

Today's Perfect - Tomorrow's Standard

The Role of Consumers
and
The Limits of Policy in Recycling

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Cover: Just as the traditional recycling symbol of three arrows giving chase to each other form a sort of Ouroboros, so too does this illustration from issue nr 14:1896 of the Jugend Magazine by Otto Eckmann (1865 – 1902) represent, to me, the ever cyclic and dynamic nature of the interplay between policy, implementation and citizens.

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Abstract

In this study the mechanisms influencing recycling rates around the system maximum are deliberated. On the one hand, Policies, System design and how Citizens understand the two aforementioned are pitted against each other. This is done in a setting where individual rewards from action are in turn set against the values of the community and the compliance measures/social marketing of recycling companies and policy makers. This is the dynamic setting of this dissertation.

In the past much research into recycling has been focused on how to get recycling started. Sweden is in a bit of a different position with recycling levels often being very high in an international comparison. This means other challenges face citizens and policy makers alike. The determinants influencing recycling rates are studied and compared to contemporary research.

Policy makers and social marketers that wish to see a system used to its fullest need to understand the determinants that remain to be influenced near the system optimum. The studied recycling system points to a trichotomy of determinants influencing recycling rates. Social or public marketing being one part; the community's understanding of recycling being a second part, and individual knowledge and understanding forming the third. Successive elimination of potential determinants in a Zwicky box, using statistical analysis, indicates that strengthening individual autonomy and ability to participate efficiently remains as the key to further and sustainable development in the field.

The study suggests compliance rates can still be improved upon, even when recycling rates are in excess of 80%, although methods might have to change. Instead of an oft used emphasis on coercive compliance and "scare tactics", a careful study and propagation of the recycling techniques developed by the many efficient citizens is pivotal. In addition, further improvements in terms of recycling facilitation may offer policy makers a sustainable path to near system optimal recycling rates.

Keywords: Recycling, Social marketing, Public marketing, Communitarianism, Austrian Economics, Praxeology, Decision making, Symbolic Regression, Compliance, Self Determination Theory, SDT.

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Dedication

To my parents, Birgitta & Roland and their unconditional support and belief in me and my prowess – you are forever the yardstick to which I aspire! To my supervisors Bo Öhlmér & Tage Klingberg. Tage, a true “brother in arms” – with whom I have fought many a battle to investigate and make sense of the world around us. With whom I have reasoned, co-read and written so much on so varied a topic – ever with the same warmth and acute intellectual wit. You are singular, you are unique, you are a concept onto its own! Bo, a compass incarnate for my academic journey. No matter how wild the ideas coming from Gävle were, you could always harness them and channel them into a suitable format. No bureaucratic labyrinth was ever made that could resist your gaze! To all the wonderful students whose nimble feet and minds helped gather data when our funds had run out. To all the environmentally friendly citizens of the Gävle region, who have “endured” my surveys and investigations with such composure! May our combined efforts resolve and make recycling a non-issue!

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1 The problem at hand – approaching the uncontrollable

Things alter for the worse spontaneously, if they be not altered for the better designedly. Francis Bacon (1561-1626)

In this chapter I outline the factors that lead me into this particular field of research, the research and societal problems that interest me and the scope of my undertaking. While attempting to make a first preliminary definition of the problem I also position it against other potential problems and contrast it to its diametrical opposites.

1.1 Background

I entered into this PhD project with my experiences from the VAIE-project at LTH in the years 1998-1999 fresh in mind. Our studies there had shown that a public policy program with the best of intentions and prerequisites could still fail to attract participants and compliance. The so called EKO-energy program which we studied was built upon voluntary energy savings in the industry on an ethical basis (Kågström, 2000, p. 75).

Among many interesting conclusions from that study was the debate on whether to focus on the avant- or arriere-garde of the participants to push compliance upwards. At the EU level it was more common to put an effort into helping the laggards to comply with the minimum level, whereas the Swedish system focussed on the vanguard to inspire the others to comply. As a consequence the Swedish system overlooked the laggards implicitly hoping that they be faced out of the market in due time (Helby, 2002, p. 151).

My work on the VAIE-project was also a basis for the evaluation of the EU Mål 4 program in the Gävleborg region that I was a part of in 2000. Again

the focus was on the vanguard of a public policy program and what they might attain and how the vanguard might pave the way for late comers.

All of this was influential in formulating a number of persistent research questions in my interest. Issues concerning participation in public policy programs, how to raise participation and compliance without becoming intrusive or forcing and while maintaining individual integrity. This had risen as an increasingly interesting field of business research, with a particular focus on public sector marketing e.g. (Moller et al., 2006; Rose & Fogarty, 2006; Webster, 2008) and consumer research e.g. (Fennis et al., 2005; Herzog, 2008). In addition, questions concerning what manner of efforts might help increase the above, without negative side effects to the individual (Moller et al., 2006) as the policy program develops and matures are attracting increasing attention in business research. It was clear early on that wherever possible focus would do well to be shifted from the system level to the level of the individual policy maker or participant. As shown by several authors (Bratt, 1999a; Barr, 2004; Hobson, 2004) this in turn meant that these effects could be studied in the public in general as well and not only at the level of bureaucrats and technicians. By including the individual level it was even more clear that the content of the policy program, as well as its rewards, sanctions, public backing, social- or peer pressure would be interesting to link into one and the same study. It also meant that a greater concern had to be taken to account for dynamic effects (Barr et al., 2003) of actual humans interacting and constantly interpreting the policy studied. Different incentives and sanctions seemed to induce different effects depending on how large and which fraction of the potential companies/organisations/individuals was involved in the policy program.

Then the opportunity to study the recycling system in the Gästrik-region arose. Here I found an applied policy program exhibiting many of the characteristics that I had already studied. For example there was a general consensus on the overall goals of the program even though the means and particulars was still a matter of healthy debate. To complicate matters it was and still is difficult to oppose or even object to the basic rationale of the policy – getting rid of waste in a rational and sanitary way is hard to object to. To further complicate matters the issue was also somewhat politicised with precepts that contained both altruistic, educational and attitude changing ambitions of a varying intensity. The latter contributes to the issue of recycling to have a character of perpetual conflict between societal and individual needs. This too has been studied as a complicating factor of social marketing (Darby & Obara, 2005; Brennan & Binney, 2008). Compliance with the system ranged from passive in-name-only compliance to full

blown pro-active participation. At the opposite range of the recycling system, at its helm we had everything from devoted bureaucrats and enthusiasts to the “zealots” and “Pharisees” of the system. To further entice our interest in the case the leadership layer had just begun questioning its technical solutions, emphasis and methods – in turn leading away from an emphasis on mild cajoling towards stressing attitudinal change.

