler, 1977, pilot survey of domestic food wastage, Human nutrition 31, 171-80.Wenlock. R and D. Buss, 1977 wastage of edible food in the home, a preliminary study. Journal of Human nutrition. 31

too. In a recent review conducted by Parfitt and Barthel (2010) they question the idea that consumer stage food waste is not important in less developed countries, arguing that;

> *"The conventional view that post-consumer food waste is a problem of industrialised countries alone is contradicted by the evidence, with some BRIC countries experiencing similarly high levels of food discard."* (Parfitt and Barthel, 2010: 3)

Given the nature of change in food supply chains over the past decade in many transitional economies, patterns of food waste are likely to be more complex and less dualistic than they are often presented. As illustrated by Parfitt and Barthel (2010), in some rapidly developing countries (the BRIC[24] countries, for example) and in parts of Eastern Europe and Asia, food wastes occurring further along the food chain are increasing. This is due to trade liberalization, urban growth, rising standards of living and changes in consumer behaviour as well as changes in food supply chains, such as the increase in 'supermarketization', whereby supermarkets increase their control over the overall food supply (Parfitt and Barthel, 2010: 3; Weatherspoon et al, 2003; and Reardon, 2003:333; Patel, 2007; Traill, 2006:163). Parfitt and Barthel (2010) warn that transitional economies are not a "homogenous group" and patterns of food production and consumption vary. While food waste may not be an issue in some, wastefulness can it is in others, for example in Brazil and China, it is suggested that "over consumption and food wastefulness is approaching levels associated with industrialized countries" (Parfitt and Barthel, 2010: 4). Although there are no studies available, it is likely that this is true of South Africa too: studies on per-capita waste generation in South Africa have shown that South Africa has a high per-capita generation of waste compared to other countries in the region (Engledow, 2010: 164). This, coupled with South Africa's high levels of supermarketization, suggests a significant amount of food waste at the retail and consumer stages.

More and more people are now part of increasingly industrialized food systems in which wastage is higher in the retail and consumer stages. This deserves attention: populations and Food Supply Chains are growing fast and will soon be significant contributors to food wastage at consumer and retailer stages (Parfitt and Barthel, 2010: 3-4). The FAO 2011 report states: "Food waste in industrialized countries can be reduced by raising awareness among food industries retailers and consumers." This probably also applies more and more to

[24]BRIC – refers to transitional economies of Brazil, Russia, India and China

transitional economies (Gustavsson et al, 2011: v)

Figure 3. Part of the initial production lost or wasted, at different FSC stages, for cereals in different regions

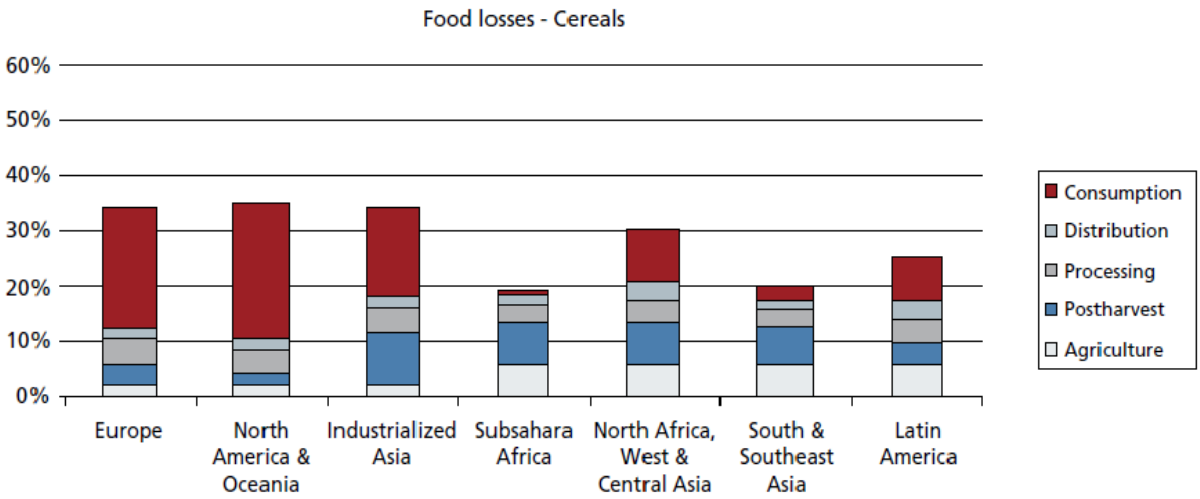

Figure 3. Global food losses and food wastes, from FAO. 2011

2.2.2. Managing food waste around the world

Because food waste emerges at different stages and in different forms, an integrated approach to managing it requires a variety of options to do what is most appropriate for each type in its specific context. As outlined by the US EPA:

> *"Food waste is generated from many sources: food manufacturing and processing facilities; supermarkets; institutions such as schools, prisons, and hospitals; restaurants and food courts; and households. Food waste is categorized as either pre-consumer (i.e., food prep waste and sell-by dated or damaged foods) or post-consumer waste (e.g., leftover food or plate scrapings)." (EPA. 2011)*[25]

The US EPA has adapted The Waste Management Hierarchy to food waste as a guide prioritising the management of how food waste (See Figure 4 below). It prioritises minimization, then reuse, then recycling and finally landfilling only if unavoidable. Following this model, food waste should firstly be avoided if possible through 'source reduction'. After that, the following options should be considered in this order: if it is still

[25] See: http://www.epa.gov/osw/conserve/materials/organics/food/fd-gener.htm, accessed June 2011

suitable for human consumption it should be redistributed or reused for human consumption; it should be fed to animals if suitable; it should be used industrially; it should be composted or digested; finally, only if no other option exists, it should be landfilled.

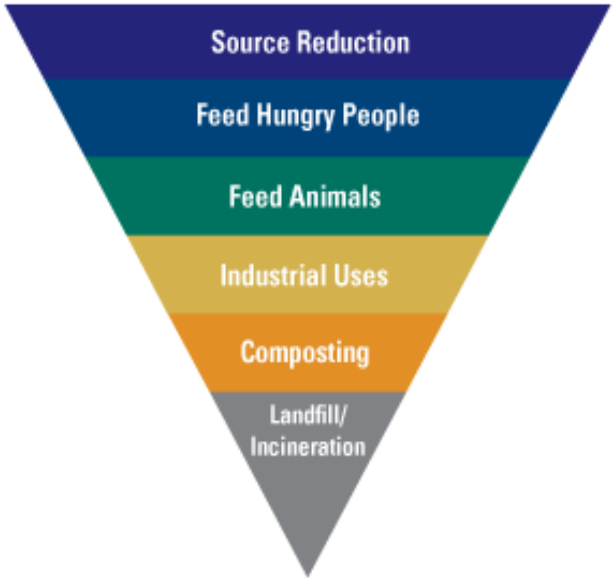

Figure 4: US EPA food waste hierarchy based on the Integrated Waste Management Hierarchy (See Fig 2)[26]

In recent years many studies have investigated different food waste-management options from the level of the household to the supermarket to city-wide strategies. Most of this attention is focused on case studies in America, Europe and Asia, where food waste is more readily prioritized, used and incorporated into policy.

While minimization is the key objective, producing zero waste is extremely difficult given the highly complex nature of today's food systems. Similarly, while the ultimate goal should be to deal with food wastes as early in the Waste Management Hierarchy as possible, some foods are difficult to manage efficiently and some are not suitable for redistribution to people or even to animals (such as diseased meat or mouldy fruit) (Kantor et al, 2007:2). Thus many studies in recent years look at a variety of options throughout the hierarchy for diverting food waste from landfill. Some focus on minimization, some on redistribution or conversion to animal food and others on recycling methods such as composting and anaerobic digestion.

[26] http://www.epa.gov/osw/conserve/materials/organics/food/fd-gener.htm#food-hier

Often, researchers have applied Life-Cycle Analysis (LCA) to look at the relative efficiency of different models in different contexts (Lundie and Peters, 2005; Fehr et al, 2005).

Throughout the literature, studies on food waste can be divided into two broad categories: research that aims at understanding and mitigating or minimising the production of food waste at different stages along its life cycle (Fehr et al, 2002; Hyde et al, 2001; Henningson et al, 2004; Scott Kantor et al, 2009), and studies on using food waste once it is already produced (Smit and Nasr, 1992; Lundie and Peters, 2005; Levis et al, 2010). While the former are vital, they are beyond the scope of this study, which focuses only on the latter. This study is interested in how existing food waste can be used to create more sustainable food-production systems rather than ending up in landfills.

For food that is still edible, Food Banking Initiatives and food pantries are popular initiatives, whereby surplus food from supermarkets and food companies is redistributed to people who need it. These proliferated in the US, Europe and Australia during the 1980s and have emerged more recently in Africa and South Africa (Riches, 1986; Lipsky and Thibodeu, 1984; Hawkinson, 1987; www.foodbank.org.za).

Usage options for non-consumable food waste include animal feed, composting (traditionally or using earthworms), accelerated anaerobic digestion, landfilling with methane capture for power generation, landfilling without methane collection and mixed-waste incineration. The latter two are highly unfavourable in terms of sustainability (Fehr et al, 2002:248).

In the EU and in the US anaerobic digestion has become increasingly popular and favoured by many governments (Stewart, 2009:234). In South Africa, few anaerobic digesters currently exist, yet organisations such as Agama energy are building up the technology[27].Various other organizations such as the Institute for Zero Waste are looking into developing the process but nothing has been established on a large-scale (IZW, 2006:16). In South Africa, interest in landfill energy production has increased significantly in recent years (Frost Sullivan: 2010), whereas the composting of food waste remains rare except for some municipal organic waste composting and some small, isolated projects (Ekelund and Nyström, 2008:23). The use of earthworms to process food waste into compost and vermi-tea

[27] http://agama.co.za/home/biogas-services

is a growing trend in Cape Town. It can be done at household level or on a large scale such as in hotels or supermarkets, but as yet is mostly still done on relatively small scales[28]. A number of organisations now sell worms composters and provide courses on the process.

2.2.3. Global trends in managing food waste

In other parts of the world, governments in a number of countries have become involved in creating awareness around minimizing, redistributing and recycling food wastes. For example, in the US the EPA have identified food waste as a significant area of attention, estimating that it is the third-largest waste stream in America, generating 32 million tons annually. They have created programs to raise awareness and get companies and consumers involved in reducing, reusing and recycling food waste[29].

In the UK, the Department for Environment Food and Rural Affairs (DEFRA) has collaborated with the Waste and Resources Action Program (WRAP), a non-profit organization created in 2000, to research and ultimately transform the treatment of wastes in England, Scotland, Wales and Northern Ireland[30]. They have helped implement many awareness-raising initiatives such as the 'Love Food Hate Waste' campaign aimed at getting consumers to rethink food waste[31].

Many studies have recommended composting as a valuable food waste-management option for municipalities in general and for supermarkets, restaurants and private homes (Goicochea, 2009; Henningson et al, 2004; Fehr et al, 2002). Yet within the food Waste Management Hierarchy composting is considered an important but almost final stage of waste management (See Figure 4). Despite this, following the principles of integrated waste management, it is likely that solutions to the management of food waste are highly contextual and that some would work for some areas while other areas would require other methods or perhaps a combination. Also, given the nature of supermarket operations and that they aim to provide variety at all times to customers who expect it, it is unlikely that waste will ever disappear completely from their systems unless consumer expectations shift dramatically. Thus, today's

[28] Interview with owner of worm farm company
[29] http://www.epa.gov/osw/conserve/materials/organics/food/fd-house.htm
[30] http://www.wrap.org.uk/index.html
[31] http://www.lovefoodhatewaste.com

research into what to do with food that is no longer edible is a significant step towards an overall integrated approach.

2.3.4. What are supermarkets doing with their food waste around the world?

The publication *BioCycle* provides a constant dialogue on food-waste technologies and their development in different parts of the world, including Ohio, California, Massachusetts, East Anglia in the UK, Brazil and Korea. *BioCycle* provides many examples of supermarkets actively engaging in food-waste management, such as the Ohio Food Scraps Recovery Initiative launched in 2007, which aims to create a successful food waste-diversion program. Large volumes of food waste, previously compacted and landfilled, are now being used in anaerobic digestion facilities for compost and renewable energy. The supermarket chain Kroger has become a key player in this process (Goicochea, 2008:19-20). Similar projects are being carried out in California. Studies show that over the past twenty years US supermarkets have become increasingly involved in organics diversion programs, as have European supermarkets (Conolly, 2006:330).

In 2005, many of the UK's largest retailers, suppliers and producers signed a voluntary agreement known as the Court auld Commitment with DEFRA and WRAP, which aimed to reduce food waste and packaging waste (Mena and Whitehead, 2008: 4-5). The WRAP website provides an important database on up-to-date studies of companies and projects engaging with food-waste initiatives[32].

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In the US, the EPA developed 'The Food Waste Challenge', which encourages companies and organisations to reduce, donate and recycle as much food waste as possible by implementing a food-recovery program into their operations. The EPA has also conducted studies on household food waste and how this can be managed more sustainably, encouraging households to reduce, reuse and recycle food wastes[33]. The EPA website also provides an invaluable database on research on food waste initiatives[34].

[32] http://www.wrap.org.uk.
[33] http://www.epa.gov/osw/conserve/materials/organics/food/fd-house.htm.
[34] http://www.epa.gov/osw/conserve/materials/organics/food.

2.3.5. Food waste and supermarket food waste in Cape Town

There is little available literature and very little empirical data about residential or commercial organic waste within Cape Town. Available studies include a 1997 baseline study conducted by the Department of Water Affairs and Forestry (DWAF) on waste management (Fiehn and Ball, 2005:17), a 2007 study compiled by the Sustainability Institute (Engledow, 2007), a study conducted on composting municipal waste (Ekelund and Nyström, 2007), and a recent study conducted in 2009 on the potential of organic waste management in South Africa (Harma et al, 2009). All of these studies agree that organic waste is underutilised. It is estimated that, overall, as much as 40 to 60 per cent of the domestic waste stream is organic and suitable for composting, though this varies between income groups (Swilling 2006:37; Engledow, 2007:37) (See Fig. 5).There are no specific figures on organic wastes generated on the commercial sector or from supermarkets, although drawing on studies from elsewhere it is likely that supermarkets produce large amounts of organic wastes in the form of food waste (Goicochea, 2009).

Presently there are no in-depth studies on African or South African supermarket food-waste strategies. Some projects do exist, but they work on relatively small scales and are poorly documented. Most of the largest retailers donate a proportion of their surplus food still suitable for human consumption to charities through a food-banking system. Some food waste is currently used as animal feed and some supermarkets have begun using small-scale worm farms[35]. As yet there are no large-scale food waste-recycling projects for non-edible or dairy and meat products. This thesis hopes to contribute research to this under-researched area.

[35] Email communication with waste management consultant.

Chapter 3. Methodology

This study aims to investigate the current management of supermarket food waste in Cape Town. It focuses on the potentials and barriers to transforming this waste into a valuable resource within the city. It does not aim to provide an overview or template of how all supermarkets in Cape Town currently manage or *ought to* manage their waste. Instead it hopes to contribute to an expanded understanding of the factors that shape the management of this 'waste' category in Cape Town and which affect its transition to being utilised a resource.

For the purpose of this study, supermarket food waste is defined as any food that has reached its sell-by date or is contaminated or damaged and therefore can no longer be sold by the store. The food wastes that were of particular interest for this study were perishable goods including fruit, vegetables, breads, fresh meats, chicken, fish, dairy, eggs and frozen foods. Dried, tinned and packaged goods were not of central focus as they tend to have a longer shelf life and are generally not wasted as frequently.

Perishable goods are outlined in the Foodstuffs, Cosmetics and Disinfectant Act 1972 (Act 54 of 1972) and the Department of Health's declaration of perishable goods (DOH, 1999)[36]as;

> *(a) Milk ;*
> *(b) meat ;*
> *(c) fish, fish spawn , molluscs and crustacean s ;*
> *(d) fruit;*
> *(e) vegetables:*
> (DOH, 1999)[37]

The movement of food waste from the supermarket through the city involves a wide range of actors, relationships and environments. The methodology employed to trace these movements needed to be appropriate from the micro scale to the macro scale of investigation. The research method therefore engaged with both store-level processes and wider city waste-

[36]regulations relating to perishable foodstuffs,, Published under Government Notice No. R. 1183 of 1 June 1990, As amended by: Government Not ice No. R.952 of 6 August 1999
[37]regulations relating to perishable foodstuffs,, Published under Government Notice No. R. 1183 of 1 June 1990, As amended by: Government Not ice No. R.952 of 6 August 1999

management systems as well the interrelation between these processes. The management of waste is a socio-technical activity, so the attempt to understand how and why it is done the way it is required an investigation of a complex system of processes, actors and relationships between them. The use of the case-study methodology was therefore the most appropriate and suited to the subject material.

3.1. Case-study methodology

In using a case-study method, the researcher enters an existing setting and observes, questions and makes observations about processes and relationships. Yin (2009) explains that case studies are well suited to understanding complex processes. Case studies are useful when asking 'how' and 'why' questions about contemporary and on-going events or processes over which the investigator does not have control (Yin, 2009:8). This was of particular relevance to the supermarket context –it would have been inappropriate if not impossible to disrupt the daily functioning of a supermarket. In addition, it was important to investigate waste as a product that is both physically and socially constructed, both within the supermarket and the broader city setting. The case-study methodology's flexibility in exploring real-life phenomena within their spatial and temporal contexts, allowed for a nuanced investigation.

As there is little available literature about food waste-management practices in South Africa or about supermarket food waste-management, I wanted to conduct a study that looked at both *how* waste was being managed and also *why* it was being managed in that way. In order to explore these questions from the micro, supermarket scale to the more macro city scale, an initial descriptive account of supermarket waste management system was necessary. Then, working outwards from this descriptive account, an investigation was needed into why food waste is not operationalized as a resource within the supermarket and the city. The interrelationships between the micro-scale activities in the supermarket were then placed within the broader macro-scale of waste-management practices and policies within the city. As Mabry (2009) explains: "Relationships between contexts and cases (and among contexts) are interdependent and reciprocal." (Mabry, 2009:218).

The decision to focus on a single supermarket store as an example of micro-scale supermarket food waste-management was informed by a number of factors. Firstly, by

focusing on one store I was able to conduct an in-depth exploration of the store's activities and practices. I was then able to explore more tangibly the relationships this particular store had with key stakeholders, policies and actors, which created a better understanding of the factors that shape food waste-management in the city more generally. Starting from the point of a single store, I tracked the different food-waste streams emanating from it. I was interested in understanding how food waste moves from the store through the city to its final destination, and how thresholds of responsibility between key actors and institutions are crossed along the way. The store in this case study acts as a point of departure for exploring how the retailer itself negotiates food waste but how this relates to the city's wider waste-management regime.

A comparative analysis could have been conducted between several different supermarkets but, given the number of food-waste streams and the complex nature of food waste within a single store, it would have necessitated too extensive a scope. The aim of this study was not to draw comparisons between the practices and policies of different supermarket retailers. An understanding of food waste-management at a range of scales, as the focus of this study, was possible through the focus on a single store.

3.2. Population and sampling

The first step was to identify a retail chain that would let me work with them and assign me a case study store. I emailed several supermarkets with a proposal of my research, asking to use one of their large Cape Town-based stores as a case study. One chain responded, met with me and assigned me a case-study store. I was put in touch with the store manager who became the gatekeeper to my research in the store. He allowed me to visit the store over a period of two weeks, observing the various food-waste streams and their associated management systems and conducting interviews with food-department managers and other members of staff working on the shop floor. Through interviews at the store I was able to build up an understanding of the different food-waste streams, how each was managed differently and which the stakeholders were involved in their management in the store and after the waste left the store. This was the starting point of a map of all the food-waste streams and how they radiated outwards from the store to different destinations. As there were many different food wastes, all being treated in different ways and involving a multitude of different stakeholders,

not all waste streams were followed to completion, but as much information as possible was gathered in the time available.

I also set up an interview with the retailer chain's sustainability manager. This gave me some insight into the retailer's higher-level management as well as store-level decisions concerning food waste. Finally, the retailer allowed me to sit in on a head-office meeting on recycling and reverse logistics, which also allowed me some insight into their thinking around these issues and the kinds of decisions and factors retailers need to consider when transforming their systems towards more sustainable systems. I was able to gain an understanding of the store's decisions and concerns around the food waste management as well as their visions for managing this more sustainably.

Once I had conducted an in-depth review of the store-level processes, I began to follow the life cycle of different food wastes from the store until they reached in their final destination, landfill or other. Interviews were done along the way with various stakeholders. In a 'snowballing' technique each stakeholder I interviewed put me in touch with the next stakeholder along the waste-management chain. This resulted in a chain of interviews with various stakeholders involved in the process of managing the supermarket's different food wastes. As different types of food wastes were treated differently, a number of different interviews had to be arranged with various stakeholders. Four principal routes were investigated that food waste took after leaving the store

The first route concerned fruit, vegetables and bakery products, which were not considered a potential threat to human health once passing their sell-by dates. These were donated to a food-banking company who collect these foodstuffs every evening. I set up interviews with three members of the food-banking company and asked them questions about volumes and types of food, what they do with the food and the difficulties they encounter around distribution or legal parameters for reusing it in human consumption.

The second route concerned to dairy and other animal-protein products that had reached their sell-by date or were damaged or considered potentially contaminated. These wastes were not donated to the food bank organisation but placed in freezers. Then, weekly, they were condemned by a Department of Environmental Health official and removed – either by the department itself or by a registered hazardous waste transportation company – and taken to a

hazardous landfill site at Vissershok. I set up interviews about these wastes with the waste transportation company and with the head environmental health official responsible for the area in which the store was located. The interviews included questions about the regulations and procedures surrounding the management of such wastes, and difficulties around the management of these wastes. I also asked whether these methods were likely to change towards greater sustainability, whether alternatives currently existed in the city and why they thought this was or was not the case.

The third route included compacted mixed food wastes. This included an array of food wastes such as vegetable peels from the deli, pre-prepared foods or damaged foods, often mixed with other non-recyclable store wastes that were placed in a large wet-waste compactor at the back of the store. Once compacted and full, this waste was collected by a contracted waste-removal company and taken to Vissershok hazardous landfill. I interviewed the fresh-goods manager of the store as well as the waste-removal company about this fraction of wastes.

The last route by which food waste left the store was highly secretive and appeared to be used minimally. I was informed that some supermarkets in Cape Town use macerators[38] to dispose of certain food wastes by putting them into the waste-water systems as this is cheaper than having them collected. This has been banned in some countries such as Japan, Netherlands, Belgium and Luxemburg and is not seen as a feasible method of disposal because it is merely displaces the problem of food waste into a problem of waste water. While the sustainability manager of the retail chain suggested that some stores still did use this method, he didn't believe it to a suitable method of disposal. The case study stores sustainability manager said that they did sometimes use macerators to dispose of some small amounts of waste in the deli, such as fish skins, but that it was not a primary method of disposal.