It was in this complicated situation we started our research. Initially we decided to tackle two of the many aspects of the problem. The first emanated from the recycling company’s observation that behaviours, recycling rates and compliance differed between different kinds of housing types. So we compared housing estates, as well as self-owned flats and villas. The idea was to gain a fundamental understanding of how different demographic factors influenced recycling behaviours.

The other aspect we decided to start with dealt with the reasons compelling individuals to recycle. In addition, we decided to add questions regarding knowledge about the established recycling system as well as self-assessment of the individual’s knowledge of the system. Our main approach at this time was to investigate how citizens recycle and to see how knowledge influences this.

1.2 The problem in general

In essence this it could be said that this thesis deals with how the individual could be made to do what society wants. That however would be gravely unjust, if anything this thesis shows the limits of coercion and public power to force political will. To the extent a policy maker takes note of my writings it should be that softer measures combined with proper knowledge of those governed will get you much further than rules and sanctions.

The studies that led me into this field (VAIE and Mål4) had in common that they both concerned public policy where both parties wanted to participate in what the politicians had conceived. Both parties also stood to gain from cooperation on the targets set, certainly using some measures to “honey coat” the deal, but it was still largely voluntary to participate¹ The opposite, where one party does what is negative to society but positive

¹ Case number 2 in the matrix.

to themselves, like speeding, is also interesting but at the other end of the scale.²

A rough division just to point towards the extremes might look something like this:³

Table 1 Actions positive/negative to the individual/society – a distinction:

	Negative to Society	Positive to society
Positive to the individual	1. Speeding, running a stop sign	2. Vaccination
Negative to the individual	3. Driving on the wrong side of the road	4. Recycling

Expressed at little differently we may ask: "How do you get X to do what society wants?" or "How do you get X not to do what society does not want X to do? Although this may seem to be two different ways of asking the same question, this is not a matter of simply reducing the double negation. Instead we see the dynamic perspective of the issue at hand. Stopping non-recycling and encouraging pro-active recycling are two very different things.

While many will argue that recycling should, or is already considered to be a common good in which everyone could ascribe to, that remains to be seen as increasing proportions of the populace are drawn into the scheme. Because as long as the societal program contains no demands as to how many or who should participate, there is little or no problem finding interested parties to start off. While as system is still largely voluntary it also little or no problem to design measures to increase interest. That is only a matter of improving or "sugaring" the incentive structure or reinforce the perception that this is for the good of both parties. Besides the VAIE and Mål4 programs mentioned, such measures as vaccination, driving on the right side of the road etc can be put into this group of measures.

This is still well within the limits of the types of policy normally studied. The real challenge is two-fold. First removing the individual gains and then finding such a system where, despite removed obvious individual gains as good as everyone still complies. In this case we have moved away from policy where individuals simply group together to agree on common rules

² Case number 1 in the matrix.

³ The examples should be seen as just that – examples – I am fully aware that a vaccination might theoretically go wrong and induce illness in the individual just as I am aware that recycling is enjoyed by many. Its just that in comparison to the alternatives, not being vaccinated or disposing of waste unsorted, can be seen as predominantly better or worse.

that ease cohabitation, or where experts offer solutions to problems that are easily, readily and widely accepted by the public. We have moved into the realm of power politics, where the public is to be made to bend to the will of the policy makers. This in itself is nothing new, and bending the public's will in accordance with the elected majority's will has been the common norm of things at least since the dawn of representative democracy. Once the initial resistance or inertia has been overcome, or once the public has been accustomed to the issue, it changes. Put somewhat more softly it has to do with making the individual citizen do more than is demanded of her. To make her do that little extra that society strives to attain but cannot perhaps demand, and which does little or nothing for the gain of the individual.

In effect: How do you make X do what X does not really want to do? Or: How do you get X to do more than what is really necessary? Or: How do you make X do more of something X already does a lot of and doesn't care for?

It is these latter questions that are at the core of my investigation. The Swedish recycling system is already established among broad swaths of the populace and has at least an implicit support since it does solve the immediate waste disposal problem in a household. However, waste management which goes beyond the immediate need for disposal of refuse is problematic. Especially as the previously, or in many other countries still, present economic incentive of recycling is not present in Sweden or indeed many other developed countries. Selling ones waste is no longer an option, instead the household has to pay to rid itself of its by-products. This means that direct reward and incentive structure otherwise present is missing and incentives to participate have to be otherwise modelled. From the perspective of the individual recycler however what remains and is directly evident is the mandatory fee that has to be paid for the proper environmental disposal of the waste. Socially a good solution perhaps but from a private perspective less easy to accept as every refinement of the recycling system so far has meant an increase in costs of tangible or otherwise for the individual citizen. Add to this that for example the problem of public littering is still not even close to being under control in spite of all recycling measures taken, something many take as the most tangible measure of how well the recycling system functions.⁴ Thus, at the

⁴ Of course, given how little trash it takes to litter a public place, it would require recycling rates very close to 100% to come to terms with this measure of how well the system works.

individual level there is very little to indicate that the recycling system does indeed work and that their efforts pay off.

It is clear that when the required compliance level causes even the most ardent recycler to fail on occasion, and many thousands of recyclers are urged to better themselves even further we can no longer regard recyclers as a unified group, we need to see to what motivates single key individuals.

Add to this that the more each and everyone does it becomes ever more perplexing when the tangible and visible signs of success are not there. Or to put it more succinctly, the early recycling efforts are the ones that give the most visible effect to all concerned. Marginal effects come in to play early on, are noticeable especially in the mental accounting of the citizens. As recycling efforts progress and reach ever higher recycling levels the benefits of doing more dwindle and are increasingly questioned and measured against competing activities. Recycling is no longer merely the disposal of smelly or unwanted by-products, it is become a purpose all of its own. These are the dynamics of recycling at work...