After I had gained an understanding of the ways that different types of food wastes left the supermarket, I set up a final set of interviews. These interviews were conducted with a variety of people involved in waste management in the city. They aimed at gaining insight into the wider processes operating in the city that shaped the management of food waste. The preparation for these interviews involved an extensive review of related policy. This was a complex process because although food waste is not directly classified or categorized in

[38] Macerators are machines that grind up waste and dispose of it through the waste water system.

waste policy, it is subject to a number of different policies in other areas, such as in health policy and agricultural policy. The overall policy pertaining to food waste is far-reaching but extremely fragmented. Thus, the interviews with policy experts, waste practitioners and environmental-health practitioners was foundational in helping guide my understanding of the policy and its implications for the management of food waste in the city, by supermarkets specifically.

This part of the research included eighteen interviews overall. Interviews were conducted with a range of stakeholders from the retailer, to the city, to private waste companies. This included interviews with city officials working in waste management and environmental health, policy experts, waste engineers, waste management consultants and managers of composting, anaerobic digestion and other waste management companies. I was also invited to attend a presentation to the city by one of the few companies involved in anaerobic digestion in Cape Town on their vision for using anaerobic digestion in Cape Town to recycle a variety of organic wastes, including food. Collectively, the interviews were aimed at gaining an understanding of the wider system of waste and food waste management in the city and the ways in which different food wastes were managed and why. They also aimed to explore the factors affecting the management of food waste in Cape Town and the experiences of various stakeholders.

3.3. Data collection technique: in-depth interviews

In-depth, semi-structured interviews were conducted with stakeholders about how food waste was managed and why it was managed in this way. I asked them about the challenges concerning the management of food waste and whether they saw any barriers to managing it more sustainably. Most interviews lasted between 30 and 60 minutes and were designed in a semi-structured way. I prepared a set of questions for each participant that included a core set of questions well as some broader questions more suited to their area of work. The core questions aimed to understand the challenges and barriers affecting the use of food waste as a resource in the city. I was interested in gaining a wide set of opinions about this. I then asked more specific questions about current processes, experiences of legislation, the role of the government versus the private sector and how the interviewee envisioned an ‘ideal’ system. I also asked for opinions on the roles of different actors in developing a robust system for the sustainable management of food wastes in Cape Town.

Interviews were conducted in person whenever possible. Some were done over the telephone or via broad questions sent over email for the informant to fill out. Altogether, 21 interviews were conducted with various stakeholders.

3.4. Data analysis

Interviews were not recorded but transcribed by hand. I found that most participants in the first set of interviews preferred not to be recorded. Waste is a sensitive and often secretive subject. Participants were wary of giving away too much information, which could have implications for other stakeholders. For example, the food-banking company had records of the volumes of waste they collected each day at the case-study store, yet they were unable to reveal this information as it would have revealed the case study stores actual waste figures. For this reason stakeholder individuals and companies were more comfortable not allowing me direct access to quantitative data and preferred unrecorded interviews.

Taking the above concerns into consideration, I tried not to pinpoint particular details but to gain an overall sense of the kinds of concerns, themes and debates emerging from the different conversations and to find the nuances between different opinions. The interviews with the wide range of stakeholders allowed for an interesting insight into different sets of opinions operating at the store level, in the realm of the private waste companies and within the municipality.

3.5. Limitations

From the start of the project it was clear that any study on waste would have a significant set of limitations: waste is a sensitive topic and information pertaining about it is often kept secret. Although national policy as outlined in the National Waste Management Strategy (NWMS) Draft 2010 (passed in November 2011) aims to have generators record their wastes and submit information about it to the South African Waste Information System, (SAWIS) reporting waste information is still not compulsory. As outlined in the NWMS, when in the near future it becomes compulsory to record and submit information on waste, private companies will still not be obliged to reveal this information to third parties (NWMS Draft, 2010:62). Given the current lack of publicly available information and the right of private

companies to keep data secret, access to quantitative data on waste was not possible. Under the circumstances, it was very generous of the retailer to allow me to research their waste-management system at all.

My lack of access to quantitative figures on waste volumes is a limitation, as I had to rely on qualitative accounts from a range of experts and stakeholders, such as waste management consultants, city officials and waste transportation companies, on the scale of the food-waste problem. While I was never given a reliable statistic, all informants agreed that large amounts of food waste, especially meat, dairy and other 'high risk' wastes, was ending up in landfills every day and that all the major retailers as well as many other food companies relied on this method of food-waste disposal. While interviews with officials revealed that the municipality is aware of the problem of food waste in landfills, there are no available governmental statistics on food waste and volumes landfilled. The unavailability of information on food waste demonstrates a lack of attention to the problem.

Another factor that was difficult to negotiate was setting up interviews with stakeholders. I needed to fit into their often highly busy schedules and participants were spread out throughout the city, so I often spent long periods waiting for responses to my email requests for interviews. Despite this, most participants generously offered to meet with me or at least correspond over email or telephone. I thus had little control over the time it took to set up interviews. For example, from the time of first contact with the retailer, it took two months to be assigned a case-study store and a further month until I could meet the head of sustainability, who has an extremely busy schedule. I was then asked to wait until after the December holidays to conduct my research with the store as the December season is too busy and employees would not have time to speak to me. Similarly, setting up interviews with other stakeholders in the city often took weeks. Thus, the data-gathering process was unpredictable, time-consuming and felt fragmented in many ways until I was able to collate the data at the end.

Finally, in terms of the coherence of the final report, ensuring the anonymity of the wide range of informants proved a challenge. The requirement of anonymity sometimes made it difficult to provide in-depth data so as not to give away the identity of the company or person being interviewed. Footnotes reflecting the identities of the informants are very broad, which may limit their usefulness, but it was decided from the outset that all companies and personal

identities would be kept anonymous. I was also unable to locate the study visually on a map of the city, which would reveal the identities of the case-study retailer and other companies. Mapping would have been useful for conceptualising waste flows and systems and their proximity to each other, but the need for anonymity precluded this.

3.6. Ethical Considerations

Because waste is a sensitive issue to any company, the identity of the retailer, case-study store and all the other companies and informants involved are kept anonymous. While this was not necessarily requested by all informants, it seemed fair that all informants were kept uniformly anonymous. For this reason, although processes were mapped, actual geographical maps of locations are not revealed, as this would indirectly disclose stakeholders' identities.

The interview questions with the retailer and the other stakeholders did not aim to critique but to gain an understanding of the handling and management of food waste within the industry and of the barriers to furthering its sustainable management by supermarkets and in Cape Town as a whole.

Before submission of this thesis, each participant was sent a copy and asked to comment on anything they felt was incorrect.

Chapter 4. Transitions in Waste Management Policy in South Africa and Cape Town

This chapter traces the development, thinking and policy around the management of waste management in South Africa since transition to democracy. Approaches to waste management in South Africa have changed a great deal over the past few decades, affected by changes in the practice of waste management both on a national level and globally. As a process which evolves in relation to a complex set of material and ideological priorities, waste management is always in transformation. Global shifts in waste-management practice, since the 1990s, coupled with the transition to democracy in South Africa, have greatly altered how waste is managed in the country and in Cape Town[39]. This chapter aims to outline some of the significant shifts that have occurred in waste-management policy in South Africa and in Cape Town over the past two decades. It aims to situate this case study within a wider context of approaches to waste management, as the supermarkets' approaches to managing waste operate within the wider policy agenda and waste framework of the city. Thus, it is important to explore both the supermarkets' approaches and the wider system in order to understand the complex relationship between them. This chapter is based on an in-depth review of all policy related to waste management and on scholarly articles and interviews with a number of waste-management and waste-policy experts in the city. The interviews were especially useful in helping understand the policy and how it has developed over time.

4.1. Transitions in National policy on waste

Since the transition to democracy, many shifts have occurred in South Africa's legislative approach to waste management. These changes have been developed through a suite of policies concerning waste management at both national and local levels of government.

The Constitution of South Africa (Act 108 of 1996) provides the basic foundation for the management of waste and the development of policies on waste. Since democracy The Constitution has guided the direction of waste management towards more integrated approaches. The Constitution stipulates in section 24:

[39]Interview with Head of Solid Waste at the City of Cape Town

"Everyone has the right –

a) To an environment that is not harmful to their health or well being; and

b) To have the environment protected, for the benefit of the present and future generations, through reasonable legislative and other measures that

i) Prevent pollution and ecological degradation

ii) Promote conservation; and

iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development"

*(*The Constitution of South Africa (Act 108 of 1996): Section 24)

The constitution sets out that refuse removal, dumps and solid-waste disposal fall under the responsibility of local government. The provincial government is responsible for ensuring that the local government carries out these functions. The Department of Environmental Affairs DEA (formerly DEAT, Department of Environmental Affairs and Tourism) are the responsible authority in charge of the development of legislation, policy and frameworks in which the lower tiers of government operate (Engledow, 2007:10).

While the Constitution provides a basis for policy on the sustainable management of waste, the development of specific policy on waste has taken many years and is an area of continual development at national, provincial and local levels. The transition from the 'control-oriented' approach that prevailed during the 1990s[40] to a more integrated approach poses complex questions at the policy level to ensure the alignment of different objectives.

During the 1990s and into the early 2000s waste-management policy was largely fragmented and unconsolidated, with a number of different laws spread throughout different sectors and waste-management authorities, but no coherent overall policy[41]. The past decade has seen a development of an array of legislation and policy aimed at transforming the systems of waste management towards greater equitability and greater environmental and economic sustainability.

[40]Interview with waste policy expert – City of Cape Town

[41]For example see National Water Act, 6 of 1998-regulates against waste contaminating water, the White Paper for Sustainable Coastal Development in South Africa, 2000, which outlines the control of harmful wastes into marine environments, The National Environmental Air Quality Act, 39 of 2004, which stipulates that certain procedures which pose a threat to air quality such as incineration need to be licensed and The National Environmental Managemnt Act 107 of 1998 (NEMA) which initially did not deal with waste management specifically, but provided a basis for legislation concerning the environment. The new EIA regulations in Chapter 5 of NEMA now also stipulate that waste management facilities require a scoping assessment of abasic EIA (For further reading see Engledow, 2007:10-13).

In 1999 the first National Waste Management Strategy (NWMS) was developed. This was the first piece of waste-management policy to address South Africa's waste challenges in an integrated way[42]. It helped consolidate a set of fragmented legislation and guidelines around waste that had previously been spread throughout a set of policies in different areas including the Constitution (1996), the National Water Act (1998), the Draft White Paper on Integrated Pollution & Waste Management (1998), the Environmental Management Policy for South Africa (1998), and the 1998 National Environmental Management Act (NEMA) [43].

In 2000, The White Paper on Integrated Pollution and Waste Management (WP IPWM) was promulgated. This document was significant because it stated for the first time the need to move away from a focus on "control" of waste towards one of "waste prevention" as well as remediation of areas damaged by waste and contamination. It introduced for the first time the globally accepted concept of the Waste Management Hierarchy as a guiding principle for waste management in South Africa (NWMS, 2010:8). It also incorporated new and vital concepts such as 'cradle to grave' management and 'integrated waste management', defining integrated waste management as:

> *"A holistic and integrated system and process of management, aimed at pollution prevention and minimisation at source, managing the impact of pollution and waste on the receiving environment and remediating damaged environments."*
> (White Paper on Integrated Pollution and Waste Management for South Africa, 2000,11)

The WP IWPM stipulated that municipalities needed to adopt Integrated Waste Management Plans (IWMPs) as a means of working towards more integrated waste management systems. This and the NWMS (1999) paved the way for the beginning of a set of new waste-management policies at national and municipal levels over the next decade.

In September 2001, preceding the 2002 World Summit on Sustainable Development in Johannesburg, members of government, civil society and business met in Polokwane for the first National Waste Summit, at which the Polokwane Declaration was developed. This was a vital step in waste-management policy and thinking as it was the first time that national targets were set for waste management and the first time that different stakeholders came

[42] http://www.wastepolicy.co.za/home/1999NWMS.htm
[43] http://www.wastepolicy.co.za/home/1999NWMS.htm

together to envision more sustainable waste management (Fiehn and Ball, 2005:16). The summit prioritized waste management as a sustainability issue and highlighted the need for urgent action to reduce, reuse, and recycle waste and move away from 'end-of-pipe' approaches towards an integrated waste-management approach. The declaration's stated goal was to "stabilize waste generation, reduce waste disposal by 50% by 2012 and develop a plan for Zero Waste by 2022" (Fiehn and Ball, 2005:12). In Fiehn and Ball's 2005 review of the state of waste management in South Africa, they identified that this goal seemed ambitious considering the present lack of infrastructure. They stated that a paradigm shift was needed whereby the city would truly begin to treat waste and "everything as part of a cycle" so that wastes could be treated more like resources (Fiehn and Ball, 2005:12).

In 2008, the National Environmental Management Waste Act (NEMWA) Act (59) of 2008 was promulgated. This act borrowed many principles from and was closely modelled on the National Environmental Management Act (NEMA) Act 107 of 1998, which lays the foundation for the treatment of the environment in South Africa. **N**EMWA introduced guiding principles and approaches for the physical management of waste, such as the 'precautionary principle', the 'polluter pays principle', the life-cycle approach to managing waste and the idea of producer responsibility (NWMS Draft, 2010:9). It also stipulated that waste-management facilities need to be regulated and that, depending on their size and function, need to have a Basic Assessment or a Scoping and an Environmental Impact Assessment (EIA) carried out.[44]

With its roots in NEMA, NEMWA was a vital step in reforming law on waste management that took environmental concerns seriously into account and worked towards the implementation of the Waste Management Hierarchy. Further, it consolidated laws from various previous acts and improved on these. NEMWA aimed to "reform the law regulating waste management" in South Africa in order to protect human health and the environment (NWMS, 2010:8). It aimed to provide measures to prevent further environmental degradation, to rehabilitate damaged land and to promote sustainable development. It did so by introducing institutional arrangements and planning systems, national norms and standards pertaining to waste as well as outlining measures for waste treatment, minimizing the use of

[44] Basic Assessment refers to a small-scale assessment for smaller scale activities for which impacts are generally well researched and understood. Scoping and EIA is an assessment done for activities identified as larger and potentially higher risk due to their potential capacity to cause environmental and social harm as well as activities, which affects are unknown. See http://www.eiatoolkit.ewt.org.za.

natural resources, and reducing, reusing and recycling wastes. It outlined licensing requirements for waste-management activities and paves the way for the National Waste Information System so that information and knowledge around waste issues can be enhanced (NEMWA, 2008:3). It outlines the waste-related roles and responsibilities of different tiers of government. NEMWA works hand-in-hand with and should be read in conjunction with the Municipal Systems Act (2000) and the Municipal Finances Act (2003), which set the budgeting and service-delivery framework for local government. The Municipal Systems Act, for example, requires that municipalities encourage recycling and produce by-laws on municipal waste (NEMWA Draft, 2010:9-12).

The most recent national-level policy – the 2011 National Waste Management Strategy (NWMS) is a legal requirement of NEMWA . The NWMS aims to provide an action plan for the management of waste in South Africa, modelled on the objectives of the Waste Management Hierarchy and the various policy objectives and targets. It sets out challenges, goals and objectives, and vital regulatory, economic and fiscal arrangements for carrying out the strategy as well as the roles and responsibilities of different actors (NWMS, 2011:6).

Overall, national waste-management policy has developed significantly over the past decade and has paved the way for the development of municipal waste policy.

4.2. The development of waste legislation and policy in Cape Town

In line with the above policies guiding the national approach to waste management, as well as other key national policies such as the Municipal Systems Act, the City of Cape Town has greatly developed its own waste-management policy over the past decade. While this, too, began as a fragmented set of by-laws and plans, it has been developed towards a more coherent and encompassing framework over the years, yet in many ways is still in a process of review and development. Every municipality is now required, in terms of the Municipal Systems Act, to prepare an Integrated Development Plan (IDP) within which an Integrated Waste Management Plan (IWMP) should be developed. Waste management has become an increasing area of priority in the City's IDP, which has been reviewed annually since 2002 (Engledow, 2007:26). The City of Town is responsible for general waste management and planning and may develop by-laws that include economic incentives to support waste minimization and recycling.

In 2006, the City of Cape Town's Integrated Waste Management Policy (CoCTIWMP) was promulgated. It identified that without serious action toward waste minimisation "the City will face an environmental and a health crisis... with dire consequences to the local economy". New methods for waste management were deemed vital (CoCTIWMP, 2006:8). The policy outlined that the city, in line with national policy, would use the Waste Management Hierarchy model and IWM Plans as a means of accomplishing more sustainable waste management practices (CoCTIWMP: 2006). It identified waste minimization as a key objective which needs to be achieved through a variety of methods, including the provision of new infrastructure, education programs, public- and private-sector participation, the facilitation of a buoyant recycling market, job creation and the implementation of stricter legislation. Accordingly, the policy states:

> *"Council is required to regulate the interventions, mechanisms and technologies applied within the city's boundaries to minimise and manage waste minimisation in a sustainable, effective, equitable and efficient manner that will minimise social, health, environmental and economic impacts as far is practically possible."*
> (CoCTIWM, Policy: 2006:8).

The policy brought together fragmented local legislation on waste and provided a basis for a solid framework towards achieving integrated waste management practices in Cape Town which are more aligned with NWMS objectives and principles (CoCTIWMP, 2006:11-12). It also laid the foundations for a by-law for integrated waste management in Cape Town.

In 2009, Cape Town became the first municipality in the country to introduce a by-law for IWM. The City of Cape Town Integrated Waste Management By-Law, (2009/ amended 2010) recognises the vital need, for environmental, social and logistical reasons, to reduce the amount of waste sent to landfills. The by-law sets out a broad set of standards, procedures and laws around the management of waste within the city and clearly defines the responsibilities of "waste generators". It puts a responsibility on all actors to implement better waste-management practices (CoCTIWM By-Law, 2009), thus recognizing the responsibilities and limitations of the municipality alone. The IWM By-Law allows the municipality to regulate all waste-management activities in Cape Town. In this way it allows for the regulation of public-private partnerships and for a decentralisation of the

municipality's responsibilities, while still ensuring that waste activities are carried out according to national waste and general environmental legislation[45].

This section has described the transitions in approaches and policies on the issue of waste management, both on a national and municipal level. The next section provides an overview of actual waste-management practices in the city, whose infrastructure and support systems are not always aligned with policy. The next section acts as a basic map to the present-day management of Cape Town's waste streams. It also outlines some of the significant challenges facing Cape Town in terms of waste management.

[45]http://www.capetown.gov.za/en/Pages/IntegratedWasteManagementby-law.aspx

Chapter 5. Managing waste in Cape Town: practices, challenges and transitions towards sustainability.

As Chalmin and Gaillochet point out, the relationship between "societies [and] their waste is highly complex, to analyze both in terms of time and space" as the meaning of waste and its treatment varies between times and places (Chalmin and Gaillochet, 2009:16). Taking this idea as a starting point, this chapter maps the systems for managing waste in the context of Cape Town. It provides an introduction to waste management in the city and overview of some of the significant shifts that have and are still taking place within the city. It aims to create a platform from which to contextualise the issue of food waste within a wider set of approaches and systems operating in the city.

In waste-management literature and research there are often generalized patterns observed between 'developed' and 'less-developed countries'. South Africa is an interesting case for waste management as it has features of both. More developed countries are those which produce more packaging wastes and less organic wastes, while poorer countries produce more organic wastes and less packaging wastes (Chalmin and Gaillochet, 2009 :12). South Africa produces high levels of both organic waste and packaging waste (Engledow, 2010:161). Higher volumes of waste generation are generally associated with higher GDP. Therefore, richer ('more developed') countries or cities are usually equated with higher per-capita waste volumes (Chalmin and Gaillochet, 2009:12). South Africa has a relatively low GDP but a high per-capita waste generation. This pattern, which precludes South Africa's classification on the developed/less-developed axis, is reflected in Cape Town's waste patterns. The city of Cape Town generates approximately 20% of the country's waste and has a high per-capita generation of waste (Engledow, 2010:164).

From 1997 to 2007, per capita waste generation in Cape Town rose significantly from 1.39kg per person per day to 2.23kg per person per day. As illustrated in the Figure 5 South Africa's per-capita waste generation is on par with countries with much higher GDPs such as Canada, Belgium, Turkey and Hungary. While a large percentage of the poor population of the country produce very little per-capita waste, a small affluent percentage of the population produces very high levels of waste which increase the average per-capita production of waste significantly (Engledow, 2010:164/5). As Swilling (2006) explains:

"This means, in effect, that the large poorer communities on the Cape Flats host rubbish dumps that absorb wastes generated by a tiny minority of rich Capetonians who have one of the highest waste levels and lowest recycling rates in the world." (Swilling, 2006:36).

A 2004 study conducted for the city's IWMP illustrated that low-income households generate less than 0.5kg of waste per day, while middle- to high-income groups generate up to 2kg (Engledow, 2010: 165; City of CT IWMP). This means that approximately 16% of households create 50% of the city's solid waste stream (Swilling, 2006: 41)

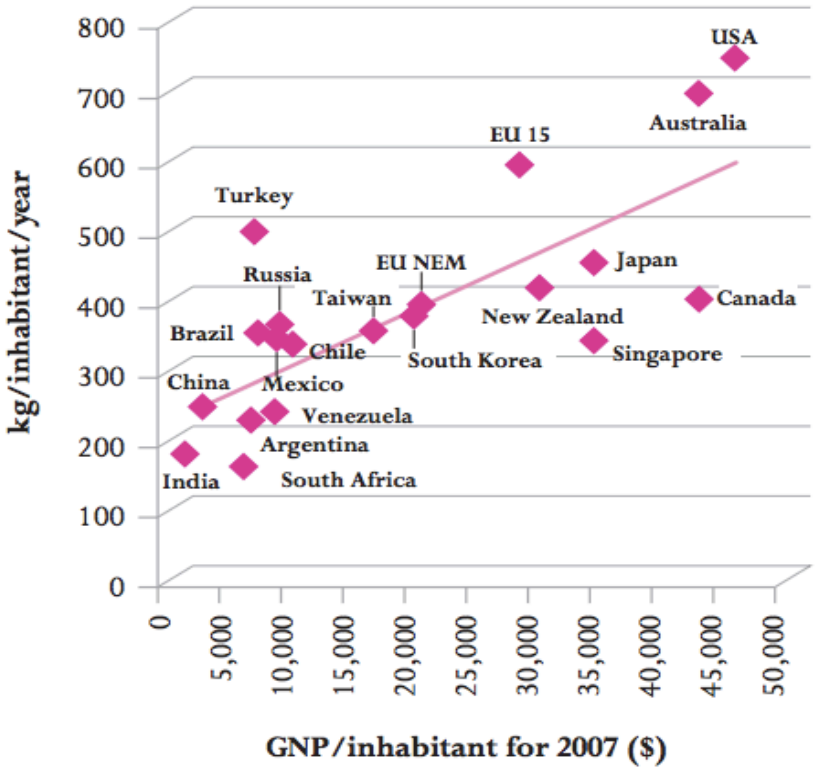


Figure 5: Graph showing correlation between GDP and Kilograms of waste generated p (taken from Chalmin and Gaillochet, 2009:14).

Inequality in service delivery as well as waste generation has posed a serious challenge for post-apartheid South African cities. While Cape Town's institutional and infrastructural capacity to manage solid waste has been described as "significantly better than that of most developing countries" (Engledow, 2010:163) and is among the most developed in the country (with reportedly up to 96% of households and business having access to solid waste collection in 2005), the city still faces many difficulties to achieving sustainable waste

management in the face of inequality, environmental pressures and growing volumes of waste (Feihn and Ball's 2005). The next section of this chapter explores some of the challenges faced by the city at present.

5.1. Growing volumes of waste and choking landfills

The overall production of solid waste in the city of Cape Town has increased drastically over the past decade (Engledow, 2010:163). A 2006-2007 study estimated that the city produces approximately 2.5 million tons of solid waste annually. This includes household, industrial and commercial waste sources (Swilling, 2006, Swilling 2010). This growth can be attributed to a collection of factors such as rising levels of urbanization and population increase, rises in income and access to consumer goods, increasing formalization and access to waste-collection services and also possibly better data-capture of volumes at landfill sites (Engledow, 2010:163). It is estimated that waste generation over the past decade has grown by as much as 10% per annum and this growth has now stabilised at a rate of 7% (Swilling, 2010). In 2008, levels of waste generation dropped slightly. Reasons for this may have included waste-minimization efforts, the increasing presence of the recycling industry (discussed below) and the effect of the global economic downturn as suggested by Engledow (2010). Yet despite this slight temporary decrease in waste generated, rates of generation are still increasing significantly. Trends show that the growth in waste generation is outstripping population growth by 5% per year (IWM Policy: 2006:8). This poses serious challenges not just for Cape Town's current infrastructure but also for the future of its waste management.

The city of Cape Town is fast approaching the capacity of its available landfill volume. It is estimated that in 2012 the city will exceed its available landfill space (See Figure 6 and 7). As depicted on the graph, it is estimated that with a greater than 7% growth in waste per annum, even if a new landfill is developed, the new landfill space will be exceeded around 2025. There is also a marked lack of 'suitable' space for new landfill sites. Placing new landfill sites too far out of the city would pose huge costs for the municipality, while locating them closer could infringe on the quality of living of people near to them, which is already the case in some of the current sites (Swilling, 2006:37). Sites should also not be located near bodies of underground or other water. Already, one of Cape Town's three landfills sites is located above a large aquifer and evidence shows that underground water contamination has occurred (Swilling, 2006:37). Given these parameters, the city recognizes that it faces an

immense landfill crisis and has to engage seriously with waste minimisation and diversion strategies in order to divert this crisis and achieve the Polekwane target of zero waste to landfill by 2022. This effort needs to involve all stakeholders and institutions: as stated in the NWMS Draft (2010), waste-management challenges can only be tackled through "the involvement of a broad range of stakeholders" (NWMS Draft 2010:5)

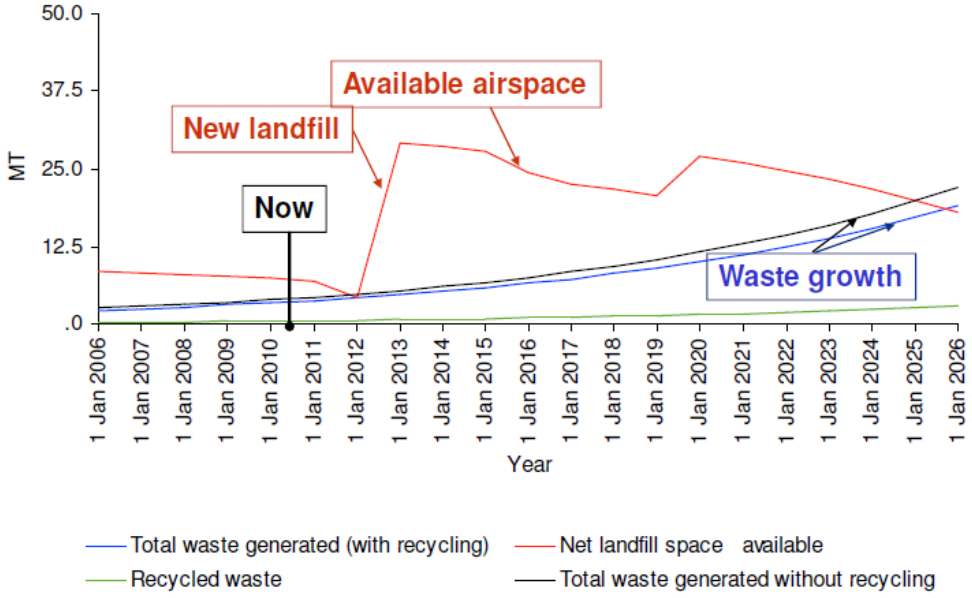


Figure 6: Graph showing available landfill space in Cape Town (taken from Coetzee, 2010)

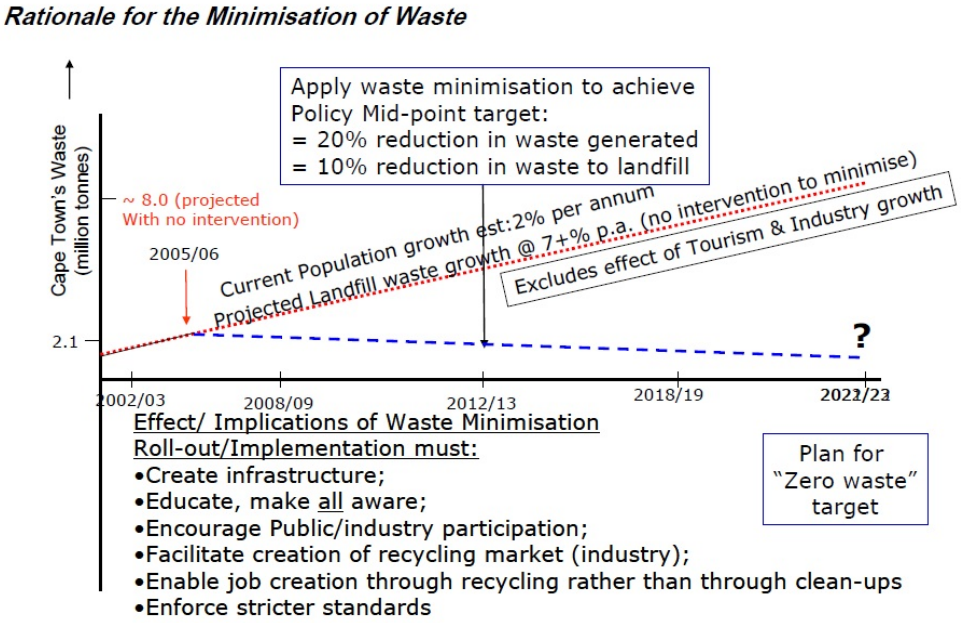


Figure 7: Graph illustrating projections for waste growth in the city and the rationale for the minimization of waste (taken from City of Cape Town IWMP, 2006))

5.2. The legacy of apartheid and challenge of equitable service delivery and achieving integrated waste management.

Another key challenge to sustainable waste management in Cape Town has been and continues to be the legacy of apartheid planning and the task of achieving equal service delivery while also striving to achieve an integrated waste-management agenda. Since the transition to democracy the City of Cape Town has experienced many shifts in the structuring of local government and municipal services. The apartheid government, in its efforts to achieve racial segregation and control, created a complex and fragmented local-government structure. Service provision varied greatly from area to area, with some areas barely having any basic services. Given this history, achieving equal service delivery posed a great challenge for the post-apartheid city. After 1994, the democratic government sought to combine urban areas that were previously racially defined. They aimed to unify service provision and to bring more equal services to all areas. Over time, municipalities were combined and a single tax base was developed. In 1995 and 1996 the number of municipalities in the Western Cape alone was reduced from 39 to 7. In 2000 these were further unified to create one municipality for the whole Cape Town metropolitan area. This came to be known as the Unicity and is managed through a series of demarcated areas called wards (Miraftab, F. 2004).

According to Oelosfe and Godfrey (2009:2), "the amalgamation of local authorities" created a number of challenges. Firstly, it created a number of new roles and responsibilities for local municipalities and, secondly, it put stress on already "stressed human resources" (Oelosfe and Godfrey, 2009:2). The Cape Town 'Unicity' has been faced with an enormous task of providing basic services as well as transforming waste-management approaches. Since amalgamating municipalities, the system encountered many problems and it was argued that funds and services did not always reach the areas where they were needed. It was also argued that the municipal government alone lacked the funds and capacity to deliver adequate services and the necessary transformation. As a result, a new model was developed for the delivery of municipal services: municipal service delivery was opened to private companies so that responsibilities could be outsourced. The private sector has been contracted by many local municipalities to help provide services, which is often an economically efficient alternative to the municipality providing the function itself (Feihn and Ball, 2005:8)

This trend of privatization is in line with the democratic government's change of approach, from their initial post-1994 Reconstruction and Development Plan (RDP) model to the 1996-implemented Growth, Employment and Reconstruction Program (GEAR) which rested on a neoliberal approach to development (Miraftab, 2005:876-878). While the RDP implied a "tightly structured" government that focused on public investment as a method of reconstructing a divided society, GEAR adopted a neoliberal stance whereby the role of the state shifted. The government was no longer solely responsible for development but instead facilitated the process by fostering an environment of growth. In this model, a 'competitive, fast-growing economy' was seen as necessary for the job creation that would help improve standards of living and distribute income (Chipkin, 2002: 57). Yet while in theory this approach was meant to bolster municipal functions through collaboration with a "vibrant private sector", this has not always been the case (Chipkin, 2002:57). Studies have illustrated that this shift in many ways increased inequalities in service provision as some areas benefited while others were neglected (Miraftab, 2005:876-878).

The restructuring of municipalities and the task of attaining equitable service in a city with such a history of inequality has been a great challenge for the city of Cape Town. Going back to Chalmin and Gaillochet's (2009) notion that waste practices change greatly through time and space, much has changed since apartheid. Priorities and challenges have shifted greatly. Since the shift into democracy the city has faced the dual task of trying to ensure basic solid waste collection for all households in a city with a rapidly growing population and an expanding urban fabric and also finding ways to create more sustainable systems and approaches to managing an escalating volume of waste.

The City of Cape Town is responsible for the collection of general or municipal solid waste (MSW). Although National policy states that the municipality is responsible for the overall management of MSW, the city is not expected physically to carry out all waste-management functions itself[46]. MSW includes mostly residential waste – (it can also include commercial and industrial waste but this is more often contracted out to private waste companies (Engledow, 2007). The City recognizes that it lacks the capacity to carry out alone the rapidly expanding waste-service needs of the city. Thus, as outlined in Municipal Systems Act, the City contracts a large proportion of the MSW-collection to the private sector: approximately

[46] Interview with head of solid waste at the city of Cape Town

30% of waste collection is subcontracted to the private sector (Engledow, 2007:41). A senior policy official at the City explained that although waste is the responsibility of the municipality, the current national model of service delivery aims to involve the private sector as much as possible, both to increase capacity and also to boost the private sector. He explained that the city alone does not have the infrastructural, financial or human capacity to manage present waste volumes generated, let alone increasing future volumes. Further, he outlined how the city sees potentially lucrative income-generating activities such as waste management and recycling as the function of the private sector and not the realm of government, so the private sector should fulfil this function[47]. Licensed private-sector companies are therefore regarded as a vital component of the waste-management system in the city of Cape Town. As Swilling (2006) explains, this must not be confused with a withdrawal of the state in the hope that the private sector will perform its functions. Rather, the current model emphasises "state-led public sector investments" whereby the state has an important function in providing funding and direction (Swilling 2006:26).

5.3. Lack of reliable and nuanced data on waste

The lack of reliable data on waste generated poses a significant challenge for the city of Cape Town. It makes planning for the future and working towards integrated waste management very difficult. As Purnell explains in a background paper prepared for the NWMS;

> *"With the shift in national policy towards pollution prevention and waste minimisation, it is crucial that a reliable database is established and maintained on the generation of waste through to its ultimate reuse and disposal"*
> (Purnell, 2009:36)

While over the past ten to fifteen years weighbridges have been implemented at landfill sites, these give only bulk-waste measurements, which do not account for the different waste streams. For example, although it is generally agreed that large amounts of food are sent to landfill, there are no figures available specifically on what fraction of waste is constituted thereby. The importance of a National Waste Information System (NWIS) was first recognised in the 1999 NWMS. As a result, Chapter Six of NEMWA (2008) stipulates the need for the development of a National Waste Information System (NWIS) in order to record

[47] Interview with Policy expert at the city of Cape Town.

and analyse information on waste. It obliges municipalities to collect information on waste generation and treatment. In 2006, the South African Waste Information System (SAWIS) was developed (Purnell, 2009:38), which aimed to have waste generators register and submit waste information. In the Western Cape this has been called the Integrated Pollution and Waste Information System (IPWIS), yet there has been a lack of commitment from generators as registration is still voluntary (Purnell, 2009:38; NWMS, 2011). Thus, in practice, the city is still far from having accurate and reliable data on waste.

5.4. Ambiguities in the classification of waste

Another possible challenge for the transition to more sustainable waste management is the way in which 'waste' is categorized and defined in policy, which can have real consequences for the way it is managed. In South African policy, waste is primarily divided into two broad classes: *general waste/municipal waste* and *hazardous waste*. These are based on the level of risk waste materials present to human and environmental health.

General or municipal waste is defined as "waste that does not pose an immediate threat to man or to the environment" (White Paper on IPWM, 2000). This includes domestic waste, building and demolition waste, business waste and inert waste. It can include materials such as mixed household waste (food, clothes, packaging etc.), recyclables, small-scale household hazardous wastes (such as expired medicine and medicine containers, paint tins etc.), office and shop wastes, various organic wastes, construction and demolition wastes. This waste is disposed of in general landfill sites (Engledow, 2010: 161).

Hazardous waste is defined as waste "which is legally defined as hazardous in the state in which it is generated. The definition is based on characteristics which cause, or are likely to cause, danger to health or to the environment, whether by itself or when in contact with other waste" (White Paper on IPWM, 2000). Radioactive waste and medical waste are examples of hazardous waste. Like any waste category, hazardous waste is difficult to define because the understanding of which wastes pose hazards to human health or the environment changes as technology, scientific understanding and perception develops (NWMS, 2010:18). Hazardous wastes can include a wide variety of materials such as health-care waste, electronic waste which can include heavy metals, batteries, fluorescent lamps, power-station waste, pesticide or chemical wastes, used oils and sewerage sludge (NWMS, 2010:19). In South Africa the

current method for disposing of hazardous waste is outlined in The Department of Water Affairs (DWA) 2005 policy, Minimum Requirements for Handling, Classification and Disposal of Hazardous Wastes, which is currently being reviewed (NWMS Draft, 2010:18). The level of hazardousness is determined using the South African Bureau of Standards system for the classification of hazardous wastes, which rates the waste from high risk (1) to low risk (4). The rating determines in which kind of landfill the waste needs to be placed. In South Africa two types of hazardous landfills exist: low-risk hazardous sites assigned the key "Hh" and high-risk hazardous sites assigned "HH" (Engledow, 2007:30). Low-risk sites can take category-3 and -4 wastes while high-risk sites can accept any category of waste, 1 to 4. As Engledow (2010) explains, "in South Africa waste is usually categorized to ensure appropriate treatment and disposal" (Engledow, 2010: 161).

Although these categories allow for clear discernment and management of hazardous versus non-hazardous wastes, this technocratic approach aims at minimizing possible hazards caused by waste but does not necessarily help to operationalize these materials as resources. Wastes are not defined in terms of their potential to be re-used or diverted. For example, *residential waste*, although multi-compositional, is assigned one broad category, in a sense legitimising its collection as mixed rather than source-separated waste. Within this categorisation, food waste exists as an un-prioritised, elusive material found in general waste and also within hazardous-waste streams. Although food waste is not classified as hazardous, many generators choose to send it to hazardous landfills via registered waste-transportation companies in case it ends up being eaten and harming human health[48].

It appears that the policy does not create space for food waste to be recognised as a category in its own right. This not only neglects its diversionary potential and its value as a resource but also inhibits its responsible management. This stands in contrast to garden or green waste, which is now treated as a priority waste needing to be diverted from landfill. Although a lot of commercial food waste finds its way into hazardous landfills, food waste is also not considered hazardous in South African policy. Yet it could be argued that, once placed in landfills, food waste poses a significant set of hazards. As noted previously, studies have shown that once placed in landfills, food waste, "the most active fraction found in municipal waste" produces harmful leachates and gases contributing to global warming (Adhikari and

[48] Interview with solid-waste management consultant.

Barrington, 2006:421). In Cape Town it is also a potential social hazard once landfilled, as landfills are often located near human settlements and food waste is sometimes consumed from them. In many parts of the world such as Japan, South Korea and Taiwan, and recently San Francisco, sending food waste to landfills has been banned as it is wasteful and contributes to environmental and social problems (Stuart, 2009; Sullivan, 2009). In order to do this in Cape Town the facts of food waste will be need to be recognised, as they have been for garden wastes, and a food-waste category created in its own right so that it can be diverted from landfill and treated sustainably.

5.5. Efforts and achievements towards more integrated waste management in Cape Town

As outlined in the introduction, while waste-management poses a major challenge for the city of Cape Town, there have been some significant developments in attaining more sustainable systems over the past two decades. This has included developments within both the public and private sector. Following shifts in waste policy, some significant changes have occurred towards more integrated waste management in the city. Significant efforts are being made to shift from an old 'end-of-pipe' landfill-oriented approach towards a more integrated system and towards meeting the reduced waste-to-landfill targets. Nonetheless, as this study demonstrates, there is still a long way to go. This section collates information on efforts towards creating more integrated waste-management practices in the city.

As of 2012, landfills are still Cape Town's primary method of waste disposal. The city has three municipal landfill sites in operation: Coastal Park, Vissershok (Hh) site and Bellville South. The largest of these is the Coastal Park landfill site at about 75 ha. Bellville South is slightly smaller, taking up about 60ha. These two sites are used only for general waste. Vissershok (Hh) is a low-risk hazardous-waste facility operated by the city. There is another, privately managed landfill site operating at Vissershok: the privately owned Vissershok (HH), site that is managed by two waste-management companies and is licensed to manage high-risk hazardous wastes[49].

As there are only three landfill sites spread out throughout the city, the city has developed transfer stations as central points to which waste companies must haul their waste. Here the

[49] http://www.capetown.gov.za/en/MediaReleases/Pages/CitysnewIntegratedWasteManagementfacilityinKraaifonteineaseswasteload.aspx

waste is compacted and then transported to landfill either by train or in trucks. There are three transfer stations: Athlone, Swartklip and Kraaifontein. Transfer stations have been identified as key nodes in transforming the city towards more integrated management of waste. They are seen as central points where waste streams can be separated and diverted from landfill into various recycling initiatives. The Kraaifontein facility has recently been upgraded to an Integrated Waste Management Facility. The Kraaifontein Integrated Waste Management Facility was opened in February 2011 as a series of integrated waste-management facilities planned for the city. This facility acts as a drop-off and recycling-sorting site for general waste. There is also a chipping facility for green waste that is brought to the site. At present this site has the capacity to manage up to 960 tons of mixed general waste per day. It will eventually also except household hazardous wastes separately[50].

The focus on waste-minimization and recycling in the city has increased over recent years. This is due to both the efforts of the municipality and the growth of the recycling industry within the private sector. Yet rates of recycling are still quite low. In 2006, 60% of industrial wastes but only 6.5% of residential wastes were said to be recycled. The latter is very low relative to international standards (Swilling 2006). The city has adopted a series of initiatives to try and minimise waste sent to landfill and fulfil waste-minimization targets and policy objectives. These include the city's *Think Twice* Campaign, their *Waste Wise* Campaign and the decision to focus on diverting (since 2008) two key bulk wastes from the general waste stream (building rubble and green waste) in efforts to reach landfill-diversion targets.

The *Think Twice* Campaign was launched as a pilot study in a small number of neighbourhoods on the South Peninsula of Cape Town and has more recently been expanded to a few more areas. This project encourages households to sort their waste into recyclable and non-recyclable wastes that are collected separately and sold to the recycling industry. These are the only areas that sort waste, while elsewhere in the city waste is collected as mixed waste unless residences or companies sort it themselves and use small private waste-collection companies or recycling drop-off sites that are often located at schools. At present there is little information available on the success of the *Think Twice* campaign (Engledow, 2010:168). The *Waste Wise* Campaign is more focused on creating awareness and changing

[50]http://www.capetown.gov.za/en/MediaReleases/Pages/CitysnewIntegratedWasteManagementfacilityinKraaifonteineasesw asteload.aspx

behaviour towards recycling. It focuses on schools, businesses and the municipality's own buildings and offices[51].

Apart from the city's efforts there exists a network of private waste companies who carry out recycling. There is also a large amount of informal recycling done by collectors who collect waste from household and commercial bins and skips as well as from landfill sites. Rather than working against this, the city has tried to improve the working conditions of waste salvagers who operate on landfill sites by allowing them contracts and mandating the wearing of protective clothing (Engledow, 2010:172).

As already mentioned, in recent years the municipality has focused attention on the need to divert garden waste from landfill. In 2008, garden/green waste was identified as a priority material to remove from landfills due to its bulkiness as well as its potential to be composted (Engledow, 2007:51). Sewage sludge and agricultural wastes have also been noted as priority wastes that need to be diverted and which could feed into 'waste-to-energy' projects now being investigated by the city[52]. Food waste could feed into this if recognised as a priority waste and a potential resource to be diverted from landfills (Swilling, 2006).

It is estimated that between 40% and 60% of the domestic-waste stream is made up of mixed organic waste such as garden waste and food waste that is suitable for composting or other recycling activities[53]. Given supporting evidence from global studies on commercial food waste, it is likely that supermarkets would have significant amounts of food waste to contribute to this, although no published figures exist on volumes of commercial organic or food waste exist and this study had limited access to private figures. There is little literature available concerning residential or commercial organic waste within the city in general and very little empirical data on the subject. Where data can be found it is often only mentioned as part of broader studies. Available studies include wider studies on waste management, such as a 1997 baseline study conducted by DWAF on waste management (Fiehn and Ball, 2005:17) and a 2007 study compiled by the Sustainability Institute (Engledow, 2007). Studies focusing specifically on organic waste include a 2009 study on the potential of organic waste management in South Africa (Harma et al, 2009) and a 2007 study by Ekelund and Nyström

[51] http://www.capetown.gov.za/en/solidwaste/Pages/WW_Introduction.aspx
[52] Interview with waste to energy consultant and policy expert.
[53] This is variable between income group (Swilling 2006:37), (Engledow,2007:37).

on composting municipal waste. Most of these studies agree that organic waste is underutilized in the city.