As the Swedish recycling system developed and refined the problems of reaching set goals have increased. Every new adjustment of the system is met with increasing difficulties to get through to the end consumer. This in spite of the adjustments often being intended to ease the recycling of the individual. The number of component chores included in the recycling system also tend to increase, although they are increased with the best of intentions. In addition, increases or changes to the number of waste fractions or collection systems used no longer generate the kind of results in terms of recycling rates as early measures did. Instead policy makers encounter a public, at the same time, increasingly knowledgeable of as well as critical and disinterested in the recycling system. This may be said to be the dilemma that lies at the core of my investigation.

Although my empirical research happens to concern recycling I see this as only one of many examples of the same general trend. The contemporary generation is probably the most well educated in terms of the dangers of smoking, alcohol, speeding, venereal disease, unhealthy food etc. However, in spite of this, progress seems to be thwarted the closer we come to the political vision of a "perfect society". Government response takes on an increasingly invasive role in response to this, speeding is fined, the sale of alcohol regulated and in the UK a costly "drivers licence" (BBC news, 2008) for smokers is even considered and still the goals are not reached. Not even in the most amiable areas of public policy and regulation the goals are

met. The Swedish Road Administrations "Vision Zero" for no deaths on the Swedish roads is nowhere near fulfilment, in spite of it being difficult to disagree with the beauty and relevance of such a vision.

This is where my research interest is – why public policy or businesses fail to get through to all of their market segment, the different kinds of hindrances that exist, how they work, interact and influence the outcome of even the best laid of plans. After all, there are policy areas where compliance is very near 100% without even thinking about it. If I allow myself to continue with the traffic analogy, then driving on the "right" side of the road or respecting a red traffic light could be examples of such situations where compliance is very near 100% and largely self-regulating. Why do people respect these rules when there is both opportunity and cause to cheat on them at times? The difference may seem to pertain to differences in degree of perceived danger, being caught and mere habits, but if so then that is exactly the difference I wish to shed more light on. Set in a business context, an equally relevant question would be to try to explain why certain technological features are shunned by users while other, even non-intended features catch on with the public and reach very high levels of use and approval. Use of e-mail, text messaging (SMS) and students on Facebook might be examples of this latter category.

It would also seem that the possibilities to influence compliance and patterns of use change with time, with the system or with maturing usage among the individuals – OR even in pace with the degree of compliance. Another example will help to explain what I mean here. The step from inventing the bicycle helmet and getting a few enthusiasts to use it is, I would argue, nowhere near as big as going from use by a majority to use by all. When the use of bicycle helmets is then turned mandatory by children, as is now the case in Sweden, we reach a completely new stage of compliance. The "rules" if you will, or the mechanisms of increasing compliance change and differ from the initial set as the degree of formalisation is increased. It seems that as compliance is shifted upwards, a stagnation seems to arise at about 70-90% compliance. Use of the safety belt in cars is a case in point. After increasing only marginally (from 79% to 88%) between 2002 and 2005 it has remained at about that level since (*NTF Nättidningen - Ett bakslag för trafiksäkerheten*). Herein lies further aspects that I would like to explain that have a bearing on many more areas than bicycle helmets or recycling.

1.3 Controlling the uncontrollable – the particular problem & my aim –

This thesis concerns problems relating to attempts to control the uncontrollable. It concerns situations where the success of one individual action is wholly dependent on how another individual interprets and acts upon the perceived intention of the first. This is the case in many fields, and I would say that it is at the very core of both business and economics. What has come to interest me over the past 10 years is the asymmetry and resulting problems of certain situations. It is not uncommon that the actions of the first party are set in motion with the best of intentions and based on the best available intel only to be misinterpreted and thwarted by the aggregate sum of the response of the target group.

Public programmes are a case in point, where bureaucrats attempt to design mechanisms and policies to achieve a desired effect, only to realise with the passing of time that their intentions resulted in something completely different. The inherent inertia of many public policy programmes may serve to exacerbate these problems by unwieldy control and correction mechanisms and perhaps an insensitivity to what is going on in the target group, or political pressure to persevere with the intended plan. In business all of the above applies to the problem as well but it could be argued that such aspects as customer relationship management and indeed profit maximisation would counteract at least some of the effects.

The problem type is generally referred to as a “Wicked problem” and I describe it below as part of my problem discussion. However, my intention is to go beyond the problem type and analyse how this “moving target” is dealt with. I do so by following how a regional recycling company deals with recycling systems and attaining recycling rates and I could have stopped there with that focus. Instead I flip the coin and focus on the recipient side of the programmes designed to overcome the wicked problem by studying the individual households – i.e. those who actually interpret and respond to the recycling programmes introduced.

This is what interests me, the unintended, unanticipated consequences of a policy, and in the end how to deal with these consequences. The complex causality of human behaviour in relation to an administrative policy decision, this is what is interesting on so many levels. Although a daunting task to take on, it is precisely therefore that I seek to go to grips with it. Even though the case I study may be specific, I hope and trust that the

results, the methods and experiences from my endeavour will bring to light the challenge of similar undertakings.

To pinpoint the case studied in this thesis and to help the reader to identify, already at this early stage what kind of case I am scrutinising I will present the following list of dichotomies as a taxonomy of public participation programmes.

- Mandatory – Voluntary
- Extremely low participation – Extremely high participation
- Young systems – Mature systems
- High detection rate of non-compliance – Low detection rate of non-compliance
- Draconic punishment – Slap on the wrist
- Negative reinforcement (guilt/shame/displeasure) – Positive reinforcement (joy/pride/delight)

In categorising the case I have chosen and followed it is interesting to see that it is possible to frame it very differently depending on your point of view. On the one hand the recycling scheme is mandatory in that all households have to pay for it, on the other hand the extent to which you participate is voluntary in that you can still just rid yourself of your unsorted waste, although that comes with a nominal risk of being caught. On the other hand again, the risk of being caught out by neighbours is substantial. This said, the punishment for being caught cheating on the system can be both draconic in regard to the relative severity of the crime. On the other hand the social cost of being caught by your neighbours is not trivial in some neighbourhoods. The system as such is mature on the one hand, with recycling being as old as waste management itself, but young and ever-changing with regard to the waste fractions covered. The nature of participation could also be described as ambivalent in that it on the one hand is high enough to render very good results on an international level, although at the same time clearly encompassing a large number of laggards. Finally, the marketing for recycling often focuses on positive reinforcement by stating the joy and satisfaction of recycling for the sake of this and then next generations – but others would say that this is just the joy of avoiding the shame of not recycling and the guilt of not doing what the authorities and political correctness has deemed morally superior.