On the other hand, composting of green or garden waste (and not other organic wastes such as food waste) is a relatively well-established activity. There are two municipal composting sites and a number of private composters operating in the city. The municipality has been involved in composting since the late 1960s, when two municipal-run composting sites, Radnor and Bellville South, were set up in Cape Town. Radnor was set up in 1969 and Bellville South in 1972. Although they have been in operation for a long time, these sites have struggled to produce high-grade compost. They were operated by the municipality from their inception until 2007 when Radnor was shut down.

Bellville South Composting Plant continues to operate, albeit with many problems. The plant runs on a system that sorts mixed residential waste from Bellville and Durbanville. It receives approximately 90 tons of mixed waste per day[54]. This waste is loaded onto conveyor belts where the bags are broken open and the contents sorted into recyclables and non-recyclables. The latter are sent to landfill. The remainder, or organic and other matter, is passed through a sieve or screen that removes plastics and other matter. The filtrate is then mixed with 'sewage water' and wood chips and dumped into large 80m windrows for composting[55]. These are turned monthly and take about three months to mature. During the process, they reach a temperature of 80°C due to the natural chemical reactions taking place during decomposition. After this the compost is once again screened before it is ready to be sold on. The manager of the site maintains that this compost is tested regularly and is of a good quality which can be used agriculturally. Yet given that it comes from mixed-source waste, many experts do not consider it safe compost[56]. It is often contaminated with pieces of plastic and glass and because it comes from a mixed-source waste it could contain any chemical that has entered the household waste stream, which could be hazardous materials and chemicals.

In many countries this system of composting is not legal and has been phased out. One waste-management consultant described this compost as "so shocking even the Parks Board won't buy it," so using it for food production is probably not feasible According to the same

[54] Interview with Bellville South Composting site manager and information pamphlet from Bellville site.
[55] Windrows are huge piles of composting material.
[56] Interview with various composting experts in the city. All agreed that this is an outdated and unsafe way to procure compost.

consultant the city is not best equipped to manage composting; they are well equipped to remove waste from households but specialized activities such as composting need to be carried out by the private sector. The same sentiment was expressed by a number of small-scale composters, who agreed that the municipal composting sites were badly managed.

The city has adopted this line of thinking in the way that they now deal with garden wastes. The city recognized that this could be done most cost-effectively and to a higher quality by private companies. The municipality therefore developed a number of drop-off sites around the city where residents and garden companies can take significant quantities of green waste. Given the city's lack of capacity, as well as its emphasis on public-private partnerships, it undertook a tender process to find private companies to chip and manage wastes at the drop-off sites. Two companies were given rights to this green waste for the production of compost. One company was given rights to 80% while the other company awarded 20%[57]. If other companies want to use this chipped material they have to buy it from the chipping companies. This system has saved the city a great deal in landfill space and costs since it was implemented (Ekelund and Nyström, 2007:27). A study conducted in 2004 found that of 120,000 tons of green waste collected in the city, 30% was being composted. Although no figures are available it is likely that the new drop-off site system has significantly increased the amount of garden waste being composted (Ekelund and Nyström, 2007:26).

While this system has been successful, drop-off sites only take garden wastes and do not take other wet organic materials such as food or agricultural wastes. They therefore neglect this significant fraction of waste. The drop-off system has also been critiqued by some smaller companies for being too centralized, allowing one or two companies too much control over this waste and allowing them to set a high price for it. Smaller companies who have to buy the material from the tendered companies cannot therefore produce compost at competitive prices.[58] One company manager believed that the larger of the tendered companies did not have the right equipment for chipping the material effectively, while the smaller company had better equipment but less access to the material. According to this interview, much material was going un-chipped as a result and was thus being wasted due to an inefficient division of access to resources (see Ekelund and Nyström, 2007:27). The centralized tender process thus resulted in much organic material being wasted and preventing small actors from

[57]Interview with manager of composting company
[58] Interviews with smaller waste companies

gaining access. It may not foster an environment in which companies can work together to manage this resource effectively.

As mentioned above, while the city has tried to divert bulky garden wastes from landfill by establishing drop-off sites and collaborating with tendered chipping and composting companies, there are as yet no city-wide initiatives for the management of household or commercial food waste. These wastes may not be dropped at the organic drop-off sites. The city does encourage the use of home composting and worm farms. In recent years a number of smaller-scale composting and worm-farm companies have established themselves, some of which are now working with restaurants, wine farms and hotels. The worm farm at the Mount Nelson is a famous example, which can process up to a ton of food waste a month from the hotel alone. The same company has tried to establish a worm farm at one large supermarket store in the city but this has not been as successful as the Mount Nelson example[59]. Another recently established company is now working with a few other hotels and composting their waste. They too do not yet work with supermarkets as they have been unable to establish a feasible system.[60] Food banks collect large amounts of fruit, vegetables and meat wastes from supermarkets and some food manufacturers for distribution to feeding schemes but do not as yet deal with foods considered 'high risk' which contain protein and thus are more likely to cause sickness. As a result, perishable food wastes such as these are mostly sent to landfill. Huge amounts of perishable goods are dumped in landfills on a daily basis in Cape Town[61].

[59] Interview with worm farming company director
[60] Interview with manager of composting company
[61] Interview with waste management and waste transport companies

Chapter 6. On the supermarket floor: a case study of supermarket food waste management.

As mentioned in the methodology section, for this project the case-study store became the centre for mapping an example of supermarket food-waste management in Cape Town. As each retail chain and supermarket store deals with its food waste in different ways, the map created for this one store is not a generalised template for supermarket food-waste management in the city. Rather, the case study functions as a heuristic device for understanding the complexities of managing food waste sustainably at both the micro-level of the store and within Cape Town as a whole.

The case-study retailer requested that they not be named in the study. This was not a problem; the thesis did not intend to critique the particular retail chain under consideration but to act as a point of departure from which to study the larger system and the interactions between different scales in working towards sustainability. As Zsuzsa Gille (2010) explains, a great deal of waste research in the past ten or fifteen years has focused on the micro, household level as well as a growing body looking at the macro processes, yet there is a need for research focused on both scales as well as for these to speak to each other (Gille, 2010:1049-50). Transitions literature emphasises the multi-scale nature of systems such as those around waste management and the need to understand these multiple layers.

This chapter begins the exploration by mapping the routes of various food wastes from the micro-scale of the supermarket outwards into the city. It is dedicated to presenting the case-study findings concerning the practical, day-to-day methods of management of the store's food waste. It takes note of the stakeholders involved and the various processes of waste management taking place. Overall, it provides an understanding of the main food wastes, how they are managed at store level and how they branch out into the wider system.

6.1 Definitions and parameters

As explained in the methodology, for the purpose of this study supermarket food waste is defined as any food that has reached its sell-by date, can therefore no longer be sold by the store and is removed from the store towards various destinations. The food wastes that were of particular interest for this study included mostly perishable goods: fruit and vegetables, breads, fresh meats, chicken, fish, dairy, eggs and frozen foods. Due to time constraints less attention was paid to dried, packaged goods, of which less is wasted as these have a longer shelf-life.

6.2. Managing food waste in the case-study store

The case-study store produces a number of different food-waste streams. These emanate from either the dry food or fresh foods departments and are overseen by the respective food departmental manager. Fresh goods include fruit and vegetables, frozen vegetables, meat, chicken, fish (fresh or frozen) and eggs as well as breads and bakery products. Dry goods include packaged foodstuffs such as tins, cereals and grains.

The case-study store was unable to give me exact figures pertaining to food waste. I was only given access to an estimated figure by a senior management employee, which I recorded. I was told that the store generates an estimated 25 to 30 tons of mixed waste a month (including paper, cardboard and other materials). Included in this total are the volumes of waste that go to a food-banking organisation and other recycled wastes[62]. Given such imprecise data, it is hard to ascertain the exact volumes of food thrown away on a monthly basis. I was only able to gather a qualitative idea by asking store employees which wastes were the greatest. The manager of the fresh goods department was able to rank the types of food wastes according to their relative wastage. He explained that most food waste generated comes from the fresh goods department – that food has shorter sell-by dates and so are harder to forecast and manage. Within the category of fresh goods, some (such as soft-skinned fruits) are more prone to wastage than others. According to the fresh goods manager, fruit and vegetables produce the highest amount of waste in the store. Breads are next-highest

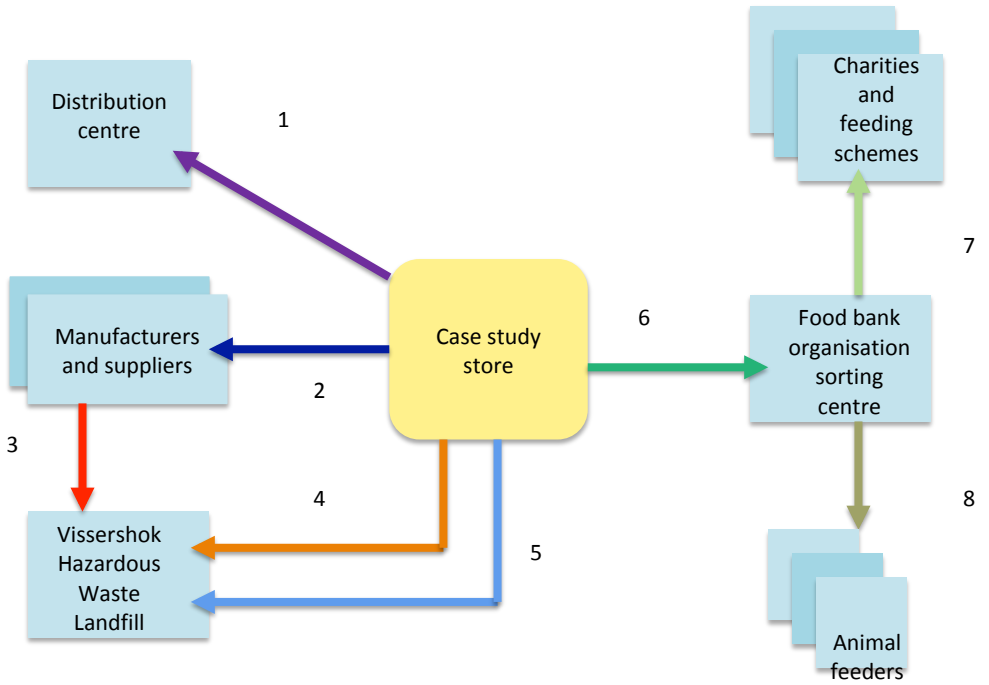
[62]Email correspondence with retailers senior management employee.

because they become stale quickly. This is followed by meat and chicken and then finally fish.

While some retailers in South Africa sell food that has reached its sell-by date to staff at reduced costs, this retailer does not. They had in the past but a directorate from top management stopped the practice. Interviews with different members of staff produced an array of reasons for this, ranging from staff having hidden stock so that it could bought cheaper on its sell-by date, to a concern that staff might resell the food outside the store which could lead to sickness and tarnish the brand. The store also does not mark down the prices of goods approaching their sell-by date as some supermarkets do to reduce wasted stock and defray some costs. Rather, they incorporate the costs of wasted foods into the retail prices of goods sold. The reasoning for this was along the same lines as not selling it at reduced cost to staff, due to fears that it may get resold.

6.3. Breakdown of waste-management procedures for different waste streams

Food-waste disposal is not centralized in the store but rather split up into a number of different routes. These differ by food type and by their potential to harm health as well as according to different contracts with suppliers. Below is a map of the different scenarios facing different wastes. This is not all-inclusive but it captures the main waste streams emanating from the store. Following this is a written break down of each food waste category and how it is currently managed



Used cooking oil

Manufactured goods past their sell-by date such as packaged food, bread, frozen foods, dairy products

Manufactured goods past their sell-by date such as packaged food, bread, frozen foods, dairy

Compacted mixed general waste containing food waste

Condemned damaged or sell by dated dairy and animal protein containing products

Sell-by dated fruit, vegetables and non-dairy containing bakery products

Sorted sell-by dated fruit, vegetables and non-dairy containing bakery products

Damaged or expiry-dated Fruit, vegetable and bakery goods

Stakeholders involved in transportation

1. retailer (in retailer trucks)
2. supplier or manufactures
3. contracted registered hazardous waste transportation companies
4. contracted registered compacted waste transportation company
5. contracted registered hazardous waste transportation
6. food banking organisation
7. food banking organisation
8. animal feeders and breeders

Figure 8. Map showing different waste streams emerging from the case-study store and stakeholders involved in their management.

6.3.1. Fruit and vegetables

Fruit and vegetables (and especially soft fruits such as papayas, bananas, grapes, peaches, avocados etc.) produce a large amount of waste. This also include a lot of fruit from the loose 'fruit islands' where customers handle and damage the fruit. According to the fresh goods department manager, the amount of waste changes seasonally and according to the type of fruit on offer. For example, soft summer fruits such as peaches are delicate and ripen quickly, so they produce a lot of waste.

The case-study store has in place a well-developed and sustainable system for the reuse of fruit- and vegetable-'wastes'. This is made possible by the store's affiliation with a large food-banking organisation that collects food surpluses and food on its sell-by date from various retailers, manufacturers and producers. The organisation is a member of the Global Food Banking Network and was established in South Africa in 2009. They became an umbrella organization for a number of small charities which had previously collected a portion of sell-by-dated food on an *ad hoc* basis from various stores. The establishment of this food bank has helped to improve the efficiency and co-ordination or food waste-distribution. Although some small charities still service smaller stores, the food bank is now managing the larger waste streams coming from big stores such as the case-study store, which now only deals with the food bank and not with smaller NGOs and charities who want to collect directly from the store.

Since 2009, due to their affiliation with the food bank, the store has greatly changed how it disposes of food wastes. The food bank now works closely with the case-study store, collecting all their fruit, vegetables and store-baked bakery products for distribution to feeding schemes daily. At the end of each day fruit and vegetables on their sell-by dates are taken off the shelves and put into crates to be collected by the food bank each evening. At the point of collection the goods become the food bank's responsibility. They have their own collection trucks, which collect the food and take it to their distribution centre, where it is sorted early the next morning and distributed by 2 o'clock pm the following afternoon, either directly to large charities or to middle points where smaller charities come and collect it. They are therefore are able to have the food at its final destination in less than 24 hours. As the case-study store does not pre-sort waste but rather sends all their fruit, vegetables and

store-baked bread to the food bank, the food reaching the depot often requires a great deal of sorting as some is inedible or damaged. Once sorted, the food bank records exactly what they have received from each store and what was edible or non-edible. Edible food is divided and sent to various organizations, depending on what it is and the quantities available. As each day will yield a different set of foodstuffs and because the time between the sell-by date and the expiry date is short this system needs to be highly organized and flexible.

While the food bank specializes in redistributing food surplus and thus the reduction of waste, they too find themselves with large amounts of food waste. At the food bank's distribution centre inedible food is sorted and placed in skips outside their warehouse. Pig farmers, worm farmers and a monkey centre collect this waste on an ad-hoc basis[63]. These wastes are excellent sources of animal feed as they contain no dairy or meat proteins, which should not be fed to livestock and although not banned in South Africa, has been banned in other parts of the world such as in the EU (EFSA, 2011)[64]. Therefore, at present this system provides an ideal solution for this form of waste: it becomes a valuable resource to farmers and is diverted from landfill. The food bank used to leave this food waste outside their warehouse for farmers to collect for compost, but they now have more standard agreements with the monkey centre and pig farmers, who collect daily. The food bank is currently investigating a project to boost their supply of fresh vegetables by supporting local emerging farmers in the surrounding Philippi area, by purchasing their produce. The food waste could feed into compost for these farmers and thus be channelled into the growing of food[65]. In the context of Philippi, where the food bank's depot is located, composting for food production could offer a valuable localised option for converting waste to resource and closing the nutrient cycle. Although a contested space in terms of land-use, Philippi has become a vital site for emerging farmers and has the potential to provide a significant space of food production in the city. Compost is also an expensive resource for farmers who often can't afford enough of it[66].

The food bank is conscious of its role in helping companies such as the case-study store fulfil their corporate-responsibility targets towards zero waste. Out of all of the waste streams explored which leave the case-study store, the fruit, vegetables and bakery products managed

[63] Interview with general manager of the food bank in Cape Town
[64] http://www.efsa.europa.eu/en/topics/topic/feed.htm
[65] Meetings with General Manager, Logistics Specialist and Food Sourcing Specialist at Food Bank
[66] Meeting with compost company director.

by food bank were by far the most sustainably managed items. Their management falls in line with the waste hierarchy and EPA food-waste hierarchy, whereby edible surplus food is donated to people and then any further inedible waste is fed to pigs or recycled through various other means. Given the store's location close to the food bank's depot and the location of the food bank's depot near the emerging farmers, in Philippi this system works very well. It has the potential to become even more integrated through the use of food waste in compost, which could boost soil fertility on the emerging farms (at no added cost) that will then sell the produce back to the food bank. In this way, food waste has the potential to bolster food security both directly, through the redistribution of surplus food, and indirectly through compost contributing to food production.

The amount of fruit and vegetables received by the food bank from the case-study store, as well as from two other stores of the same chain, varies seasonally. The largest volume is usually in the December-to-January holiday season and then again in winter months of June and July, while March and April are quieter. Reasons for this are explored in detail in the next chapter. The system is well suited to the fluctuations and uncertainties of waste streams. This is important to consider when thinking about sustainable options for managing food waste, as different types of food-waste streams are suited to different solutions. In this case, where waste flows are variable, anaerobic digestion of wastes would be less suitable as it requires a constant, balanced and quite predictable feedstock.

6.3.2. Bakery products

Bakery products are divided into two main categories: 'bakery' products baked in the store and 'bakery retail' products which are pre-manufactured elsewhere and brought in by suppliers. Store-baked products are disposed of daily if not sold by the end of the day. These go to the food bank where they are sorted and redistributed in the way outlined above for the fruit and vegetables. This excludes bakery products that contain dairy, such as cream doughnuts or milk tarts, which are restricted from being used for human consumption as they are considered higher-risk items that might cause food poisoning. Dairy-containing items are collected and compacted by store-owned compactor. The compacted waste is collected by a contracted waste-transporting company which takes the waste to the city's Vissershok (Hh)

landfill site. It is trenched and covered according to the guidelines outlined in food-safety policy[67].

Pre-manufactured breads, such as sliced packaged breads, are sent back to the manufacturers or suppliers on their sell-by dates. The suppliers are contractually responsible for collecting them on their sell-by date. Different suppliers have different methods of disposing of these wastes.

6.3.3. Dairy Products

As mentioned above, dairy products are generally not sent to the food bank as they are considered high-risk items. Although there are no specific laws forbidding their redistribution, companies such as supermarkets and manufacturers are reluctant to allow redistribute them unless the process is very well regulated and follows the Hazard Analysis and Critical Control Points (HACCP) guidelines which supermarkets use in the higher parts of their own supply chains[68]. The food bank would like to manage dairy products but at present they do not have the HACCP systems fully in place. HACCP standards would ensure a tightly regulated cold chain extending from the store to their sorting depot and to each final-destination charity after that. The food bank is looking into developing this system. One dairy manufacturer is currently working with the food bank to establish an HACCP-regulated supply chain. This will extend from their premises to the food bank and on to the charities. Therefore it will ensure a tightly regulated system that adheres to the manufacturers own standards. This is vital for them: mismanaged food resulting in sickness could be detrimental to their corporate reputation.

At present most of the store-brand dairy products that have passed their sell-by date are sent to landfill after being condemned by the Environmental Health Department. Branded dairy products are generally collected by the supplier and returned to the manufacturers who manage them in different ways depending on their unique waste-management systems. Yet given the logistical complexity of managing these wastes according to health and safety requirements, much is sent to landfill to avoid possible problems. The food bank have on

[67] Interview with contracted waste transportation company.
[68] See: https://www.sabs.co.za/index.php?page=certhaccpfs

occasion received dairy products, such as yoghurts, but these have been items that were well within their sell-by date but had slightly misprinted labels and so could not be sold[69].

Fresh Meat and Chicken

Meat and chicken are also considered high-risk food wastes and as such pose a serious management challenge for the stakeholders involved. They are taken off the shelves on the sell-by date and put into large freezers at the back of the store. The Department of Environmental Health then comes on a weekly basis to 'condemn' (mark and sign off as no longer fit for human consumption) the build-up of waste. Once the waste enters the hands of the health department it is no longer the responsibility of the retailer, who is given a form to say the waste has been released. While the store manager said that this waste is "destroyed", it is in fact taken by either a registered waste-removal company or the Health Department themselves to the Vissershok (Hh) landfill site where it is trenched and buried. Recent reports in the newspaper have highlighted that although this landfill site is assigned to hazardous waste and should be a highly restricted area, people are in fact salvaging meats off the landfill and eating them.[70] This is expanded on in Chapter Seven, that although food waste is managed to ensure national legislative standards are met and the retailer's reputation is not damaged, once it goes beyond the boundaries of their store and 'responsibility', these controls lapse. This points to the need to integrate this system to that different actors can work together to create more socially and environmentally sustainable systems.

6.3.4. Fresh Fish

Most fresh fish that reaches its sell-by date is frozen along with chicken and fish and then condemned by the Department of Environmental Health and disposed of at the Vissershok (Hh) landfill site. Some of the deli fish, especially skins and bones that remain after cleaning, are macerated and sent down the wastewater system. While maceration has been described by certain waste-management companies as a useful method of reducing the disposal costs of organic wastes, many waste experts interviewed believed this practice to be extremely unsustainable and banned in some countries. The case-study store maintains that they keep

[69] Interview with logistics specialist at food-banking company
[70] http://www.iol.co.za/capeargus/the-people-who-live-off-our-waste-1.1050758

maceration to a minimum and that only bones and skins from cleaning are macerated. It would generally not be in their interests to increase this, as their COD[71] count would go up drastically[72]. Under the Treated Effluent By-Law promulgated in 2010, the municipality is entitled to monitor the store's effluent. If it is found to have too much organic content (which would be the case if macerators were used to dispose of large quantities of food waste) then they could be charged heavily for this[73].

6.3.6 Frozen Meat, Chicken and fish and other frozen foods

Frozen meat, chicken and fish that reaches its sell-by date is collected by suppliers. Suppliers then manage this waste according to their own waste-management policies. According to the health and safety authorities this usually means that the waste is disposed of in hazardous landfill sites so as to avoid sickness. While some companies have agreements with pet-food companies, the latter companies are very strict about using sell-by dated meats. They prefer to get off-cuts that are fresh. An employee of a large pet-food company explained that they do not make pet food out of meat that would cause harm to human health. This is both to ensure the high quality pet food and to safeguard them against the possibility of pet food being consumed by a person who then falls ill[74]. An interview with the food bank revealed that manufacturers are reluctant to redistribute such products.

If frozen meat, chicken or fish products are damaged within the store grounds, for example due to a refrigeration problem, they are frozen and stored until they are condemned by health authorities and sent to landfill via the heath authorities along with the fresh animal-protein products.