All of this may seem confusing and indeed arbitrary at first but keep in mind that this only another way to illustrate how “wicked” this problem is. Only

by changing one point of view at a time, keeping the other aspects constant, can we hope to gain insights into what manner of perspective is the most rewarding when trying to explain what we have observed during so long a time. For the sake of clarity I should state that very early on in the project I felt the need to formulate, at least for myself my own core beliefs on the predominant outlook of the system. What I decided on as my default perspective was to regard the system as mandatory, on the basis of how my studied policy programme lacks any and all formal opt-out options. It is also only fair to view the programme as mature and as displaying extremely high participation rates. In addition I originally found the recycling problem interesting precisely because it tends to build its rationale for participation so heavily on feelings of guilt and shame rather than rational arguments, although I can admit to no small feeling of satisfaction when I recycle myself. I also tend to regard the detection rates for deliberately or accidentally mistaken recycling as small. The anonymity with which most recyclers in the studied area do their recycling even caters for plausible deniability for those who would so wish. Even if an addressed envelope would be found misplaced who is to say that it did not end up there by someone else's hand? Finally, even IF apprehended the fines or punishments in the studied region have been lenient rather than draconic. There are no garbage spies in the studied region and to the extent the recycling company punishes someone for failed recycling it is normally done discretely and collectively as a small fine increase etc.

Coming clean – my take on the studied recycling system at the inception of my investigation

- **Mandatory** – Voluntary
- Extremely low participation – **Extremely high participation**
- Young system – **Mature system**
- High detection rate of non-compliance – **Low detection rate of non-compliance**
- Draconic punishment – **Slap on the wrist**
- **Negative reinforcement (guilt/shame/displeasure)** – Positive reinforcement (joy/pride/delight)

Before venturing further into the chosen problem, let me just illustrate what its antithesis would or could look like. That would be a case where participation was completely voluntary, the system young, participation was secured by positive reinforcement alone, however participation rates would be very low. Detection rates would be high, self reporting even, and the cost of opting out would be high.

A case in point which prima facie would fulfil these criteria might be the SMS technique on cell phones at its inception, or even more to the point, participation in social networking sites such as Facebook when it was new. Participation or using either of these services is entirely voluntary and without a doubt they combine the remarkable feature of being both positively reinforcing on the one hand and exacting a draconic social cost for some if opting out, with the detection rate of (non-) use being highly transparent and near 100%. However, precisely due to these attributes participation soon boomed and to unprecedented levels. Products or services with the same attributes, not having reached maturity might include fringe technology or heavily niched services. Being each other's diametric counterparts I will nevertheless argue from here on that the mechanisms of participation are the same and generally applicable to all cases if it is the goal of the provider/policy maker to increase the participation. Simply put, the reasons why a person increases her recycling or SMS usage by 10% are merely facets of the same mechanism.

We are thus near the “knowledge gap” that I intend to address in this thesis. Much is know about the early stages of new public policies, the introduction of new products and services. However, knowledge about how compliance or acceptance is pushed ever closer to 100% of the system maximum is scant at best.

My aim is to contribute to filling this knowledge gap by:

1. Studying the mechanisms that govern compliance in terms of recycling rates near the 100% mark.
2. Studying the determinants which influence and are possible to influence around the same mark.
3. Identifying key actors/consumers whose behaviour might serve to improve compliance among the masses.
4. Weighing the many different policy options available in improving compliance rates against each other.
5. Trying to identify which means are most efficient in terms of bring desired change about.
6. Positing diametrically opposed theoretical approaches against each other to find as diverse answers as possible to my research questions.

In the following my aim is to analyse the problem of public participation in recycling programmes. I do so with a two pronged approach, I study determinants, their effect on recycling and the possibilities to influence them and I study the demographics, the cluster side of the recycling programme, how individuals and communities act with relation to the programme. This allows me to present a more varied and complete image of the aspects affecting the outcome of a recycling programme. All of this is done in line with the abductive approach presented below as a means to single out the anomalies of the daily realities of public policy implementation.

2 De-, in- or ab- ducted? My forthright take on method...

"All human knowledge, up to the highest flights of science, is but the development of our inborn animal instincts" Charles Peirce

"I think perhaps the most important problem is that we are trying to understand the fundamental workings of the universe via a language devised for telling one another when the best fruit is." Terry Pratchett

This chapter is an honest attempt to openly account for my views on method as such in general and my work in particular. It is outside the scope of this thesis to have an ambition to approach the topic epistemologically, but a forthright account of the arduous everyday process of research is the least whereby I can serve my readers. I also touch upon some of the more peculiar aspects of my statistical methods – in particular the field of “Symbolic regression” where I believe that I am and will continue to strive to be at the forefront of applying the method to the social sciences and economics.

2.1 How to measure this, by what count?

An important research question that a method in this context must address is how to establish the possibilities to influence the individual citizen to do a little extra in a system where the societal utility of this act is greater than that of the individual.

It is in this context that the method should be seen. Every step has been undertaken in order to facilitate the operationalisation of those factors that influence the individual to participate in recycling.

If we were to judge solely from the above it would perhaps be possible to boil it all down to a Cost-Benefit analysis of sorts. The way in which we have chosen to categorise the problems do lead in that direction. However, we soon find that in that case it is a non-monetary CBA that has to be made. It would for example be too easy to say that a person's CBA must be positive as long as they recycle. Seen from a strictly monetary perspective it would be straight forward to assess this, but as stated we also take into consideration non-monetary elements. Elements that do not easily allow themselves to be studied or quantified in monetary terms.

2.2 Neither in- nor entirely deductive – rather more abductive...

While I would consider myself schooled in the deductive tradition, I soon found this approach to be suboptimal. A traditional method of scouring databases for articles, research results and models yielded plenty of results. However, the majority of these results were inapplicable to the Swedish situation at hand. They would have set us up with a set of rules and models which would have distorted the empirical case, effectively making us chase ghosts, and in the end risked making us see things that were not there. Likewise, an inductive approach would have risked leading such a long-term study as this astray. Taking the case as such as the guiding principle we would risk distancing our results from the international context too much, rendering our results inapplicable in a broader perspective.

An example may illustrate the method problem at hand.