6.3.7. Mixed-deli wastes

Mixed-deli wastes, which include both leftover foods and trimmings and peels, are sent to the compactor at the back of the store and picked up by the waste-removal company. The volumes of these wastes are unknown by the retailer or by the collection company, who take

[71] "COD" is the chemical oxygen demand of the effluent in milligrams per litre. If water is contaminated with organic matter this is raised, making the oxygen content low and reducing the water quality (City of Cape Town Wastewater and Industrial Effluent Bylaw, 2006).
[72] Interview with waste management consultant
[73] Interview with waste management consultant
[74] Interview with large pet food manufacturing company.

it to the City's Vissershok (Hh) landfill site along with the other compacted mixed wastes. Interviews with the waste contactor revealed that both the supermarket and the contractor were unsure as to how much food waste ended up in the compactor of mixed wastes on a daily basis. It is likely, although no figures were available, that this constitutes a potentially significant amount of food waste that could be recycled.

6.3.8. Cooking oil

Cooking oil used for in-store frying is returned to distribution centres where it is purified, mixed with diesel and used to help fuel a fleet of the retailer's trucks. This waste source has been transformed into a valuable resource for the company: it lowers fuel costs and also conitrbutes towards overall sustainability goals. This system is now operating in many of the retailer's stores throughout the country.

6.3.9. Stakeholders involved

It appears from mapping the case-study store's waste flows, as well as from speaking to the retailer's sustainability manager, that what is done with food waste is largely guided by the retail chain's hygiene policy (discussed further in the next chapter) as well as by which companies and facilities are available in the area of the store. As the Sustainability Manager explained, while retailer policy stipulates that cardboard and plastics are to be recycled as much as possible, in some areas there are no recycling facilities or companies nearby. Transporting recyclables long distances is also not always the most sustainable option; in such circumstances this needs to be considered carefully. The management of food waste is guided by higher-level policy within the retailer but also by the store itself, which has to create a waste-management system suited to the area in which they operate.

To manage edible non-dairy or animal-protein food waste, the retailer works with the food bank whereever they are in operation throughout the country. While the retailer has a nationwide contract with one waste company to manage most of their other waste in the country, this also depends on where stores are located[75]. The case-study store's waste was not contracted out to the standard waste-removal company employed by the retailer; rather the store had a contract with another registered waste-transportation company to remove

[75]Interview with retailers sustainability manager

compacted wastes to landfill and with another company to remove condemned wastes also to landfill. Condemned wastes were also sometimes removed by another waste company employed by the Department of Environmental Health.

From the above mapping of the different waste streams, it is clear that there are a variety of different waste trajectories, which involve a range of stakeholders. Yet, apart from the surplus fruit, vegetables and breads that go to a food banking company, most of this is not at present reused or recycled through, for instance, composting or anaerobic digestion. While interviews with top management of the retailer clearly point out that it is dedicated to working towards zero-waste-to-landfill goals and has made great efforts to achieve this where possible, food waste still proves problematic. The next chapter explores the reasons for this in further detail.

Chapter 7. Waste or resource: exploring the framing of food waste by the retailer and other stakeholders.

> "*What is waste? Rubbish, detritus, effluent, excess, garbage, scrap: it has so many names, and comes in so many forms, that to try and sum it up in a word can be misleading-even meaningless. Just about the only thing that can be said about waste is that it is the stuff that someone, somewhere does not want. However that is not to say that, someone, somewhere else might not want it. What is considered waste –what is wasted –differs from one nation to another, from one section of society to the next, from one man to his neighbour. Waste like beauty is in the eye of the beholder*" (Steel, 2009: 260)

In recent years, supermarkets around the world have been realizing the importance of integrating sustainability into their management systems and supply chains. In South Africa most of the large retailers have become engaged with increasing their overall resource efficiency as well as aiming towards more sustainable procurement practices and integrating sustainability measures into supply chains in various ways. Over the past decade retailers have increased sustainability reporting. Common measures outlined in Corporate Social Responsibility reports are reduction in water consumption, energy use and recycling of wastes.

Surprisingly food waste appears one of the less common areas of focus within sustainability reporting of food retailers. Some have explored worm farms as options for recycling food waste, but this is on a small scale[76]. The most common food waste initiative undertaken by supermarkets is the collaboration with a food banking organisation. Yet despite this significant contribution to food banking schemes, much other food waste produced in stores is still sent via waste removal companies to landfill, either directly from the supermarket or via the suppliers who are contracted to remove waste food from the retailer on its sell-by date[77].

[76] Interview with owner of worm farm composting company
[77] Interview with supply chain and logistics expert

7.1. Positioning waste in the workings of the supermarket

> "Food waste is a specifically difficult area, it goes into so many avenues" [78]

While the previous chapter provided as far as possible a systematic map and breakdown of how the store practically manages its food waste on a day to day level, this chapter explores the framing of waste by the retailer and case-study store and explores what factors shape the production of as well as the management decisions around food waste. The first part of the chapter outlines factors that contribute to the production of food wastes within the supermarkets operating system. The second part of the chapter explores some of the rationales behind the management choices for this food waste once produced, inquiring into why food waste is not operationalised further as a resource at store level and what barriers exist to the realization of this.

7.2. Food waste: a necessary part of the system?

This section explores the dynamics that shape the volumes of food waste produced in the store. It investigates the relationships, ideas and rationalities at play in the retail system, which contribute to the production of food wastes.

The case study retailer are currently engaged at looking at ways that they can minimize food waste generated, while still having "optimal shelf availability"[79]. Besides the social and environmental reasons for this, food lost is a loss of money not only in terms of lost products but also because waste disposal is expensive too. As one of the food department managers explained; "one of the biggest emphasis (for the retailer) is waste because we are basically throwing business away" for this reason he maintains that as a store they are "very strict about waste".[80] Yet despite this strictness over waste, there still exists a large amount of food waste produced daily in the store. As explained by the retailer chain's sustainability manager, waste minimisation is the key objective in terms of food waste. Yet this goal is not always straightforward to achieve[81].

[78] Environmental health professional
[79] Interview with sustainability manager
[80] Interview with store food department manager
[81] Interview with sustainability manager

7.2.1 "Patterns of retail are not a science"

As patterns of consumption are constantly shifting, and products are endlessly being developed and increasing in variety, stocking shelves appropriately is a complex task. The case study retailer has developed mechanisms to forecast or predict according to past sales how much of a product should be stocked in relation to demand[82]. Yet this is not flawless and patterns can change from day to day. As the fresh goods departmental manager explained "patterns of retail are not a science" and it "comes down to (finding) a balance".[83] But finding this balance is not a simple task as conditions and consumer's choices are always changing. Stuart (2009) explains how a sudden change in the weather might affect consumer's preferences and thus suddenly generate a shortage or a surplus of products, thus throwing predictions off (Stuart, 2009). At the case-study store, certain months such as during the December- January holidays tend to produce more waste than others. I was asked not to conduct research as the store during this period as it was too "chaotic" and managers were too busy to be interviewed[84]. One manager explained that under such conditions it is more difficult for predictions to be carried out systematically. Often the store purposefully overstocks to avoid running out and creating disappointed customers[85]. Quieter months allow supermarkets to manage stock more efficiently, which generally lowers the levels of waste. The store attributes the fluctuation in levels of waste to having to do with do with various factors such as seasonal consumption patterns, weather changes, holidays, store busyness as well as types of seasonal produce. In December peaches, plums, mangoes and other soft fruit are in season, which spoil faster and generally produce more waste, while winter fruit such as apples and pears damage less. As a result, the fruit waste generated at the store is not constant and fluctuates significantly in volume throughout the year[86]. The store's fresh good department manager does try and minimize this waste through a system called the 'top 10 wastes', whereby each month the most wasted fresh produce items are identified and measures are put in place to try and reduce this. Such measures can include changes to the quantities ordered, the way it is handled or packaged or presented. But despite minimisation measures such as these large amounts of food wastes still get produced on a daily basis due to the unpredictability of retail.

[82]Interview with case study store food department manager
[83]Interview with store food department manager
[84]Correspondance with store manager
[85]Interview with fresh goods manager.
[86]Interview with employee from the food bank

7.2.2. Full shelves at all times: keeping up the 'Illusion of plenty'

Stuart (2009) explains that despite efforts to use various methods such as food forecasting, there will always be waste in supermarkets (Stuart, 2009:27). According to Stuart, an important reason for this is because supermarkets aim to satisfy their customers who like to think that they have a variety of choice, and who are disappointed if they cannot easily obtain what they request. If a store kept running out of items the public would not have a positive view of its management and efficiency and choose to shop elsewhere. As explained in an interview with a fresh goods department manager "retailers would rather waste them than run out of chickens"[87]. As a result supermarkets will often choose to place more goods on the shelf than are likely to sell. Furthermore supermarkets will often "deliberately overstock" because of the upheld idea that customers like to see full shelves, as this gives them the "impression of infinite abundance" or "cornucopian choice" (Stuart, 2009:27). It is believed that the "illusion" of abundance is vital for the perpetuation of consumer culture (Stuart, 2009:27). Consumers are increasingly used to an abundance of variety. With so many products to choose from waste is inevitable.

While overstocking would appear a waste of money for the retailer, as it means losing enormous profits on wasted items, retailers are able to make up for these losses through building it into the prices[88]. As explained by Stuart "overstocking can still be profitable" as the sale price of an item is usually double that of its cost price. Although there is a drive to reduce waste by retailers, surplus represents "potential profit" and therefore is inherently part of the system. Wasted goods cost less than goods sold and therefore even if lost they are necessary in terms of generating profit[89]

Parfitt and Barthel, (2010) explain that in most BRIC or OECD countries there is "no financial incentive" for retailers to minimise their food waste levels, because reducing waste may turn out to cost them more. This is partly because "environmental costs of food wastes have not been internalised" and so disposing of food waste costs less than risking not selling

[87]Interview with an employee of a waste management company who has done work towards reducing poultry wasted in supermarkets in Cape Town.
[88]Interview with supply chain management expert.
[89] "The modern food industry is a business; not the planets caretaker. So long as the bottom line remains unaffected, it is content. Worse still the industry is dedicated to overproduction, because it is discovered that, with little persuasion, it can expand and apparently limited market just that little bit further. Viewed as closed loop system all excess is waste. Viewed as a business opportunity, it is potential profit" (Steel, 2009:269)

food due to shortage. However, as populations and food shortages increase over time, so will the opportunity cost of wasting food (Parfitt and Barthel, 2010:123).

Thus in a sense wastage of a proportion of the stock is seen as a 'necessary evil' for the perpetuation of this system. While waste minimization is a core objective within the Food Waste Hierarchy and the retailers waste policy, in the case of food retailing it is a complex outcome to achieve. Food waste has become an inherent part of the system, and is bound up in a complex interplay of economic, social and geographical factors. It appears that when looking towards sustainable options, until we are able to change the entire food system and the expectations of consumers, minimization cannot be the only solution, and reuse and recycling too must play a vital role.

7.2.3. Sell-by dates – creating order and legitimacy at the expense of creating waste?

In South Africa and globally sell-by dates are increasingly an important part of the retailer – customer relationship. For customers they create a level of confidence in the consumer. They also help guide the retailers in maintaining a health and safety standards by helping eliminate any chances that consumers could fall ill from something bought off their shelves. On most items today we expect to see a 'use-by' or 'best before' date and on perishables we are used to seeing both a best before date and a use-by date too. Yet despite the pervasiveness of these date markings in today's food system, the labelling laws guiding these are surprisingly less strict than one would imagine. In the EU 'use by' or 'best-before' dates are required for (most) pre- packaged products but sell-by dates are an addition entirely developed by the food industry itself as both a method of attaining consumer confidence and as a way of helping them manage the stock on their shelves (Stuart, 2009:60).

In South Africa labelling laws are even less strict. This came under the spotlight last year (2011) when some retailer food waste was dumped in an informal settlement and residents ate some products that had reached their sell-by dates and became ill[90]. In relation to this Heath Authorities revealed that there exists at present no legislation requiring merchants to date their food products.[91] As explained by the councillor of Cape Towns Health Portfolio

[90]Mjekula, Are expiry warnings past their sell by date, Jan 14, 2011, available at http://www.iol.co.za/news/south-africa/western-cape/are-expiry-warnings-past-their-sell-by-date-1.1011952
[91]Mjekula (as footnote above)

Committee, " at the moment, there is no legislation that governs the date marking of food and therefore there are products on our shelves without expiry or use by dates"[92] Cape Town's Health Director explained further "There is currently no legislation that governs the date marking of foodstuffs. The date markings provided by manufacturers/sellers on labels of foodstuffs relate directly to the marketability of the products concerned and relate mainly to the optimum quality and/or freshness characteristics thereof,"[93]. There are plans to change this approach to labelling, through the pending labelling legislation, which is expected to come out in March 2012[94], which will make date marking compulsory[95]

Whether compulsory or not in national legislation, large-scale retailers consider use-by dates useful. Use-by dates are often set with a lot of precaution and far from when the food may actually be off. Sometimes they are even brought forward purely to ensure food is eaten at its optimal texture and freshness so as to retain an image of fresh and 'crispness' even if the food will not cause any harm sometimes way beyond its set date (Stuart, 2009:62). This happens especially with perishable and pre-packed goods, which studies have shown, are becoming one of the most popular items in supermarkets today (Tsiros and Carrie, 2005:114). As a result a large amount of food becomes deemed waste merely as product of this system. According to the food departmental manager "there are many occasions when foods such as pre-packed broccoli expired today but there is nothing wrong with it, its excellent quality but because of the policy we have to get rid of it"[96]. In the case-study store the retailer policy stipulates that foods having reached their sell-by dates must be removed from the store the same day or frozen and removed thereafter. Finding sell-by dated food on the shelf would look bad for the store concerned who need to appear at all times to mange food efficiently and hygienically.

Contributing to this wastage is that consumers are not aware of what these dates mean and that they are highly precautionary. This often leads to consumer avoiding foods that are not just on their sell-by date but close to their sell-by date, even though in reality these good have

[92]Councillor J Vos, quoted in 'city completes food poisoning investigation' Media release. No. 91/ 2011/ 08 Feb available online at http://www.capetown.gov.za/en/MediaReleases/Pages/CitycompletesPholileParkfoodpoisoninginvestigation.aspx
[93] I. Bromfeild quoted in 'are expiry warnings past their sell by date?' in Waste Revolution e-journal, Volume 2 issue 1, thursady 20 Jan 2011 available online at http://www.wasterevolution.co.za/content/waste-revolution/ejournal/item/918-are-expiry-warnings-past-their-sell-by-date?.html
[94] I. Bromfeild (as footnote above)
[95]Councillor J Vos, quoted in 'city completes food poisoning investigation' Media release. No. 91/ 2011/ 08 Feb available online at http://www.capetown.gov.za/en/MediaReleases/Pages/CitycompletesPholileParkfoodpoisoninginvestigation.aspx
[96]Interview with store food department manager

a much longer shelf life (Stuart, 2009:63). This can lead to a number of items being left on the shelf as consumers choose the ones with longer shelf lives.

Therefore as outlined in the above sections, although minimization is a priority for the retailer and is the foremost step in working toward more sustainable management of food, in supermarkets it is a complex process to achieve in practice, due to the unpredictability of the system, the priority of health and safety standards and the current nature of the food system which favours displays of abundance. For this reason within this system as it operates at present, it is vital that where minimisation potential is limited there are options for recycling food wastes.

7.3. Managing food in the store once deemed 'waste'

This next section explores the management decisions around waste in the case-study store and among other stakeholders dealing with waste once it has been generated. It explores how the handling of waste is shaped by larger systems, ideas and interests.

7.3.1. Legal requirements and guidelines for managing food waste

Despite its potential social and environmental hazards once landfilled, food waste as a whole in South Africa is not classified accordingly and merely falls under the category 'General Waste' (NEMWA. Act 59 of 2008). Although classification of wastes by generators according to the South African National Standards (SANS) is a legal requirement, General Waste and thus food waste falls under Schedule 1: Pre-classified waste, meaning that no further classification is required for any wastes falling in this category (Draft Regulations and Standards for Waste Classification, 2010)[97]. Schedule 1 wastes include; both hazardous and general waste groups that have been pre classified. Hazardous ones include medical and asbestos waste while General waste includes; domestic waste, building and demolition waste, inert waste, waste tires, green waste/garden waste and waste paper, food waste is considered part of this (DEA, 2010). Thus food waste is considered general waste (or rather falls in this category due to the fact that it is not classified) and therefore its management is not strictly specified under the current waste management legislation. Yet some food types are further

[97]Interview with waste management policy expert.

subject Health and Safety Legislation Guidelines which do direct how it is managed and if it can be reused or recycled. These are of vital importance to the management of supermarket food wastes, as are the supermarkets and the food industries own health and safety guidelines.

In South Africa non-perishables such as grains and other dry goods are not regarded as a public health concern. Unprocessed vegetables and fruit waste is also not considered a health risk, and thus can be redistributed without guidelines. They may also be recycled, such as through composting or co-disposed in a regular landfill site, through a general waste collection channel. No permits are required for the handling of unprocessed fruit and vegetables, making the management of these wastes much simpler[98]. Thus these wastes once having reached their sell-by dates can be donated to food programs such as through Food Bank quite easily within current legal requirements. A facility that recycles such food wastes may do so without a permit unless the scale exceeds 20 tons a month in which case it requires a basic assessment or EIA (NEMA, 2008).

Yet in order to handle perishable foods in South Africa a retailer or other body is required to have a certificate of acceptability from the department of health (DOH, 1999). Perishable foods include foods that need to be refrigerated, either due to its original nature or because it has been processed (fruit and veg and other). Perishables are required to be handled under the R918 Regulations governing general Hygiene requirements for food premises and the transport of food (DOH, 1999/ amended 2002). In terms of perishable food wastes, from a health and safety perspective the concern lies with perishable foods that become spoilt and which may cause harm to human health. This includes foods that have passed their sell-by dates, been contaminated by disease, chemicals or damaged such as dented tins or where there has been a break in the cold chain and HACCP (expanded on later) standards.[99] Such foods are required to be inspected by a Health and Safety practitioner and condemned, whereby the health authority issues a certificate of condemnation. After which they need to be collected by a registered waste collector and either treated or incinerated at a registered facility (of which few presently exist) or taken to a Hh landfill site, in the case of Cape Town there is only one such facility; Vissershok (Hh). These wastes then need to be trenched and

[98]Interview with senior environmental health and safety practitioner, city of Cape Town. (27th June 2011)
[99]Interview with Environmental health practitioner.

buried at a depth of minimum 6 meters[100]. Guidelines on the disposal of meat can also be found in the Meat Safety Act 2000 and the Animal Safety Act 2002 under the Department of Agriculture. This legislation requires that meat wastes are either - Denatured and thereafter buried deeper than 6 meters, incinerated, sterilized or disposed of by any other approved method of disposal.

In addition to the legal guidelines on the handling of perishables there are sets of standards that although not compulsory under national legislation, have become widely adopted and expected of the food industry. These include ISO 9000 and HACCP. The ISO 9000, developed by the International organization for standardization "represents an international consensus on good quality management practices" and has become an important standard for food handling premises (ISO, 2011). Food handling companies can be certified, but this is not a legal or compulsory requirement[101]. Hazard Analysis and Critical Control Point, or HACCP, was developed by NASA as a way of monitoring food safety in space. Since this time it has become widely adopted worldwide. Whereas before the food industry relied on spot checks, this system allows for an integrated monitoring system throughout the supply chain, guaranteeing much safer health standards[102].While these are not required under South African legislation, they are used by most large retailers including the case study retailer. Most large retailers require that companies involved in their supply chain adhere to them too.

The food bank working with the case study retailer are now incorporating the HACCP system and are currently working on setting up systems that enable them to extend this from the origin of the food surplus back to their depot and then to the point where food is dropped off, so that the cold chain is in no way broken. While they are able to do this with vegetables at present their systems are not quite up to standard as yet to do this on a large scale with perishables such as meat, fish and dairy products[103]. Once they achieve HACCP standardization it is likely that supermarkets and food manufacturers will be more willing to donate higher risk perishable foods as in a sense their operation becomes an extension of the retailer's supply chain. HACCP allows for the regulated continuation of the cold chain[104]. The food bank working with the case study retailer hope to be able to handle perishables

[100] Interview with Gavin Heugh and eddie Hannekom
[101] http://www.iso.org/iso/iso_9000_essentials
[102] http://www.techpros.co.za/HACCPfacts.pdf
[103] interview with general manger of food bank
[104] Interview with food bank 28 july 2011

from supermarkets using this system in the next six months. At present they do sometimes accept small amounts of such products but only if they have the ability to distribute it within the same day, and the quantity needs to be large enough to warrant this effort.Having the HACCP standards in place gives the retailer more confidence in the food bank as a partner. As it is vital to the retailer to protect their brand, they are strict about what they will donate to organisations planning to redistribute it for human consumption. Supermarkets are reluctant to donate perishables unless they are a hundred percent sure that they will be managed hygienically at al points until they reach their destination-they are considered high risk foods.

While there are no specific health standards guiding the redistribution for human consumption of food reaching its sell-by date the process is indirectly regulated by the above legal and voluntary standards. While supermarkets are guided by some legal standards, they too impose standards on the management of their food waste as if any item attributed to them cause harm to human or animal health they could be in serious trouble and it could tarnish their brand name. They are not willing to take this risk and thus will not channel food into redistribution or recycling systems unless they are very sure that they are safe. The new Consumer Protection Act which commenced on the 31st of March 2011 (although no final regulations are approved) has the potential to tighten these concerns and standards and thus affect the redistribution of food. It will put even stronger responsibility on retailers, giving the consumer more power against the retailer if something does happen.

There are currently no environmental protection-orientated guidelines concerning the recycling or sustainable management of such food waste from the food industry. Therefore its management is largely guided by health and safety criteria as well as the concerns of the retailer themselves. The health and safety guidelines pertaining to perishable goods such as meat, state that these items need to be taken to a hazardous landfill site and trenched. This is considered a responsible method of handling such wastes under the current guidelines. There are currently no guidelines pertaining to this waste that are geared at diverting it from landfill or encouraging generators to see that it is recycled. In relation to legislation that encourages the diversion of food wastes from landfill, one environmental health practitioner explained that, “at the moment it’s not looking good, controls are not in place”. At present the Department of Environmental Health struggle to maintain that even these health and safety standards are up kept. In a conversation with one environmental health practitioner I was

informed that in his office one health and safety inspector alone handles 400 sites. This lack of capacity is a serious problem for ensuring standards are up kept.

The lack of specifications for how food waste is managed in terms the environmental impacts means that generators are mostly guided by health and safety standards as well as price and their own hygiene objectives. Given this, companies can end up sending food waste to landfill as it is the easiest way of avoiding any complications that may spoil their reputation.