Using a predominantly deductive approach we find that journal article X set in an Anglo-Saxon recycling context (substantially lower recycling rates than in our case) shows that factors Y_1 - Y_x have been found to be imperative to understand citizen compliance with recycling policy. We design a field study based on this and either find that we can reject or corroborate this finding. Most likely, given the case at hand we would reject this and most other international finds in a time consuming and frustrating (albeit orderly) fashion.

Switching to a inductive approach (most likely out of frustration with the lack of progress using the deductive approach) we disregard international findings and jump straight into the empirical findings in our case and device rules and models based on this. It is then up to the scientific community in general to relate to our findings. Most likely a researcher in an Anglo-Saxon context will find themselves in as much of a conundrum as we were in the deductive case.

The abductive approach finally, allows us to best describe the actual process of scientific curiosity. A number of anomalies originally made us interested in this field. Pursuing these observations and setting them into a broader international context is a viable path forward. Thus, through successive approximation or abductive validation we can establish that Y_1 , Y_3 and perhaps Z_4 from another article, but NOT Y_2 may be applicable to our observations. Thus, this context driven approach best contributes to an overall understanding of our observations.

So to conclude the example – by preserving the very curiosity which first sparked my interest and matching the rules or models which best fit the observations, abduction paves the way for deduction. Similarly my thesis hopefully paves the way for a more complete understanding of the mechanisms involved.

It is the considerations above that have moved me to accept the interactions of deductive and inductive elements in my research. I have found that this is often the case in research deeply committed to applied problems and their analysis. My method is therefore better described as abductive. In being so, it is built upon a systematic development of the concepts and models gradually formed during the process of my research. The “father” of modern abduction Ambrose Pierce compares abduction to natural selection in that it is a process which gradually weeds out those explanations that do not hold (Peirce, 1902). It is in this spirit that Paavola (Paavola, 2004) insists that abduction is better at explaining the process of discovery than classic deduction, without resorting to relativism or historicism. Finland’s perhaps foremost proponent of this school of thought, Ilkka Niiniluoto (Niiniluoto, 1999), also adhered to this perspective adding that “inference to the best explanation” (IBE), in spite of certain logical problems, remains one of the best models for explaining the actual process of practical/applied research. This is especially the case when statistical methods are used as a venue to approach the problem. Using different probability tests to see how well the generated research reflects on reality becomes a systematic and critical way to approach even the most complex, or to use my terminology, wicked problem. Thus, using this approach it becomes possible to test the veracity of the theory or model by studying its “truth–frequency”. Or, as Niiniluoto puts it:

Given evidence E, accept the theory H which maximizes the likelihood $P(E/H\&B)$.(Niiniluoto, 1999, p. 8)

This in turn means that the validity of the study is in focus. The observations that we make are put into context with the hypothesis H and background B which defines the problem. To my mind this is a very elegant way of describing with a minute formula what we are trying to do. We collect data (E) and compare that to the models and theories (H) of contemporary research and the context in which we operate (B) to determine which combination of all has the highest likelihood to provide us with an “inference to the best explanation”.

In discussing abduction from an otherwise critical, postmodern perspective Alveon – Sköldbberg (Alvesson & Sköldbberg, 1994) concede that abduction opens up to an interpretation of facts⁵ that is completely separate from classic deduction. This, the emphasis on underlying patterns and the gradual build of theory are the virtues of the method in their eyes (Alvesson & Sköldbberg, 1994, pp. 42-43). Taking into account the perspectives of the appraisals of a critic is by no means negative in this context. By doing so, I realised that while the emphasis and ambition to attain a factual truth may be objectionable to the post-modern eye, the insistence on taking into account as many perspectives as possible in this quest might perhaps not be.

As opposed to deduction and induction, abduction takes as its starting point an observed anomaly. That is, abduction starts with the very problem that the researcher desires to investigate. Without the anomaly, there is no problem, and without the problem there is no basis for research. Taking the anomaly as a starting point comes naturally to many a researcher as it is the anomaly which sparks interest in a certain field and leads the researcher to pursue through its course. Already in this starting point, I would say that abduction is the method which best describes the process of our research project. We started in an actual problem, the problem of increasing recycling rates further as a recycling system matures. The anomaly being the consistent failure of established methods to provide additional advances in recycling.

Working with abduction is thereafter a search for the hypothesis or rules which best explain the observed anomaly. Once such a set is established a period of empirical testing sets in, during which the plausibility of available/possible hypothesis are evaluated. In the end a deductive process ensues through which is determined if the remaining hypothesis corroborates the original anomaly. To illustrate the difference between the different approaches I have set up these tables.

⁵ Alveon – Sköldbbergs use of fact in brackets since they sport a relativistic view on facts.

Table 2 The difference between Abduction, Deduction and Induction.

	Abduction	Deduction	Induction
Premiss/given	Fact/Result ⁶	Rule	Case
Premiss/given	Rule	Case	Fact/Result
Outcome/Conclusion	Case	Fact/Result	Rule

Source: Inspired by (Niiniluoto, 1999)

Table 3 The difference between Abduction, Deduction and Induction.- using my study as a means of illustration.

	Abduction	Deduction	Induction
Premiss/given	It is increasingly difficult to increase recycling rates.	Recycling rates are determined by X.	X consists of factors a, b, c & d.
Premiss/given	Recycling rates are determined by X.	X consists of factors a, b, c & d.	It is increasingly difficult to increase recycling rates.
Outcome/Conclusion	X consists of factors a, b, c & d.	It is increasingly difficult to increase recycling rates.	Recycling rates are determined by X.

My dependence on an interchange between observations, direct or mirrored through our surveys are direct exponents of the abductive approach. The groups that we study are not the same all through the study, but by studying trends and incongruities I can systematically approach a set of determinants which are valid for later stages of our research and results. This way of working allows ample opportunities to question and indeed falsify partial results as they are presented. In effect this process of discarding determinants, thus minimising their numbers is perhaps one of the more important contributions of this approach. This process of internal criticism towards working results from the ongoing research has been vital in improving on and advancing our knowledge in the field.