7.3.2. Waste; a 'nuisance', which must be removed quickly and efficiently/ Waste an externality not a resource

In the store there is no one directly in charge of waste or food waste, rather it is the responsibility of each departmental manger to take care of[105]. As each departmental manager is extremely busy and this is not their primary job description, the outcome is that it tends to be managed efficiently in terms of cost or hygiene but is not necessarily managed most sustainably. This lack of accountability for waste was identified as a key issue by one of the waste management experts interviewed who has a history of working with waste and supermarkets. As staff are required to see that waste causes no harm to health and costs are minimized they are not necessarily expected to make sure that the most sustainable options are undertaken or that it is utilized as a resource[106]

At present most food waste at the store level is largely treated as an externality, or 'necessary evil' rather than a potential resource. It needs to be removed as quickly as possible so as not to build up, take up space and create a potential health hazard. Although values of sustainability are enshrined in the retailer's core objectives for the future, and they are currently carrying out a number of initiatives to make the retailer chain more sustainable as a company, at store level the day to day interests seem to be mostly about efficiency and maintaining a 'tight ship'. The fresh goods department manager explained; " we are not allowed to let waste build up, it is store policy and in this store we aggressively get rid of waste"[107]. Within the supply chain the supermarket is a node of constant through flow of goods, products are constantly entering and then leaving. Everything needs to work rapidly,

[105] Interview with fresh goods manager
[106] Interview with diercetor waste managemnt company
[107] Interview with fresh goods manager

smoothly and efficiently. Thus waste removal systems are designed so that they are cost effective, rapid, effective and hygienic but not necessarily most sustainable.

In an interview with one of the food departmental managers, I asked if options other than sending sell-by dated meats (which are still edible) to landfill had been considered, such as making pet food from the meat that had approached its sell-by date or sending it to a pet food company. He replied that it had "just never been mentioned" and when I asked about the possibility of converting it to pet food, he said that he hadn't thought of sending the meat to a pet food company. Although he is responsible for seeing that this waste is disposed of correctly, issues improving sustainability are not necessarily considered as part of this role.

Although staff members at a store level are aware of the pressing concerns of sustainability, they do not necessarily internalize this objective as part of their realm of influence and responsibility. Also at the pace at which the supermarket system is carried out there is every little time to stop, take stock and change the system at this level. As explained by one of the food departmental managers; "in retail you don't get any rest"[108]. In a conversation with the stores general manager he expressed that food waste was an area of concern for him, after which he was interrupted and had to leave to attend to a customer who was unsatisfied with the way a product had been mis-advertised. Thus at store level the structure and pace in many ways does not allow for experimenting with new methods and ideas that could possibly be more sustainable. A food departmental manager explained that ultimately they would like meat wastes not to go to landfill, but explained that "in order for change you need a proper system"[109]. The alternate system would need to be developed so that does not upset the current system too much. He explained further that "the (waste management) companies would have to be ready to take it on" and that the store management would "need to be a hundred per cent sure its going to work" because if it didn't would be too risky and upset the running of the supermarket. He explained that food products leaving the store such as "chicken has our (the retailers) name on it" which if not managed correctly it would not only interrupt the system "it could be a public relations nightmare"[110]. It is precisely this that leads this discussion into some of the vital factors driving the choices around managing food waste- hygiene and corporate image.

[108] Interview with fresh goods manager
[109] Interview with fresh goods manager
[110] Interview with fresh goods manager

7.3.3. The fear of waste; food poisoning and corporate image

In Mary Douglas's 1966 book *Purity and Danger*, she examines society's relationship with food waste and how it comes to be seen as 'dirty', while in nature 'dirt' does not exist (Douglas, 1966; Steel, 2009: 263). She explains how the control over dirt or 'waste' stems from a compulsive need to create order and dirt as does waste "threaten(s) to undermine our human sense of order" (Douglas, 1966 in Steel, 2009: 264). She explains, how when food is on the plate it is seen as good, yet once it becomes a scraping and has been cast aside "its position becomes ambiguous", it becomes possibly 'dirty" or "dangerous", a potential threat, once placed or "safely scraped off into the bin" in the rubbish bin it cannot cause harm and "can no longer be mistaken for what it is not" (Douglas, 1966 in Steel, 2009:264)

Although Douglas and Steel are theorizing about the relationship between the individual and waste, these same ideas appear to filter up into the level of the retailer. If consumers are so conscious of the cleanliness of food, retailers need to be the providers and guardians of this. A small event of food poisoning can be a disaster for a retailer, it can tarnish their brand name and cost them both indirectly in terms of lost sales and possibly legally. Thus they need to be considered infallible when it comes to food hygiene. This makes retailers' reluctant to change their systems of food waste management unless they are extremely sure that it will be managed safely[111]. As Stuart, 2009 explains;

> *"Food poisoning is the bogyman of the food industry and companies with valuable brands live in fear of damaging headlines. A single case can cause sales to plummet and share prices to dive" (Stuart, 2009:60)*

These fears are not unrealistic as if sickness did result from food waste that went bad and then was eaten after leaving the store it would be a problem for the retailer in question. In January 2011 such an incident did occur in Cape Town, where a truck of sell-by dated food from a small retailer in Somerset West was dumped in an informal residential settlement area instead of being taken to the Stellenbosch landfill site, which it was destined for. Fifty eight people were taken to hospital and another 93 treated onsite for food poisoning. In the investigation it was found that it was due to the fault of the contractor whom had agreed to

[111] Interview with manager of the food bank

drop the food at the site on request rather than take it to landfill as he was supposed to[112]. Although in this particular case the waste transportation company was found negligent, if waste does end up in the wrong hands supermarkets could risk having their reputation tarnished. For this reason they are strict about food that leaves the shop floor. For every batch of food waste that leaves the store they require a 'receipt of acknowledgement' or 'certificate of safe disposal from the waste company stating that it was dumped at the right location[113]. Large-scale retailers such as the case-study store will generally only deal with waste removal companies that are certified by the Department of Health[114]. For animal products, the Department of Health comes in and condemns waste once it has reached its sell-by date or if it is damaged such as through a break in the cold chain. In this event both the Department of Health and the supermarket should be issued with a certificate of safe disposal from the waste company signed by the hazardous landfill site where it is dumped[115].

In their dealings with third parties whom are interested in reusing or recycling of their food wastes, such as a food bank, large retailers are more likely to deal with a well established reputable organization than small ad hoc collectors who may not handle the food correctly or sell it. The third party organization such as a food bank needs to be able to provide them with records and documentation for each batch of food[116]. Where retailers do recycle food waste they need to be sure that it falls into the right hands and will not potentially tarnish their image and brand. (Retailers are generally not as strict with fruit and vegetables but are reluctant to donate higher risk perishables such as meats and dairy products). The company also needs to be able to integrate their way of working with the supermarkets methods of operation and not disturb the workings of the store.

Mary Douglas explains that our perception of dirt, in this case food waste, "is dominated by our knowledge of pathogenic organisms " thus rendering " a strange relationship with it; a fear that renders us incapable of acknowledging its creative, even redemptive power" (Douglas, 1966 in Steel 2009: 263). Thus our fear of the potential health risks of food waste make us incapable of seeing it as a potential valuable resource. As Douglas put its, industrialised societies are often "closed" to "this regenerative property of dirt", "because of

[112] http://www.capetown.gov.za/en/MediaReleases/Pages/CitycompletesPholileParkfoodpoisoninginvestigation.aspx/
http://www.iol.co.za/news/south-africa/western-cape/150-poisoned-after-eating-dumped-food-1.1009865
[113] Interview with waste management expert from department of environmental health and store fresh goods manager
[114] Interview with environmental health practitioner
[115] Interview with envioronmental health prcatitioner
[116] Interview with food banking comany

our obsession with purity"(Douglas, 1966 in Steel 2009: 263). Hereby there is a tendency to look past the potential of a resource that is considered dirty and which is seen as a threat to health and order.

Although the case study retailer has begun utilising old oil for diesel in their fleet of trucks, at present the store are very much operating under a system of food waste 'control', rather than tapping into the resource potential of their wastes. Douglas would say that waste, such as waste food is regarded as "matter out of place" and thus needs to be removed as quickly as possible. The case-study store is extremely efficient at removing this 'matter out of place' out of 'harms way', but less efficient at operationalizing it resource potential.

As a society obsessed with hygiene, we are often happier when food is carted off and dumped in landfills, far away where it cannot cause harm to health, unpleasant odours or attract vermin and vectors. Yet ironically, this obsession with removing waste from sight and mind produces the ultimate hygiene nightmare –landfill sites. Apart form fruit and vegetables wastes which are not considered too much of a health risk, the majority of food waste that is not recycled by supermarkets or suppliers in Cape Town is transported to Vissershok the lower risk hazardous landfill site, where it is dumped along side other categories of waste such as chemical and medical waste. Although one can understand the supermarket's fears around food leaving the store, and their rationale for sending it to landfill, the irony is that even within this rigid system, food sent to landfill, once considered 'out of their hands; and no longer within their realm of responsibility, often still gets eaten by people.

7.3.4. Mining for meat: unseen extensions in the supply chain

Recently a series of newspaper articles have brought to public attention that residents of areas nearby Vissershok hazardous (Hh) landfill have been consuming food dumped there. One respondent interviewed for a newspaper article stated; "I get my lamb chops and beef there every day…it's expired meat and other products from Pick n Pay and Checkers".[117]Although the site is fenced, guarded and food is supposed to be trenched and buried at a depth of six meters[118], somehow people do manage to gain access to the food on a regular basis.

[117] Barnes, Cape Times. 02 April http://www.capetimes.co.za/residents-eating-expired-meat-1.1050959/http://www.capetown.gov.za/en/MediaReleases/Pages/CitycompletesPholileParkfoodpoisoninginvestigation.aspx
[118] Interview with hazardous waste removal contractor

According to reports this often happens at night. It is also reported that people (some claim the sites guards) 'mine' meat from the landfill and sell this meat to residents[119]. According to one newspaper article "the City of Cape Town says it knows about the problem and is urgently looking at moving the residents of Skandaalkamp, on the border of the Vissershok landfill site, from the area", a contentious issue in itself as residents have settled and do not want to move from the site despite its potential hazards.[120]

This issue draws attention to the inefficiencies and dangers of relying on landfills as a suitable method of disposal for food wastes. Despite its obvious social and environmental impacts, dumping commercial food waste at a hazardous landfill and residential food waste in a general landfill is at this time considered legal and a responsible method of disposing of food waste in Cape Town. According to waste management contractors and Environmental Health professionals, all the large supermarkets as well as many large food manufacturers, and suppliers and abattoirs are currently using Vissershok (Hh) landfill site to dispose of their meat products. This is a regulated and well-established procedure carried out through the department of environmental health[121]. Off cuts, damaged or sell-by foods are condemned by the Department of Environmental Health whereby they become listed as hazardous waste materials[122]. Once such wastes have been collected by a private contractor and been signed off they legally become the responsibility of the waste contractor and then the Vissershok (Hh) landfill site respectively. In a sense these products could still be considered part of the supply chain, yet at present in Cape Town there is little onus on generators to assume any kind of extended responsibility for food wastes being recycled. As the system whereby food waste is condemned and then landfilled is a well functioning and legal system it is often the easiest route for companies with potentially hazardous food wastes[123]

7.3.5. Towards an integration of wastes in the supply chain

Until recently the retailer has tended to remove themselves from the management responsibility of their food wastes as much as possible. Before the presence of food bank, food waste was either sent to landfill via a waste transport company or sent back to

[119] Barnes, Cape Times. 02 April http://www.capetimes.co.za/residents-eating-expired-meat-1.1050959
[120] C. Barnes, Cape Times. 02 April http://www.capetimes.co.za/residents-eating-expired-meat-1.1050959
[121] Interview with environmental health professional
[122] Interview with environmental health professional
[123] Interview with waste management consultant

manufacturers and suppliers who assumed the responsibility for its management. This created an extremely fragmented approach to the management of food waste. Food waste emanating from the store is managed in a variety of different methods and sent to different destinations whereby no consolidated approach is adopted in the interests of sustainability.[124]Overall, under this system food waste is treated as an externality rather than integrated into the supply chain.

This approach to thinking about 'waste' is starting to change at the case study retailer and even since the start of this research project the retailer has begun to shift their thinking around their food waste streams. They are realizing that this fragmented approach to food waste management needs to be changed. While during the first set of interviews I had been informed that they had looked into bio digesters but decided it was too expensive, in a more recent interview with the same informant I was told that they are now relooking at digesters for their distribution centres, which could potentially generate energy for the workings of the centre. Although this shift in attention towards the resource potential of food wastes is not necessarily visible on a store level as of yet, on a management level the retailer is becoming aware of the resource potential of these food wastes. This interest appears to be part of a growing emphasis on resource efficiency and sustainability in the chain, and recognition that as a retailer they can take recycling of wastes even further. In this way recycling is not just a means to attaining a better corporate image but an economically efficient model. They are in the process of redesigning their supply chains in line with this, and exploring ways to integrate reverse logistics into their supply chains and thus see the resource potential in post consumed goods[125].

Over the past few years reverse logistics has become an increasingly popular area for retailers globally (Bernon and Cullen, 2007). It is described by Rogers and Tibben-Lembke (1998:30) as "the process of planning, implementing and controlling the efficient, cost effective flow of raw materials, finished goods from the point of consumption to the point of origin, for the purpose of recapturing value or proper disposal", Bernon and Cullen (2007) add to this that the products do not necessarily have to be returned to the point of origin but could be returned to any point of recovery within the supply chain. Within a reverse logistics system a

[124]Interview with supply chain expert.
[125] Meeting at retailer head office concerning reverse logistics

company comes to see their waste materials as potential resources for their own operations thus they find ways of integrating cyclical uses of resources.

One important development in the case study retailer's recent approach is the focus on distribution centres becoming central points in the operation of the supply chain. This means that in the future all products reaching the store will be distributed from a central distribution centre and none will be delivered straight to stores by suppliers. This development is vital in terms of sustainability and reverse logistics, as it will allow a central point of collection for waste materials. In this way retailers no longer merely have to pay recycling companies to take their recycling away but rather with the aid of a reverse logistics consultant and trader, can manage their own recycled material by sending it back from the store using their own empty trucks to their distribution centres where they then compact it and sell it to the recycling market. Thus they are able to control their waste and profit from it, as well as potentially re-use this waste in their supply chains for example plastics could be recycled to make refuse bags which they will use themselves or cardboard to manufacture their packaging[126].

At present the retailer have begun to focus on investigating reverse logistics operations for plastic and cardboard (for which there is an already established and growing recycling and reverse logistics market), but they are also considering placing bio digesters at these distribution centres in the future. As yet none have been implemented but this is a possibility they are looking into although they are unsure if this scale of investment is appropriate and whether it was their role to develop the actual infrastructure to manage the food waste themselves (most likely through a contacted company as most functions at DC's are contracted to specialist companies)[127] They are possibly a little hesitant as although Anaerobic Digestion (AD) is not a new technology, according to the company that builds the digesters in Cape Town, clients are not yet convinced of the feasibility of these operations as there are as yet few large scale digesters in operation in the city to view as examples. Up until recently it seems that retailers prefer to work with other companies whose core business it is to manage the waste in their own right. As with their relationship with the food bank, the system works well because the retailer does not have to be involved in the process, the partner company manages all the steps. This is not necessarily a bad thing because it is not

[126] Meeting at retailer head office concerning reverse logistics, with reverse logistics company
[127] interview with retailer sustainability expert

the core business of the retailer to manage waste and it is not there area of expertise. Yet with the new interest in reverse logistics and a more centralized approach this is starting to change. There is a growing awareness of the value of waste materials in the supply chain both in terms of profit and as raw materials.

In preparation for the shift towards sending wastes back to the DC, the retailer is beginning to change old contracts and relationships with their suppliers. They are starting to utilise what they call a 'Swell Allowance' in the contracts with their suppliers[128]. This means that instead of it being written into the contracts that suppliers need to remove wastes and surplus from the store themselves, suppliers essentially pay a fee to the retailer for the disposal (or recycling) of these items, which can then ultimately be carried out centrally through the retailers own systems. Waste management is still not the core activity of the retailer but through the collaboration with reverse logistics specialists they could be able to eventually manage their wastes as resources.

While supermarkets are working towards increasing their overall sustainable practice and integrate their supply chain operations, they do don't operate in a vacuum and their practices are shaped by the possibilities of sustainability within the wider context. As yet there does not exist an infrastructure or buoyant market for organic wastes recycling in the city. While reverse logistics companies already exist equipped to manage cardboard and plastics, it is more complex when it comes to food waste. In terms of cardboard and plastic, these in store drives they are supported by a wider system of recycling which has developed significantly in Cape Town (Engledow, 2010:172). Thus supermarkets are quite easily able to become part of this wider system of recycling especially in terms of cardboard and plastics which are generated in large scale at store level.

When it comes to food waste it appears to be much more complex. The food bank provides a vital service, by collecting fruit, vegetable and bread wastes. The retailer have also recently established a system for recycling used cooking oil for use in their truck fleets. But there appear to be fewer readily available option for other food wastes, especially the 'high risk' protein based foods no longer fit for human consumption. The stores sustainability manager explained that they have addressed what they can first in terms of recycling of other materials

[128] interview with retailers sustainability manger

and are now thinking about what to do with food waste. As the retailer sustainability he explained;

> *"We started with dry wastes as there are already solution for these-you know what you can do, but with food waste it is more complicated"*[129]

While food waste is so often considered a waste material, it has the potential to be regarded as a material of value rather than an externality. The retailer is increasingly aware of this and is beginning to consider how to extract this potential yet at present exactly how to turn inedible food waste into a resource, but at present such food waste within the retail chain still poses a significant problem. While from a sustainability and management point of view the retailer is concerned about the management of food waste, this has not yet translated into managing it as a resource on a store level. It appears that on a store level food waste is still regarded more as a nuisance than a resource or potential resource but that there is the will for and potential for change.

At present it appears that overall the system is managed efficiently in terms of efficiency and hygiene but not necessarily in the most environmentally sustainable ways. Yet it does appear that attitudes within the retail chain are shifting towards viewing waste materials as potentially valuable resources within the supply chain. This is definitely more developed in terms of plastics and cardboards, as food wastes are more complex for the retailer and within the context of Cape Town this is a very under-established area of recycling.

[129] Sustainability manager at the retailer

Chapter 8. Thinking about transition: potentials and barriers to operationalising supermarket food waste further as a resource in the city of Cape Town.

While retailers are powerful actors in global food systems, with the capacity to facilitate considerable change, they are also part of a wider, "complex socio-technical system" (Oosterveer 2009). Their actions, decisions and management processes are not isolated from the ideological, material and social realities of the society and global forces in which they exist. Changing their practices towards being more sustainable requires the internal will of the retailer to change, as well as a wider environment that supports this change. While the retailer under study is making an effort towards increasing the sustainability of its operations, it maintains a dialectical relationship with the broader socio-economic system in which it is situated. This chapter moves outward in scale to explore the transition of food waste to resource at a city scale, in order to gain an insight into the wider context and how this affects the supermarkets' actions.

8.1. Where can supermarkets' food wastes go in Cape Town?

This thesis has shown that for the case-study store there are sustainable systems in place for non-animal protein supermarket-food wastes that are still within their sell-by dates. These foods are sent to a food bank and redistributed, and where foods are damaged or expired they are used for animal feed. This system is very much in keeping with the Food Waste Hierarchy developed by the EPA as an ideal model for managing food wastes. Here the collaboration between the case-study store and a food-banking organisation has allowed for the creation of a system in which food waste is treated as a valuable resource. Yet, while this system works well for non-animal protein food wastes, it is much more complex for food wastes that do contain animal protein. Much of this latter food waste is still regarded as a potentially harmful waste and for the most part it is sent to landfill. Retailer and other food-waste generators are concerned about the possibility that these 'high-risk' wastes could cause harm to human health and seriously damage their corporate image. For this reason and because landfilling food wastes is a legally accepted and relatively cheap option in South Africa, at this point retailers and other food-waste generators often prefer to have such wastes condemned and sent to landfill rather than risk their mismanagement. Yet, given the right

systems, as illustrated in other cities around the world, these food wastes could potentially be a valuable resource in the city, either for the production of energy or even for the production of compost. Supermarkets around the world are beginning to realise the potential value of their food waste either for making compost – which can be sold in their stores or used to grow vegetable, in turn sold in their stores– or used for anaerobic digestion schemes (Goicochea, 2009; Majercak, 2002). In Cape Town, this is not yet the case.

Since 2006, the case-study retailer has greatly increased its recycling of dry materials in a drive to increase levels of sustainability within its supply chains. In 2007, a recycling pilot study was conducted in nine large stores in the country for the recycling of dry wastes (paper, cardboard, tins, polystyrene and plastics). After a great success, recycling systems have been implemented in all of their stores. As a result the case-study store currently recycles all of its paper, cardboard and plastic wastes, of which it produces large quantities daily, mostly from packaging needed to transport goods from suppliers to the store. The retailer's sustainability reports now dedicate a large section to reviewing its developments and commitments to sustainable waste-management, which includes three key areas of focus: retailer waste, reducing packaging and providing facilities for customer recycling. They have also recently implemented a zero-waste-to-landfill target[130]. While recycling has been a key area of focus for a number of years, the retailer's approach to recycling is changing. Until recently the retailer paid private contractors to collect and remove recyclable materials. This is now shifting towards a more systems-based approach through integrating reverse logistics into their supply chains[131]. Given the changes in prices of raw materials and the increasing market value of secondary materials, the retailer is aware of the value of its recyclable 'wastes' within their supply chains. It is interested in moving away from paying companies merely to remove these wastes and towards making a profit from the 'waste' materials, possibly feeding some of them back into its own supply chains. At present the retailer is in discussion with reverse-logistics companies and looking at ways to integrate reverse logistics into its systems. When it decides to go ahead, the retailer will be able to hire a reverse-logistics company to set up the infrastructure, manage the system, make sure that it receives the best rates for its 'wastes' and also help find ways to channel materials such as cardboards back

[130] This information was obtained from the stores sustainability manager, it is also available in the retailer's CSR reports but these have not been included so as to keep the retailer anonymous.
[131] Interview with sustainability manager at retailer.

into the retailer's own supply chain[132]. However while this is possible for dry recyclables, reverse-logistics companies are not as yet managing wet wastes such as food wastes.

Food wastes are somewhat different from dry recyclables like plastics and cardboard for which there already exist a robust, growing infrastructure and market for resale to the recycling industry as secondary materials. Supermarkets have fewer options available when it comes to food wastes. While dry recyclables are rapidly becoming regarded as valuable resources capable of generating a sizeable profit, food wastes in the city are still treated more as a waste than as a resource. Therefore, in Cape Town if the supermarket (or another large-scale generator) wishes to recycle its non-edible or 'high-risk' food wastes, at present it needs to develop the systems itself and cannot tap into an existent system.

The 'unlocking' of the 'resource potential' of food waste in the city is still far from being realised (Greben et al, 2009). For over a decade, garden wastes have been identified as priority wastes to be diverted from landfill. Composting of garden wastes was identified in the 1999 NWMS as a vital method of reducing waste to landfill. In 2004 the City of Cape Town conducted Environmental Impacts Assessments (EIAs) for the establishment of drop-off facilities for garden wastes and there are now eight such sites in the city (Engledow, 2007:57). While these sites accept garden waste, they do not accept high water-content (putrescible) organic wastes such as food wastes. Thus, in contrast to food wastes, there exists a more established system for gardens wastes.