In certain parts however, both inductive and deductive elements can be seen, just as the above model shows. Through for example “causal inference” we try to say something about our case. That is, when we

⁶ Or in the case of abduction – ”anomaly”

observe that x% of population A1 do action y, then we believe that we can say that it is likely that population A2 also do action y in x% of the cases. While this is implied in most methods using statistics, I wish to stress our awareness of this way of thinking since I believe it can be put to good use in this study. Through causal inference our statistical methods can be interwoven into our knowledge of the local arena. For example, we have regularly surveyed different parts of the population at different times relying on local knowledge to maintain consistency while covering a larger portion of the populace. Seeing that the odds of actually surveying the exact same people longitudinally is minute we might as well survey similar areas to get the trend while testing for new anomalies in the material. Again, I should stress that we take as our starting point an assumption that the anomalies we study are prevalent in the general population as a whole and not just isolated to certain particulars. This is done while at all times stressing that all results should be possible to falsify.

So far, these were the ways in which I sought inspiration from our empirical material. Adding to this are the deductive elements. For example, we went into the area with an ample understanding of the problem, its component elements and its theoretical basis. The modelling that I do from this in the end should be seen as whole however. A whole, to either accept and build upon, or a whole to criticise and falsify. Either way I will view it as a means to improve upon the work I have done. The resultant model in this case is adapted to the studied case and area and the particular circumstances under which it operates. However, the addition of sequential conclusions during the project must not be seen as ad-hoc hypothesis, but should rather be viewed as the building blocks through which we piece together a final unitary model for the studied problem. This in turn is very much in line with our view of the problem being complex. Our openness in this is intended to show our sincere commitment to the research presented herein and our results.

2.3 Variables

In this study the degree of participation/compliance, expressed as recycling rates, is the dependent (Y) variable. It may take on many expressions depending on the policy we study however. In our studies recycling rates is the predominant expression used. That is, the proportion of all materials entering the market recycled in accordance with the regional rules and regulations. Recycling rates have the advantage of being measurable and being regularly done so by the recycling company at the local level as well

as by the industry at the national level. It is also possible to ask the individuals themselves to make a self-estimate of their recycling rates, more often than not with aggregate results that are on par with the regional and national levels. Recycling levels are also frequently cited at the national level when discussing the levels of ambition for recycling.

Succinctly expressed out method is well suited to study which independent (X_{x-1}) variables or determinants affect recycling levels. We have tried to establish a series of constructs which can be used to generate hypothesis on how to feasibly influence recycling rates in the current context. In every stage of the process previously generated constructs have been stricken from the records as they have been falsified and others replacing them has allowed us to triangulate solutions which best describe the anomalies acting as our starting point. In this our method has been incremental, so that we could isolate those factors or determinants which had the most penultimate effect on compliance in the system.

2.4 Research as a series of choices

As is continuously stressed throughout this text, recycling is a large and complex issue. Add to that the practical consideration, the issues that garner special interest among colleagues and research partners in the business and it turns even more complex.

For all intents and purposes this thesis is built upon a long series of field studies conducted from 2002 onwards. Every field study in turn is based on the results of the previous. Certain leads turned out to be dead ends or areas that turned out to open up such new venues as would entail another thesis to encompass. The most poignant example of the latter is the Producer responsibility which was a focus early on in our project. However, it is in its nature that neither the local recycling company, nor the individual citizen can directly change or influence it. This is why it was not included in further field work. Should the opportunity arise however, I would be glad to revisit it to test the results of the present work. At the other end of the scale we have for example “knowledge”, problematic yet crucial it was and is a focus of our field work to this day. The reason for this is that we wish to illuminate the most important determinants from as many perspectives as possible. This was done primarily by a study of the reflective rather than the formative aspects of the phenomenon. That is, our focus has been resting with the symptoms of the problem rather the precepts that could cause them. In addition the studied variable – the recycling rate – is a

moving target varying depending on for example what kind of recycling we study, where or even when we study it. With the passing of time, even during our relatively short period of study, recycling in this region has changed and so has the system and policy regulating it.

2.5 Level of analysis

The choice of level of analysis was also a conscientious one. Our partners at the regional recycling company did influence us, as did certain practical hindrances against studying the issue at a national or even regional level. This delimitation should however be set against the local knowledge, cooperation and *fingerspitzengefühl* which we have established during our progress. Setting the individual level as our level of analysis of choice was an early and conscious choice. It is also a choice strengthened throughout the process. It was tempting to do as most contemporary research in the field and set as our focus the recycling company or the policy level and let all else revolve around this. By making the individual citizen the “sun” of our solar system we gain a set of other advantages. A consequence of this a priori choice is that we are able to see completely new ways of changing the recycling rate that stem from the needs of the individual. Instead of letting the technical aspects of the recycling system set the boundaries of our research we do so by the multitude of innumerable potential solutions provided by exactly those people who are tasked with improving on recycling on an everyday level.

2.6 Theory generation & the Zwicky box

The selected level of analysis also generates other consequences since the entire inquiry may be seen as theory generating. Our systematic method is a way of isolating the main determinants and to falsify those determinants that lack in explanatory power. Due to the chosen level of analysis we in part investigate other determinants than those normally covered in a comparative investigation of this type. Instead of technical variables tied to the recycling system our emphasis rests with what may be termed as the psychological and behavioural determinant of recycling. Add to the individual-technical continuum, an individual-collective continuum and you get a better grasp of what we intend to do. The individualistic axiom of Ludwig von Mises, is to my knowledge here for the first time set against the communitarian complex of Amitai Etzioni. This thought experiment opens up entirely new venues for explaining the increasing difficulties that those

who try to tweak the Swedish recycling system encounter. It will also help to set in a new light how individuals reason on the recycling tasks allotted to them in comparison to other chores or commitments.

Developed by Fritz Zwicky as a methodological approach towards problem solving in the 1940's this kind of thinking about scientific problems helped Zwicky deduce the existence of neutron stars and developing new kinds of telescopes (Zwicky, 1948, p. 124). Simply put it is a method where all variables of a problem are delineated and categorised in a matrix from which known and unknown combinations can be catalogued, identified and eliminated. Having no limits to the number of variables a Zwicky box may take on many graphical representations, but it may look something like this:

Table 4 The Zwicky box – a fictive example “Modes of transportation”

Wheels	Nr of passengers	Propulsion	Top speed	Cost
1	1	Electrical	10 km/h	20•
2	2	Diesel	20 km/h	200•
3	3	Petrol	50 km/h	2000•
4	4	Fuel cell	100 km/h	20000•
	<u>10</u>	<u>Pedals</u>	200 km/h	
	<u>20</u>			

By multiplying the alternatives we easily see that there are ($4 \cdot 6 \cdot 5 \cdot 5 \cdot 4 =$) a whopping 2400 potential combinations available already in this limited Zwicky box. However, by eliminating combinations that are seen as unrealistic for the purpose at hand (eg. any combination of fuel cells and costs below 200•, or pedals and 10 to 20 passengers) we can soon reduce and limit the number of potential alternatives. Furthermore, the inherent systematic reasoning also allows us to pinpoint choke-points, crucial values of a certain variable that might change the potential outcome if remedied – eg the ~~price of fuel cells~~. The real strength of the Zwicky box however rests with its ability to facilitate the discovery of unusual yet feasible combinations – for example the “hydrogen fuel cell bike” which actually turned out to exist after a brief Google search (*Hydro-Bike - hydrogen fuel cell bicycle*, 2008)!

Referring back to the discussion on abduction it should also be noted that the reiterative nature of working with Zwicky boxes aligns very nicely with abduction. By systematically excluding combinations that are inconceivable or unobserved we add a dimension to what Niinilouto describes as

inference to the best explanation. With that said, I would like to stress that with a Zwicky box the process might just as well entail “deduction to the best explanation”.

This is exactly how I have worked with my field studies. By setting up a Zwicky box for each study and eliminating and/or trying to discover hidden/potential combinations, my understanding for the problem has grown considerably with every field study while facilitating concerted research efforts where they were most needed to explore new combinations of variables. As we shall see in the concluding chapters this systematic approach to the problem has proved to be of great value, and is to be credited with many of my findings.

2.7 In the field

2.7.1 Checks and balances

The longitudinal nature of this thesis has as its inevitable consequence that my very own preferences and skills in terms of available research methods has changed in tandem with my topic. In order to fully grasp this, which is a research process on its own, I have tried to summarise the principle field work upon which this work is based, its methods and the rationale/pros- and cons- of each study.

Table 5 Methods used in the field

Study	Year	Principle method	Study object	Rationale	Selection
Order & living	03	Interview & survey	110 hh	Exploratory	"Rich cases"
Pre-compost determinants	03	Survey – factor analysis	277 hh	Swe vs int nat determ	Diversity among household types
Producer responsibility	03-04	In-depth interviews	10 pers	Establishing limits – excluding determinants	"Rich cases"
Collection fees	04	Theoretical study			
Food supply chain	04	In-depth interviews	6 pers	Establishing limits – excluding determinants	"Rich cases"
SME:s & eco-services	04	Survey	70 comp	Establishing limits – excluding determinants	Existing clusters
Miscreant study	04	Theoretical study			
Coordinated waste	05	Summary of field work			
Pre- /post-compost study	05-06	Survey – factor analysis	500 hh	Trying to capture mechanisms of change	4x city areas
Compost informer	07	In-depth interviews	15 pers	Crucial group	Snowball
Double value-action gap	07-10	Survey – factor analysis & symbolic regression	2*700hh +110 pers	Fine tuning of actual determinants	2*random + 110 students as a reference group

While most of the methods used are both conventional and familiar, I shall describe shortly how we applied them and what advantages and/or shortcomings I see after using them.

Interviews

Having used in-depth interviews as my principle data gathering tool during my previous research (Kågström, 2000; Helby, 2002) it was only natural for me to continue emphasising this as our principle qualitative method. The advantages of in-depth interviews are widely (Darlington, 2002; Kempf Leonard, 2005; Malhotra, 2006; Gray, 2007) known and understood and include the ability to get accurate answers on often sensitive issues (Gray, 2007, p. 173). In my own experience this is especially true with a non-intrusive question design. Knowing beforehand approximately what issues and topics need to be covered and then allowing for the respondent to talk – nigh on unhindered is crucial in my experience. By allowing the respondent more leeway and time to deliberate even on issues outside the scope of the interview a sense of rapport and trust is fostered between interviewer and respondent. This particular mechanism of in-depth interviews has been documented among other practitioners of the method as well (Darlington, 2002, p. 73; Kempf Leonard, 2005, p. 223). As long as trust is gained most respondents that are comfortable with the situation like telling their story, and this can be put to good use. Allowing for questions like the ones below will ensure vivid, elaborate and personal descriptions of the process you want to know more about.

Can you tell me what it was like to visit the recycling station...
Describe the first/last/most recent time you recycled X...
Explain how you advice new tenants on the recycling system...

Of course this approach to in-depth interview require more time in the actual interview setting, since such interviews can take some time to conduct. They also require more restraint on the part of the interviewer, so that you do not interfere too much in response. It is tempting to interject to show off your understanding of the respondents situation, but not only does that distract from the narrative, it also runs the risk of introducing aspects that the respondent had not considered. What it all boils down to is of course how well the interview is able to chart the underlying motives (Malhotra, 2006, p. 162) of the respondents and discover new insights into the more sensitive (Gray, 2007, p. 173) aspects of their understanding.

In this thesis interviews were used throughout the process, but they were the primary source of information at the very beginning of the process as

well as whenever more detailed information was needed. The initial “Order & living” study in 2003 made use of interviews to supplement our understanding of survey findings, which in turn were based on a literature study of recycling determinants. It was also at that time that I decided to take every opportunity to visit recycling rooms/centres and discuss recycling issues and keep a diary of sorts of quotations from citizens concerning recycling. The 2003 interviews contributed greatly to a deeper understanding of which of the internationally recognized determinants might be applicable and how they might apply to our case. This was also the case with the 2003–2004 interviews concerning Producer responsibility and the 2004 study of the Food supply chain. The two latter studies also confirmed quantitative indications that these two aspects of recycling, although important, were not in the minds of the individual citizen. The final major interview study concerned a key-group of Compost project informers, tasked with disseminating the Hows and Whys of composting to the public. In this case in-depth interviews were a viable option due to the smaller number of potential respondents and the types of information that we were hoping to gather.

Surveys

In terms of broader data collection, surveys have been the main method throughout the process. Research into recycling determinants is heavily dependent on surveys and although the specific methods differ there are many commonalities. Area segmentation, stratification, and focussed sample selection are all used as sampling methods. Likert scales are commonly used eg. (Davies et al., 2002; González-Torre et al., 2003; Martin et al., 2006) and questions are rarely closed-ended in character. The reason for this is that factor analysis is one of the most prevalent eg. (Schultz et al., 1995; Bratt, 1999a; Ebreo et al., 1999; Barr et al., 2003, 2005b, a; Tonglet et al., 2004a, b) forms of data analysis in recycling determinant research.