The identification of garden waste as a priority waste to be diverted from landfill and the development of drop-off sites to facilitate this has greatly helped the transformation of garden wastes into a resource (although this, too, could be developed further, as argued by Greben and Oelosfe (2009) in their study on "unlocking the resource potential of organic waste" in South Africa). Yet food waste, which is not prioritised, has even further to go towards being recognised and used as a valuable resource. This chapter further explores this path and the barriers to the development of a robust system for the recycling of food wastes within the city.

[132] Notes taken from reverse logistics meeting at retailer.

Interviews conducted with various composting companies during this study have revealed that turning wastes into resources is a complex process. Entrepreneurs looking to harness the resource-potential of garden wastes struggle in South Africa to get projects off the ground due to a number of factors from legislative issues to finance limitations and immature markets[133]. From the viewpoint of transition theorists, this is an example of how new, greener technologies often have to battle against the dominant system to gain legitimacy and become competitive enough to compete with the dominant system. The dominant system in Cape Town at present is still far more geared towards landfilling food wastes. The following section explores the potentials for and barriers to operationalizing food waste as resource in Cape Town.

8.2. Towards a functioning, sustainable food waste-management system? Potentials and barriers to operationalizing food waste as a resource in Cape Town

The Constitution of South Africa Act 108 of 1996[134] outlines that local government is responsible for refuse removal, refuse dumps and solid-waste disposal (Engledow, 2007:10). Yet despite this obligation, "failing waste-management services are however a reality" in South Africa (Oelosfe and Godfrey, 2009:1). As outlined by Oelosfe and Godfrey (2009) and Engledow (2010) and explored in Chapter Five, municipalities such as the City of Cape Town face a number of challenges to effective and sustainable waste management. Such challenges include ever-growing waste volumes, expanding population and urban growth, lack of financial and human capital and capacity and a lack of detailed information on waste. Given this, municipalities cannot independently create a sustainable waste-management system for the city. As mentioned previously, this limitation is recognised in the NWMS 2010 (Draft) which states that the "measures set out in this [the] strategy cannot be undertaken without a collective approach to waste challenges and the involvement of a broad range of stakeholders in their implementation" (NWMS Draft, 2010:5). Under the current model of service delivery in South Africa, decentralisation of service delivery is recognised as a key method of ensuring service provision and also reducing the burden on the state (Miraftab, 2004). According to Swilling (2006), while the initial post-democratic period (1994-2004) was highlighted by a focus on liberalisation and privatisation, the current system of governance strongly emphasises the importance of "state-led public-sector investment"

[133] Interviews with managers of composting companies
[134] Section 1555(6)(a) and (7)

(Swilling, 2006: 25). Thus, although policy and legislation is centralised and controlled by the state, the state and thus municipalities rely on the role of the private sector to take up activities such as the collection of commercial waste and recycling of wastes in the city. While in theory this envisions a system that benefits both the state by removing its burden and the private sector by providing a space for growth[135], entrepreneurship and job creation, in reality the negotiation of this is complex. It appears that often the roles and responsibilities of different actors are unclear. As outlined in the literature review, innovations studies literature provides a useful way for thinking about the development of new, sustainable systems within already-existing systems and about the roles of different stakeholders and how these need to be aligned to bring about change. Through a review of policy and interviews with various stakeholders, this chapter explores the dynamics around operationalizing food waste as a resource in the city

During the process of the research, I interviewed the managers of six private composting companies and one company that make small- and medium-size bio-digesters in the city. Of the six composting companies, only two currently compost food waste, both on a small scale. One company also occasionally adds food waste to their compost when it can obtain some, but is not registered to use putrescible wastes such as food wastes. The bio-digestion company currently has a number of small-scale digesters operating in and surrounding the city, which use food wastes as a feedstock. One company, that currently only composts garden waste, is in the process of conducting an EIA in order to be allowed to upscale their facility to a large indoor composting facility suitable for composting high volumes of organic wastes including food wastes. Although these companies all operate quite differently and on different scales, the interviews provided an interesting set of observations about the experiences of private companies trying to operationalise organic wastes into a feasible and profitable resource in the city. Throughout the interviews, participants highlighted a series of difficulties they faced in establishing a successful system for the management of food wastes. While private companies have identified the resource potential of these wastes, it is difficult and complicated to establish the necessary systems to operationalise them.

This chapter draws on innovations-studies literature on transitions. As outlined in the literature review, it specifically makes use of ideas such as the multi-layer perspective and

[135]Interview with waste management expert at in the City of Cape Town.

Negro and Hekkert's (2008) seven core functions. It uses these theoretical tools as a basis for thinking about the transition of food waste towards being utilised as a resource in the context of Cape Town and for exploring what factors may be contributing to or undermining this transition. The chapter is divided into sections according to Negro and Hekkert's (2008) 'seven core functions' outlined in the literature review. Negro and Hekkert (2008) identify seven 'functions' which proved necessary in the success of the German bio-digestion industry. These include: entrepreneurial activities, knowledge development, knowledge diffusion through networks, guidance of search, market formation, resource mobilization, and advocacy coalition (creation of legitimacy/counteracting resistance to change). For the purpose of this thesis, these have proven useful conceptual tools for thinking about the factors helping or hindering change within a system.

The decision to adopt the seven core functions as a conceptual framework for this chapter, these are intended only as points of departure for thinking about the transition of food waste to resource within the specific context of Cape Town and as a point of comparison with the German case outlined by Negro and Hekkert (2008). Therefore, some functions have been grouped together in single sections.

8.2.1. Entrepreneurial activities, knowledge development and diffusion though networks.

In fuelling transitions, Negro and Hekkert (2008) speak of the importance of entrepreneurial activities, the development of knowledge on new systems and technologies and the diffusion of this knowledge through networks. 'Entrepreneurial activities' are vital for initiating change (Negro and Hekkert, 2008). Yet new niche technologies often have to compete against the dominant system and thus need to be sheltered and '"co-constructed' by stakeholders over time (Grin et al, 2010:22). Once knowledge is developed around the new technologies, this needs to disseminated and communicated. Negro and Hekkert (2008) speak of the diffusion of knowledge through networks as the "exchange and movement of information which sparks interest and boosts research into furthering these systems and technologies." Similarly, Grin et al (2010) speak of the importance of "the building of social networks that carry, nurture and develop novelties" (2010:22). New technologies and systems can remain at niche level for a long time and thus need support to help keep them afloat until they become part of the dominant regime (Grin et al, 2010:23). We can see the importance of this in the successful emergence of the German bio-digestion industry where, during the 1980s and 1990s many

pilot projects were set up for research purposes and as examples of the technology. These projects acted as points of knowledge development and, when successful, demonstrated the potential of such technologies. In Germany, the state (through the use of legislation and financing, discussed below) had a large role to play in facilitating the growth of entrepreneurs engaging in bio-digestion. In other parts of the world such as in India (Mumbai, Bangalore, Chennai and Pune) thousands of micro- to large-scale enterprises have been set up by entrepreneurs that compost green and food waste, largely facilitated there by the lack of regulation (Zubrugg et al, 2002).

In the UK, the government has played an important role in facilitating the development of knowledge on food waste and the techniques for recycling it. The UK Department for Environment Food and Rural Affairs (DEFRA) has collaborated with the Waste and Resources Action Program (WRAP), a non-profit organisation, to research and ultimately transform the treatment of wastes in England, Scotland, Wales and Northern Ireland[136]. This has helped to implement many awareness-raising initiatives such as the *Love Food Hate Waste* campaign aimed at getting consumers and large-scale food generators to rethink food waste[137]. The EU have extensively researched the options for bio wastes, including food waste, and this research is made accessible through various reports, such as a report on "the options to improve the management of bio-waste in the European Union" (EC, 2010). This has helped better understanding about new technologies and helped created a space for their development.

Similarly, in the US the Environmental Protection Agency (EPA) has identified food waste as a significant area of attention, constituting 34 million tons of waste annually, making it the third-largest municipal waste stream and a significant contributor to methane production[138]. Over the past decade the EPA has embarked on programs to raise awareness and involve companies and consumers in reducing, reusing and recycling food waste. It has targeted large food-waste generators such as supermarkets and produced guidelines for the establishment of food waste-recycling systems. It has commissioned much research on best-practice systems and help interested companies with vital information concerning what technologies to use and which companies to collaborate with. The Massachusetts EPA has even established a

[136] http://www.wrap.org.uk/index.html
[137] http://www.lovefoodhatewaste.com
[138] http://www.epa.gov/osw/conserve/materials/organics/food/fd-house.htm

supermarket composting handbook (which can be accessed via their website[139]) as a resource for retailers wanting to become more sustainable but also generate a profit from and reduce costs of landfilling these wastes[140]. Such initiatives have played vital roles in the transition of food waste to resource in these places.

In Cape Town, systems for recycling food wastes no longer suitable for human consumption are being developed both in the private sector and within academic institutions that are collaborating with the private sector and carrying out foundational research[141]. Academics are also working with the South African Department of Science and Technology to explore the opportunities for energy from waste in South Africa and how this can be bolstered (Greben and Oelofse, 2009). The Department of Environmental Health is currently looking into various alternative options for the organic fraction of municipal solid waste (OFMWS) such as sterilization, composting and 'pelletisation'. There is a possibility that it could eventually feed into the bio-solids energy-generation project currently being researched by the city. The department is primarily looking into using sewage sludge, abattoir wastes and farm waste such as chicken manure, which have been identified as extremely voluminous and problematic categories of waste in the city. This could potentially include condemned food wastes[142]. The Municipal Systems Act, Section 78(3) Assessment of Alternate Service Delivery Mechanisms for Solid Waste Management in Cape Town (2011) recommends the investigation of "waste-to-energy synergies in respect of organic solid waste and sewerage sludge" and that such projects should be initiated as soon as possible (CoCT, 2011:354). However, these projects are still in the exploration stage and may take a long time to set up. As yet, the city has not actively been involved in knowledge development and diffusion around turning food wastes into a resource through composting. Composting has proven successful for garden wastes and could be an important factor in helping to prioritise the transformation of food wastes to resources in the city. As explored in the next section, the presence of the government/municipality and its role in setting targets and agenda is vital in shaping change.

[139] Available on http://www.mass.gov/dep/recycle/reduce/smhandbk.pdf
[140] EPA Supermarket Composting Handbook available at http://www.mass.gov/dep/recycle/reduce/smhandbk.pdf
[141] Interview with engineer and Professor currently working with bio digestion technology in Cape Town.
[142] Interview with waste management expert and interview with environmental Health Professional

8.2.2. Guidance of Search

Negro and Hekkert (2008) speak about the importance of 'guidance of search', i.e. setting the agenda for the development of new sustainable technologies and systems. They explain that in Germany the government played a key role in setting this agenda through identifying bio-digestion as a key technology for recycling organic wastes and producing energy. In the US, where composting appears to be the preferred method of recycling food waste, the EPA[143] has been instrumental in guiding the interest in exploring and developing this area of technology, most notably in the states of Ohio, California and Massachusetts (Biocycle, 2005; Majercak, 2002). The state of Massachusetts has actively sought to "turn composting into a regular way of doing business" (Majercak, 2002:1). With the help of funding from the U.S Department of Agriculture, the Massachusetts DPA and the centre for Ecological Technology (CET), a program was launched in 1996 to assist technically the development of a robust composting industry which composts yard waste and food wastes (Majercak, 2002). Having identified the agriculture industry's need for compost, they aimed to connect farmers, waste haulers, and commercial waste generators such as supermarkets (Biocycle, 2005). Within three years this developed into a well-established composting system, which provided economic benefits for waste companies, farmers and waste generators by reducing the cost of landfilling (Majercak, 2002:1). In 2007 the State of California began looking into stimulating the composting of food wastes as there were few facilities able to do so (Calrecycle, 2009). In 2009, the city of San Francisco banned organic wastes from landfills and made compulsory the separating of organics through the Mandatory Recycling and Composting Ordinance (Attinger, 2011:36). Similarly, in in 2001 food waste was banned from entering landfills by the Food Waste Recycling Law (Ogushi and Kandlikar, 2007: 4504)

In South Africa, although food waste has not been prioritised, as illustrated above green wastes, abattoir wastes, farm wastes and sewage sludge have been identified as areas of concern and as wastes which, if diverted, have the potential to reduce greatly the amount of waste sent to landfill. This, coupled with the looming energy crisis, has caused the Cape Town Municipality to outline waste-to-energy projects as an area of exploration in their Assessment of Alternative Service Delivery Mechanisms (CoCT, 2011). This is an important development in guiding interest towards the recycling of organics, including inedible food

[143] See EPA website: http://www.epa.gov/epawaste/conserve/rrr/composting/index.htm

wastes, in the city. Yet, in order for these systems to materialise, these efforts will need to be aligned with many other favourable conditions and factors.

8.2.3. Financial, material and human resource mobilization

Negro and Hekkert (2008) refer to the importance of financial, material and human resources, all of which are necessary for the activation of a new technology (2008: 467).

In terms of material resources, by talking to various stakeholders this study has shown that food waste no longer suitable for human consumption exists in abundance in the city. Yet only qualitative accounts were available because there exist no formal studies on quantities of food waste in the city. Interviews with waste-management experts and waste-removal companies revealed that large amounts of food wastes from food manufacturers and retailers are dumped in Vissershok (Hh) landfill site daily. As most of the household waste in Cape Town is not separated, this is also a large source of food waste, which mostly ends up in general waste landfills.

From the interviews conducted with entrepreneurs, in terms of human resources there appear to be a number of companies with the know-how and motivation to develop food waste-recycling systems capable of recycling all types of food wastes including non-edible and animal-protein wastes (such as composting, anaerobic digestion systems and bokashi systems). The city has identified a lack of human capital/capacity (Engledow, 2010:174), which could be boosted by the participation of the private sector. To enable this, there is a need for further financial capital mobilisation, as private companies and entrepreneurs struggle to get funding for new projects.[144]

Financial capital is a major factor because setting up food-recycling systems is expensive[145]. While traditional open composting is relatively cheap to set up, it is not suitable for composting putrescible organic wastes such as food within the city. Studies have shown that composting can be used hygienically to break down almost any organic material (even birds infected with avian flu) but when dealing with food wastes on a large scale this needs to be carried out correctly (Senne et el, 1994). More noxious wastes such as sewerage sludge and

[144] Interviews with various waste companies interested in recycling food waste.
[145] Interview with organic waste recycling company.

protein or processed foods need closed/indoor composting systems[146]. This could be done in a variety of ways, including specially designed thick plastic windrow tunnels, concrete tunnels or more complex indoor composting warehouses (Spencer. 2007)[147]. Two of the companies interviewed were looking at up-scaling their facilities to covered systems that would be able to compost food wastes. However, both explained that finding the funds to do so was a difficult and lengthy process. Alternatively, anaerobic digesters are good for breaking down of all kinds of food wastes in an urban setting. All of these options require a large initial investment (Ayalon and Avinmelech, 2001).

Additional to the start-up costs of such facilities, South African waste policy requires that important but costly assessments need to be carried out before the establishment of waste storage and recycling activities including composting and anaerobic digestion facilities. In terms of NEMWA, for 'Category A' activities including small-scale general waste recycling facilities (which process 10 tonnes or more a month) a Basic Assessment must be conducted (NEMWA, 2008). For Category B activities a full Scoping and Environmental Impact Assessment must be carried out. Category B activities include hazardous waste management facilities as well as the establishment of facilities proposing to use technologies not previously used in the city. Thus Category B activities include those seen as potentially harmful to the environment and for which their environmental affects are not well established in a particular context or zoning area. An example would be the construction of a large anaerobic digestion plant in the city of Cape Town or a large-scale food waste-composting site[148]. For a small company, these assessments are costly processes. A Basic Environmental Assessment costs around R80, 000 and a full EIA as much as R150,000[149]. Small companies hoping to do this would need large amounts of start-up capital just to carry out the Basic Environmental Assessment or EIA, which might take up to two years. They would need an alternative source of income during the process. Also, as one informant explained, sometimes companies are reluctant to spend such large quantities on an EIA for developing infrastructure on land they do not own[150].

[146] Interview with composting expert
[147] Interview with various composting companies.
[148] See Final Scoping Report for Soil and More Reliance. Available on: http://rmsenviro.co.za/files/1321971314-Reliance_FSR_final_for_website.pdf
[149] Interview with owner of small composting company
[150] Interview with owner of small composting company.

In Cape Town, many entrepreneurs find that they cannot find financing for such projects at the outset from financial institutions. Banks are generally unwilling to finance projects that still needed to pass an EIA process.[151] Yet many companies don't have the initial capital available to do an EIA or even a Basic Assessment. As a result, many companies interviewed either purposefully kept their operations small or simply did not adhere to the legislation as they felt they had no choice but to circumvent it.[152] One company that decided to go the EIA route is still waiting, after two years, for the process to finish[153]. They have relied on external donors to fund this process and still do not have adequate funds to go ahead with construction even if the EIA is approved. Thus, it is often a struggle for entrepreneurs and small companies to get recycling projects off the ground.

The lack of financial capital is a major inhibitor to the development of infrastructure for the recycling of food and other organic and putrescible wastes. In cities around the world where successful systems have been developed by the private sector, they have been aided by vital financial arrangements supported by the government. In the UK, anaerobic digestion companies are entitled to grants to cover the costs of setting up the digestion plants. There are also a number of additional grants they can apply for (Stuart, 2009:235). This has greatly boosted the development of anaerobic digestion plants in Britain. Another vital financial arrangement for the bio-digestion industry in the EU is the 'Feed-In Tariff' system, whereby private alternative-energy producers can feed electricity into the grid and be paid for it. This proved instrumental in motivating waste-to-energy activities and increasing the allure of biomass digestion in Germany. It was believed that, in order to achieve targets to increase renewable energy production by 2010, a system was needed that would guarantee entrepreneurs a long-term and fair price for energy to make their investments worthwhile (Negro and Hekkert, 2008:473).

Although the role of 'feed-in tariffs' has been acknowledged in South Africa, their use is still uncertain. In 2009, guidelines were published around to a new set of feed-in tariffs for specific renewable energy production. These were published in two drafts, the first in March, but did not include anaerobic digestion technologies. In December 2009 the guidelines were expanded to include anaerobic digestion, in keeping with new policy that outlined that waste-

[151] Interview with waste-management consultant.
[152] Interview with owner of small composting company.
[153] Interview with EIA consultant for the composting company.

to-energy projects need to be supported[154] these guidelines were redefined but the rates previously stipulated were lowered. In an interview the owner of one of the bio-digestion companies bio-digestion explained that while these feed-in tariffs are "interesting" and could potentially be a motivation for further investment in the technology, at present he described the situation as still being "flaky". He is unsure whether it will ever be solidified and whether, when it is, the rates will high enough to ensure a profit can be made. He also expressed concern that the whole feed-in tariff scheme may become redundant as nothing is set yet.[155] According to this informant, the current uncertainty does not create a stable environment for investments in new alternative-energy technologies such as bio-digestion.

Another issue raised by the owner of the bio-digestion company was the fact that ESKOM is the purchasing authority for power fed in by renewables. Small companies interested in generating energy and feeding into the grid are concerned that this could create an uneven power dynamic between future sustainable-energy generators and ESKOM, which has a monopoly and will be able to set prices[156]. It was suggested in one interview that the government needs to play a greater role in supporting emerging renewable-energy-generating projects such as bio-digestion projects through a set budgetary allowance solely dedicated to buying reliable renewable energy.

Another factor entrepreneurs are wary of is the current government model of optimising service delivery through issuing tenders to one or a few companies. This issue was raised by two entrepreneurs who have an interest in bio-digestion and composting. Respondents expressed their uncertainty that the most efficient company was always chosen for the job. One composter complained that it is difficult for smaller companies to gain access to garden waste in the city as this material is owned by the municipality who have awarded the rights of use to two private companies who chip it. Other smaller companies that wish to utilise this material have to buy it from the tendered companies. This means that small companies cannot produce compost themselves at a competitive price because the input costs are too high. This gives the tendered company an advantage and does not ensure that the waste is used most appropriately. During interviews, smaller companies explained that the company with the largest percentage of rights to garden-waste material does not have adequate systems in place

[154] Interview with bio digestion engineer.
[155] Interview with bio-digestion company manager.
[156] Interview with manager of bio-digestion company.

to process the volumes they receive. This results in large amounts of green wastes, which could be used by smaller companies, going un-chipped and unused. Thus, the potential of these wastes as resources is not being fully exploited.

According to Hekkert et al (2008) resource mobilisation is a vital component of a successful transition. It is not enough for there to be organic matter existent to be recycled – it needs to be accessible, so systems need to be in place to make this possible. As outlined above, access to a steady flow of green wastes is not always easy for smaller companies to gain at a good price. According to one company which composts food waste on a small scale, clean sources of food waste are also hard to come by. To attain sorted food wastes they have designed their own bin and collection systems at hotels and restaurants. In many countries and cities around the world, including Japan, San Francisco and Vienna, it has become compulsory for both residences and businesses to separate wet organic wastes which can then be collected separately (Stuart, 2009; Majercak, 2002; Ogushi and Kandlikar, 2007). In Japan and San Francisco it is now illegal to send food wastes to landfill (Majercak, 2002; Ogushi and Kandlikar, 2007). In these cases, legislation has provided vital motivation for creating alternative processes to cope with diverted materials. Many companies interviewed expressed that it was difficult to gain access to clean sources of materials for composting, especially in terms of food wastes. One company that gathers food waste from hotels explained that hotels were good to work with because the food they threw away is generally not packaged and a system is easily enough set up to collect it. They had more difficulty when dealing with supermarkets as supermarkets were not willing to un-package wastes. The composting company was already operating on a tight budget and couldn't afford to employ people to sort and separate the waste.

There is a need for systems and policy to be developed that facilitate the transition towards compulsory sorting and separating of food wastes on residential, commercial and industrial scales. Given the classification of food wastes as general wastes, there is little onus on generators to channel it into recycling systems, so most ends up in landfills. Establishing compulsory separation of organics would go a long way towards facilitating the operationalization of food waste as a resource. It would not only create a legitimate and vital niche for gardens and food waste-recycling companies to exist, it would remove landfill as an option and would therefore channel some of the money spent on disposal into recycling

projects. This leads on to Negro and Hekkert's (2008) next function to consider: market formation.

8.2.4. Market formation

Negro and Hekkert (2008) explain that as new technologies need to start from scratch, they often find it hard to compete with already-'embedded' and extant technologies or systems. In order to get a head start, new technologies often need to be supported through incentives or tax breaks to attain a place in the market (Negro and Hekkert (2008), 2008: 467). At present in Cape Town there is no buoyant market for recycling food wastes. Low landfill costs mean that landfill is still a favoured option for most generators of food wastes (Greben and Oelosfe, 2009). Because landfilling food waste in hazardous landfills is an 'accepted' option for the disposal of food wastes, there is no onus on generators to recycle their food wastes. This does not help to establish a market for the recycling of food wastes.

As mentioned above, in many cities and countries the banning or taxation of food waste to landfill has helped greatly to establish an alterative recycling market. In San Francisco, banning all organics from landfill and making separation at source mandatory has helped boost the composting industry. Since 2001 Japan has instated the Law for Promotion of Recycling and Related Activities for the Treatment of Cyclical Food Resources, which is applicable to all companies who generate food waste. This has stimulated the anaerobic digestion industry, which is the favoured method due to limited amounts of urban space. This is part of a suite of laws aiming to integrate extended producer responsibility (EPR) into the Japanese system of managing waste (Ogushi and Kandlikar, 2007). While many countries have begun to integrate EPR into policies, Japan is among the first to do this for food waste.

In the UK, anaerobic digestion companies and composting companies are supported by a favourable tax regime, which now places additional taxes on food-waste generators that landfill their waste. To avoid this taxation, generators seek out recycling alternatives. They are also willing to pay for these services as it is cheaper than landfill. Two composting companies interviewed during this research explained that, in South Africa, food-waste generators are willing to give away food wastes (usually not protein-based wastes) but are generally unwilling to pay companies to collect food wastes and compost them, but they are willing to pay waste-removal companies to remove their mixed wastes. It is perhaps for this

reason that retailers are so willing to collaborate with food-banking companies as they take the food away free of charge.

Given the reasons above, access to markets appeared to be a struggle for all the composting companies interviewed. The largest of these companies explained that even they struggle to produce compost at a competitive price. In fact, they hardly sell their compost to food farmers as it is too expensive. As a result, most of the compost they sell goes to small-scale residential clients or developers for landscaping projects. This is very unfortunate, because both urban and city-peripheral food growers could benefit greatly from access to affordable compost. In the EU, compost production is regarded as vital for the agricultural industry and subsidized, making compost affordable to farmers[157]. In Massachusetts, as mentioned above, relationships have been fostered between organic-waste generators, waste companies and farmers to develop a cyclical system that has boosted the food waste-recycling industry and is beneficial to all participants (Majercak, 2002).

In Cape Town there is still a long way to go towards creating a robust market for recycled food waste. Although companies are becoming more interested in its potential as a resource, actualisation of this interest will likely require both help from policy and legislation to pressure large-scale generators to buy in to the system. Alternatively, given the current model of privatization in South Africa, it will require the government to make provisions for the financial support of these new technologies so that they can operate competitively in the marketplace.

8.2.5. Advocacy and creation of legitimacy

Negro and Hekkert (2008) refer to the need for 'creative destruction', i.e. the need to break down old systems and paradigms and "put new technology on the agenda" (2008:468). This can require the mobilization of interested parties to lobby and raise the profile of new technologies, ultimately working towards their legitimization. As demonstrated in this study, methods of recycling food wastes are still new and under established in the context of Cape Town. While some mixed composting, which includes food waste, has been carried out in the city at the Bellville South landfill site since the 1960s, this is still considered a poor-quality

[157] Interview with composting company.

and infeasible system. There is still a great deal of uncertainty as to where food waste-recycling activities could be located within the zoning of the city[158]. There is also an overlap between departments in terms of the responsibility for overseeing these EIAs on composting, as it crosses many administrative spheres. Thus, when EIAs are conducted, there is often considerable disagreement between government departments and other stakeholders as to where food waste-recycling activities such as composting or anaerobic digestion plants could be implemented, as they are not formerly recognised 'urban' activities and there exist no zoning criteria for them. In cases where they have been permitted, these activities have been labelled as "harmful" or "noxious" activities, which indicates how such activities are perceived within the city at present[159].

There is a need to legitimise the large-scale recycling of food waste, whether through composting, anaerobic digestion and small-scale options or combinations of all of these, as an acceptable and necessary practice in Cape Town. Waste generators, policy makers and entrepreneurs will need to work together to make this happen. Public awareness of the value of reframing food waste as a resource, and the potential it has to mitigate environmental problems, must be addressed at a number of levels. This process can only begin once the support of policy has been securely put in place.

In Cape Town, there have been a considerable number of cases in which civil society organizations and entrepreneurs have pressured government into thinking about making such policy changes or where they have contested changes to policy (Bond, 2002; Bond and Guliwe, 2003, Bond et el, 2003) This might be possible in relation to food-waste management. The role of civil society and entrepreneurs is vital in the process of advocating for better food-waste management and practices. At present, however, it appears that instead of collaborating to create unified submissions to government around specific needs, all of the potential contributors, including entrepreneurs and civil society organisations, are working in a highly fragmented manner, often against one another. During the interviews, tensions between various companies were often voiced. This tension appears to be amplified by the current municipal tendering process, whereby different private companies are forced to compete against one another for access to resources rather than working together to create the most sustainable and feasible solutions. One company owner explained that he did not wish

[158] Interview with waste-management consultant and EIA practitioner.
[159] Interview with waste-management consultant.

to put a negative spin on the system but that there was a "lack of transparency and clarity" and that companies with collective interests and causes were not working together. In order for companies and government to work together and not against each other, a more transparent and interactive dialogue needs to be established around the issue of food waste

While in Cape Town there are a number of regulations guiding the management of waste and the development of waste-handling and -recycling facilities, there are not many supporting the actual development of sustainable infrastructures. Infrastructure development of needs to be supported – otherwise legislation becomes disabling rather than enabling. Where food waste has been operationalized as a resource, this has often happened where legal and financial legislation around waste management support entrepreneurs trying to establish waste-management initiatives.

South Africa and Cape Town now have strong policy guiding the management of waste. This policy needs to be supported by enabling policy and funding; otherwise it merely restricts the operationalisation of wastes such as food wastes as resources. In India (in Mumbai, Pune, Chennai and Bangalore) the lack of regulation around waste has led to better resource-mobilisation of organics than in Cape Town, yet naturally this comes with health risks. In a developing context as in a more developed one, if strict regulations guiding waste management practices are implemented, support is needed so new initiatives can be developed responsibly and gain a foothold in a competitive environment. One waste-management expert suggested that the Cape Town local government could come up with a set of norms and standards for setting up composting facilities suitable for all organic wastes as well as for anaerobic digestion facilities. This could potentially do away with the expensive EIA's and mean only small scale assessments would be necessary. In this way he is suggesting that the city should invest in developing well-researched standard procedures that could be adopted by entrepreneurs, more affordably, quickly and efficiently. The EU has done this through their research into guidelines for composting (EC, 2010).

This exploration of the operationalization of food waste as a resource through Negro and Hekkert's (2008) seven core functions has revealed that in Cape Town, as in any place, transforming the utilisation of a waste to a resource is not a simple process. If the recycling of food waste is to be developed it needs to be supported, developed and legitimised so that it can become part of the dominant system. Transitions theory is useful for thinking about how

this might come about, as it helps to consider the dynamics that foster socio-technical change. Although this body of theory has mostly been applied in the northern hemisphere, it is also applicable in the South as change from one system to another is always a multifaceted process.

Chapter 9. Conclusion; supermarket food waste from waste to resource, a system in transition

Today we are faced with not just "historically unprecedented" volumes of waste generation, but also the dwindling of global resources (Fagan, 2003:69). As social waste theorists have pointed out since the Industrial Revolution the emergent "logic of increasing production and increasing consumption" has created the "by-product" of waste and the "environmental externality of wasting" (Fagan, 2003:69). This "throwaway culture" replaced a previous "waste not want not approach" in which waste was minimised and recycled as much as possible. Waste in the present time is a topic of vital environmental importance. More integrated waste management practices have the potential not just to mitigate harmful effects of waste on the environment but the ability to harness the resource potential of wastes. As Gaillochet (2009) explains "We must realise that part of our future depends on this waste" (2009:7). Since the 1990s the rhetoric of sustainable development and the idea of Integrated Waste Management has increased greatly. The popularity of the Waste Management Hierarchy, adopted globally has provided a vision for the sustainable and thus cyclical treatment of wastes as resources. Many methods and technologies have been developed for the minimisation of wastes and the recycling of different materials. However as Innovations Studies literature explains, while alternate methods and technologies may already exist their integration into and success within systems formerly geared towards discarding wastes is often a complex process. 'Waste regimes' are made up of complex socio-technical arrangements, which shape how waste is treated and what is valued or discarded (Gille, 2010).

This thesis explored the current state of supermarket food waste management in Cape Town and the transition of this food waste towards being utilised as valuable resources in the city. It examined how the case study supermarket managed their food wastes at store level and how this related to the wider context of waste and food waste management in the city. Using a multi-scalar approach it explored the current systems of food wastes management and the possibilities for as well as barriers to managing food waste more sustainably within and beyond the current system. By way of conclusion, this section synthesises and reflects upon the findings of this thesis.

While minimisation is the first principle in the Food Waste Management Hierarchy, this thesis found that it is challenging for supermarkets to minimise food waste completely within the current food system which is geared towards catering to and generating a climate of consumerism. Store managers are conscious of the need to keep shelves full and stocked with a variety of goods at all times. Retailers such as the case study store do try and minimise wastage in various ways. As explained by the stores' manager, food departmental managers monitor the levels of wastage of different products and implement measures to try and reduce wastage and damage to foods. This could include changing the packaging or the way food is presented on the shelves, or using records of waste to better predict the stock quantities needed. Despite these measures wastage still wastage still occurs. It is not an easy task forecasting the exact quantities of stock needed. As the case-study store manager explained "it is not a science" and often they get forecasting wrong. Sometimes a mere change in the weather can change what customers choose to buy (Start, 2009). Retailers generally prefer to have waste than run out of goods that could lead to a potential loss in sales, customer dissatisfaction and an eventual loss of clients. To prevent running a loss on wasted items, the cost of wasted items is built into the cost of the stock. Unless customer expectations are to change it is unlikely that food wastage will ever diminish completely. Thus it is important that there are options available for the redistribution and recycling of food wastes generated in this system.

This thesis found that different types of supermarket food waste are managed in various ways depending on the characteristics of the food. Some are managed sustainably while others are not. Vegetable, fruit and bread wastes still suitable for human consumption (having exceeded their sell-by dates but not their use-by dates) are relatively well utilised as a resource. These are redistributed through a food banking system. This food banking system works closely with the case study retailer and with most of the countries' large retailers. This fraction of food 'waste' is donated via the food banking system to charities and feeding schemes. If this food is damaged or passes its sell-by date during the food banks handling of it, it is collected at the food bank's distribution centre where farmers collect it for use as animal feed. This system replicates the Food Waste Management Hierarchy, whereby food wastes are firstly donated to charities and feeding schemes and then if not suitable for this, but suitable for feeding animals it is used for that purpose. Therefore this study found that given the collaboration with the food bank company-fruit, vegetables and bread wastes produced in the store are managed in a sustainable manner.

However, as well as the food-banking system functions it does not include wastes that contain animal protein or dairy. These food wastes are seen by the retailer as potentially hazardous to human health (if managed incorrectly) and too risky to re-distribute. Sickness caused by re-distributed food could tarnish their brand name and reputation. In this way, while the supermarket is actively involved in furthering the sustainability of their operations with a big focus on waste management, the recycling of food waste that contains any animal protein is still a big challenge for them. In recent years while they have significantly increased the recycling of fruit, vegetable and bread waste food banking, begun recycling cooking oil for their transport fleets and implemented systems for recycling of dry wastes such as plastic and paper they are still sending large amounts of animal protein foods to landfill on a daily basis. As yet there is no system for the recycling of sell-by dated or damaged animal protein foods. These wastes are either compacted as mixed waste and sent to landfill or condemned by the Department of Environmental Health and sent to Vissershok Hazardous landfill site. Much of this waste is also returned to manufacturers, of which a large amount ends up being sent to landfill where it breaks down, causing the production of methane- contributing to global warming, and leachate-which can contaminate ground water. In Cape Town such wastes sent to landfill also pose considerable risks to human health due to people salvaging them and consuming them or re-selling them.

This study illustrated that at present there exist very few large-scale options for the management of food wastes in the city. In some cities supermarkets can feed all of their food wastes into already existing bio-digestion or composting network. An interesting example in America is the Massachusetts supermarket composting scheme whereby the Massachusetts Environmental Protection Agency has collaborated with private companies and supermarkets to establish a food waste recycling scheme (Goichocea, 2009). Yet a supermarket in Cape Town wishing to recycle all of their food wastes would have to implement a recycling system themselves in order to do so. While the case study retailer looked at setting up a pilot anaerobic digestion system some years ago, at the time they decided that it was not part of their core business and would be too costly. They were also concerned about the feasibility of the technology as there are few examples in South Africa of large-scale commercial bio digester projects in operation. More recently the retailer have begun reconsidering setting up anaerobic digestion plants at their new Distribution Centres in efforts to reduce waste to landfill and because of the potential value of this waste for energy generation. Yet while

retailers such as the case study company may choose to implement their own systems, there is no onus on retailers or other members of the food industry to recycle their food wastes, nor a robust system for recycling it in Cape Town. Given the lack of available options for recycling food wastes and the relatively low cost of landfilling it is likely that landfilling will continue to be the primary choice until this changes. The supermarket does not exist in a vacuum but is part of a wider set of ideas, infrastructures and practices. Currently in Cape Town food waste considered non-edible is largely treated in a way that neither acknowledges its harmful impact on the environment (once sent to landfill), nor its value as a resource. While some small-scale (niche level) operations do exist in the city for recycling food wastes such as through composting or anaerobic digestion a number of barriers were identified which inhibit this development of these projects.

Policy and practice concerning Integrated Waste Management has increased greatly over the past decade in South Africa and in Cape Town. In Cape Town local government has greatly enhanced policy measures concerning sustainable waste management such as through the 2006 City of Cape Town Integrated Waste Management Policy, The 2009 City of Cape Town Integrated Waste Management By-Law and Yearly Integrated Development Plans. These policies recognise that without serious efforts to reduce waste to landfill the city will soon be facing a huge environmental and health crisis (CoCTIWMP, 2006). The City is very aware of the landfill crisis and the fact that landfills are under enormous pressure and are expected to reach their capacity by 2012 (Coetzee, 2012). In recent years there have been great advancements in establishing dry material recycling both within government and the private sector, there is also a large informal recycling sector that has been established (Engledow, 2010). There have been efforts to divert certain 'bulky' wastes from landfill. Garden waste has been identified as a priority waste to be diverted from landfill due to its voluminous nature as well as its potential as a resource. Garden waste drop-off sites have been established throughout the city for this waste. These sites are run by tendered companies that chip and compost this material themselves or sell it to smaller companies for composting. Yet while these sites have greatly increased the volumes of green waste being recycled they do not accept putrescible-and therefore food wastes.

Many countries and cities in the world have now banned all organics from landfill such as Japan and San Francisco (Ogushi and Kandlikar, 2007; Majercak. 2002). Recently it has emerged that there are tentative plans to ban all organics from landfill in Cape Town through

a pending Landfill Criteria Policy Document[160]. If this is to happen there will need to be serious efforts made to establish alternatives to landfill for food wastes, as presently there are simply not enough places for such waste to go on a large scale. Some small composting sites, worm farms and anaerobic digesters which compost food waste do exist in the city but none on a large scale- certainly not large enough to cope with large waste volumes such as produced by supermarkets or food manufacturers. While large amounts of food wastes from both the commercial sector and residential sector are sent to landfill, food waste is not yet prioritised in the City of Cape Town. Food waste is considered a mere fraction of general waste and not categorised in its own right[161]. There are also no available figures concerning volumes of food waste produced in the city, which reflects the neglect of this category of waste. While garden waste is a specified category in policy food waste is not mentioned (for example see NEMWA 2008; CoCTIWM By-Law, 2009). Generators of food waste are not required to manage this waste sustainably. Landfilling food waste is currently a recognised and legal method of disposing of food waste in Cape Town. It is also a cheap option as landfill costs are extremely low, despite the looming landfill crisis. While health and safety guidelines are in place for food waste, there are no equally weighted environmental guidelines determining how food waste is dealt with and so most is sent to landfill regardless of its negative environmental impact.

After exploring supermarket food waste at a store level, and the factors affecting the stores decisions in terms of food waste, the thesis worked outwards into an exploration the wider food waste management systems in the city. Chapter 7 focused on why food waste is not being utilised further in the city despite the hazards it causes and its potential as a resource.The chapter explored the potentials and barriers to operationalizing food waste as a resource in the city using Innovations Systems literature and specifically Negro and Hekkert's (2008) 'seven core functions' as a starting point for thinking about the 'ingredients' needed to boost a transition from waste to resource. Negro and Hekkert's (2008) study explores the successful development of the German bio-digestion industry and the factors or 'functions' which helped enable this success. This study was valuable for thinking about the dimensions affecting the success of an organic waste recycling system in Cape

[160] Interview with department of solid waste management employee.
[161] Although no figures exist for food wastes generated in the city studies estimated that 40 to 60 percent of the domestic waste stream is composed of organic waste of which a large proportion is likely to consist of food waste (Ekelund and Nyström, 2007; Harma et al, 2009; Engledow, 2007:37). Reflecting on studies else where it is likely that the food industry greatly increases the amount of food sent to landfill, overall (Stuart, 2009; Fehr et al, 2002; Hyde et al).

Town capable of diverting all organic materials from landfill. What became clear is that while there exist many small-scale companies and entrepreneurs interested in the potential of food waste as a resource it is difficult given a number of factors to get these projects off the ground so that they can develop into large scale robust systems. Reasons for this included policy and legislative barriers, access to finance, lack of legitimacy of technology, lack of access to separated clean organic waste stream, and the absence of markets and support from stakeholders.

Entrepreneurial activities do exist and knowledge is being developed by private companies, engineers and researchers in academic institutions, yet this is not yet being translated into large scale action and the development of infrastructure. As Negro and Hekkert (2008) explain the presence of entrepreneurs, the development of knowledge and the diffusion of this knowledge are vital in bringing about the success for new technologies, yet this is not enough. While these niche technologies do exist in Cape Town they have little support from the government as yet. In countries where food waste recycling systems have become successful, such as in Germany and in the United States the government has played an important part in directing and funding research towards the development of these activities. This has created a better understanding of new technologies, boosted their legitimacy and thus created a space for their growth. Negro and Hekkert speak about the importance of "guidance of search"[162], thus the setting of an agenda to explore a certain prioritised activity. They illustrate how often a technology such as bio digestion is established by government and incorporated into policy as a priority. In this way it becomes seen as a legitimate area of interest and investment by entrepreneurs and but investors. In South Africa waste-to-energy projects have been earmarked as important projects to be investigated within the government's (2011) draft report: Assessment of Alternate Service Delivery Mechanisms (CoCT, 2011). Yet the identification of the importance of such projects is not enough unless there are the financial support and incentives to support this.

Negro and Hekkert (2008) speak of the importance of "financial resource mobilisation". Here they refer to available and incentives and financial grants and investments for the development of new technologies. For example in the EU grants are available for the start up

[162] Guidance of search refers to the setting of criteria or objectives for example by the government to focus on the development of a particular technology or area of technology for example waste to energy projects. This can help gather 'momentum' and interest (Hekkert et al, 2008: 467).

of bio digestion plants and composting is subsidised. Bio digestion plants are supported by standardised feed-in-tariffs dedicated to the buying of renewable energy such as produced by bio digesters. These supportive financial arrangements are vital for the growth of new technologies that often cannot compete initially with older less sustainable but more established technologies. Thus financial support helps the development of a market for new technologies and their products. From interviews with entrepreneurs it was clear that lack of financial resources is a major inhibiting factor to the success and growth of technologies in South Africa and in Cape Town. Niche level companies struggle to gain access to funding and access to markets. National policy stipulates that the establishment new recycling activities need to undergo either a Basic Assessment or Scoping and EIA processes depending on the proposed activity. These assessments are costly processes and often investors and banks are unwilling to finance new technologies that have not yet passed an environmental assessment. In addition to this, environmental assessments are a lengthy procedure sometimes taking up to two years. During this process small companies are unable to make profit and can struggle to keep going. In terms of the financial feasibility of bio digestion projects, companies are also hesitant to invest as yet in South Africa because while feed in tariffs are promised, they have not yet been set. From the interviews it was clear that companies are unsure when and if tariffs will be set in the near future and if they are if they will be set at a rate that makes their projects financially viable. This unstable financial environment makes investment in new technologies difficult.

Another vital factor for the growth of organics and food waste recycling activities is the access to materials to recycle. The specified diversion of these materials from landfill is a vital part of operationalising them as a resource. In many countries and cities compulsory sorting of wet wastes and in some banning of organics from landfill has greatly boosted the organics recycling industries which become a vital facet in waste management systems. This can be seen in Japan and in Cities in the US such as San Francisco and Ohio (Stuart, 2009; Majercak, 2002; Ogushi and Kandlikar, 2007). In the EU the EU landfill directive is phasing organic wastes out of landfills (Stuart, 2009). In Cape Town the municipality owns garden all wastes. While sources of garden wastes are available through drop-off sites, the rights to this resource is contacted to two large composting companies who then sell it on to smaller companies. This creates an unfair advantage and makes access to organic wastes difficult for small companies, and often too expensive to produce a competitively price final compost product. Additionally the lack of legislation specifying the separation of residential or

commercial organic wastes means that most is sent as mixed waste to landfill and is difficult to access for companies. Some companies have set up their own collection bin systems with hotels and restaurants that provide them with clean sources of food wastes. Yet this does not yield large quantities and could be greatly enhanced.

Lastly Negro and Hekkert speak of the importance of "Advocacy and creation of legitimacy". These are important social dimensions for the success of new technologies and systems. They speak of the power of "creative destruction" as a process whereby old paradigms are broken down and replaced but better for sustainable options (Negro and Hekkert, 2008:468). This requires the profile of new technologies to be raised through creating awareness and a movement of people committed to their success. The change of attitude towards the recycling of putrescible wastes on a large scale in urban areas is evidently important in Cape Town. From research conducted during this thesis it was clear that composting and bio digestion of food wastes –especially animal protein containing wastes are considered an ambiguous activity in the urban context. It is not necessarily accepted or trusted as a feasible urban activity despite is use elsewhere in the world. Where such activities have been permitted in the City's zoning scheme, they have been labelled 'noxious' activities, thus illustrating the lack of legitimacy they are given as safe and vital activities. This lack of legitimacy will need to be addressed through the collective work of various stakeholders in the city. In order to do this tension between companies (interested in the resource potential of food and other organic wastes) will have to be resolved so that they can work together towards the common cause of creating a space for the growth of such technologies.

The Constitution of South Africa Act 108 of 1996 assigns local government the responsibility for waste management. Yet it is unlikely that municipalities can address the challenges of providing basic service delivery and creating more sustainable waste management systems alone. As stated in the National Waste Management Strategy 2010 (Draft) Integrated Waste Management objectives "cannot be undertaken without a collective approach to waste challenges and the involvement of a broad range of stakeholders in their implementation" (NWMS Draft, 2010:5). In terms of supermarket food waste, there is a need for further recognition of the importance of sustainable food waste management in the city. While it is currently an underutilised resource there is great scope for its' transition towards being used as a valuable resource. However as illustrated within the Innovation Systems literature and reiterated in this research, transition towards sustainability is complex process. The

development of more sustainable systems for recycling food wastes will require the alignment of multiple layers of change. It will require that all stakeholders such as government, entrepreneurs, the private sector and civil society collaborate in creating a space for new more sustainable systems, which recognise the resource potential of food waste.

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