This thesis follows this tradition, with some additions and modifications. The desire to use factor analysis to discern determinants in the material lead to a gradual increase in the number of scale steps used in Likert based surveys to the full implementation of Visual Analogue Scales (hereafter VAS-scales) from the 2005 Pre-/Post-compost survey. Problems with Likert scales, such as perceived anchoring effects and the inherently ordinal nature of the Likert scale (Reips & Funke, 2008, p. 704; Funke et al., 2010, p. 8) influenced me to use VAS-scales. The VAS-scales used here consist of 10cm long lines with the question on the left and labels on each end. The

respondent marks her answer with a mark on the paper or a slider (on-line version) and the result is then measured with a ruler or by the computer. VAS-scales have a long history in e.g. medical research, especially in measuring subjective feelings such as pain. I interpret this ability to allow the respondent to optically inspect and compare the ratings they make as one of the reasons to its introduction into business and economics research (Couper, 2006; Brace, 2008; Malhotra et al., 2009).

Disadvantages of using the VAS-scale mainly include practical problems concerning data gathering and collection (Brace, 2008, pp. 80-83). With advances in computer assisted coding and e-surveys, this problem is largely if not entirely averted (Reips & Funke, 2008). As to the accuracy of the VAS-scale versus other measurements there is conflicting evidence. Laerhove et.al. (2004, pp. 834-835) found that children prefer Likert scales over VAS-scales. However, they admit that this may have to do with how used the children are to these scales and how literate they are, since immigrant children consistently preferred the VAS-scale. To my mind this “disadvantage” indicates an actual advantage of the method in terms of distancing the survey results from factors such as levels of educations etc. This aspect of scale design is also covered in Funke et.al. (2010). The propensity towards “first response” and/or “end-aversion” among respondents, prevalent in the discussion on the Likert scale has been researched for VAS-scales, but results are conflicting. Again, children seem to prone to biases in both scales (Laerhoven et al., 2004) while larger data-sets seem be advantageous to the VAS-scale, with the higher number of scale steps being an added advantage (Reips & Funke, 2008; Malhotra et al., 2009; Funke et al., 2010).

In my personal experience the practical disadvantages of the VAS-scale are exaggerated, measuring and inputting the value of each answer takes scarcely longer than a corresponding Likert-scale survey. In terms of respondent reaction and the reliability/validity of answers there was no discernable lower response rate or inconsistency in our material. When it comes to e-surveys, some work needs to be done to fully take advantage of the method, but there are both “numerical VAS-scales” as well as third-party projects to cater for this.⁷ All in all, the choice of survey method has worked well in all both the data-gathering, processing and analysis phases of research.

⁷ Google doc surveys are underway and <http://vasgenerator.net/> is also available as a work in progress.

Factor analysis

The principle method of data analysis has been factor analysis. Again, a concession to the existing paradigm of recycling determinant research in the field. As I see it, factor analysis is used in two ways. Either in an exploratory/data-mining role or in a hypothesis or model corroborating role. In terms of use, the earliest surveys were more exploratory and questions were designed to test the existence of determinants found in international research in the Swedish setting. As the research process advanced there was an increasing shift towards testing constructs or sets of determinants that had been seen to have greater than average explanatory powers in the field. The importance of such an approach together with Cronbach's alpha to test for internal consistency (Gliem & Gliem, 2003, pp. 87-88) should be stressed in that context. This shift coincided with the introduction of the VAS-scale and was dominant thereafter.

Among the advantages of factor analysis that I wanted to uphold using this method was the ability to identify and describe underlying factors in the material (Rencher, 2002, p. 448). On the other hand, the resultant factors are entirely mathematically derived and blind to the deficiencies of the data (McNabb, 2010, p. 212). With increasing understanding of the data, this drawback could be avoided; and I would like to stress the importance of having a good hands-on knowledge of both data, the data collection process and the field work behind the factor analysis. This is also important in interpreting the resulting factors, since they do need to be interpreted by the researcher, and how can that be done without a careful knowledge of the field? The latter is also often described as one of the main advantages of factor analysis, allowing the researcher to apply meaning to what would otherwise remain numbers (McNabb, 2010, pp. 211-213).

My own objection to this is that what could be seen as an arbitrary must be dealt with. For if meaningless or hard to interpret factor analysis results are discarded out of hand and the data is subjected to repeated factor analysis until "meaning" is found – then it is scarcely more than data-mining. To deal with this, which I felt was abhorrent; I introduced the Zwicky box (see above) as a means of structuring and applying a systematic approach to factor analysis. Only then can the arbitrary nature that would otherwise permeate the method be contained. This is no small task however, and it is reiterative in nature. Each factor analysis must be checked with respect to what has been tested for and what remains to be tested for according to the Zwicky box. In a smaller, model or hypothesis testing environ, this should not be a problem, but if I am allowed to give one piece of methodological

advice it is that studies that are more longitudinal in nature be accompanied by such a systematic approach!

2.7.2 Our description of reality

The observations that we have made in the past 7 years, and additional data from as far back as 2001 form an unusually good coverage of the state of recycling in the Gävle region. Our method, with its many consecutive observations is a guarantee for the validity of the study. Each new study carrying us closer to a more exact description of the situation. The continuous development of a terminology to describe what we see also enables an increasingly more precise description of the research question, both from an academic perspective and from the perspective of the individuals in our focus. However, discussing these recycling issues in such a mundane way as not to distract the individual recycler, while maintaining enough academic stringency to be comparable to other contemporary studies has been a challenge. The necessary distinctions between different forms of recycling bins, methods, places etc that are clear to the research group and recycling firm is seldom as clear cut to the individual recycler for whom all recycling essentially deals with garbage and a bin is a bin no matter what its purpose is. Thus far content validity.

Perhaps it is more important to touch upon the topic of how we have worked with construct validity. The end model, which aims to capture the mechanisms of recycling in our region is built upon a number of constructs. Each of these constructs has been tested for and derived at statistically to see if they retain their explanatory power throughout the study. This mimics the process by which I have tried to ensure the discriminant validity of each included component. The goal of course has been to establish some basis to be able to express myself on the predictive validity of the resultant model, that is its ability to predict results in for example terms of recycling rates. This ambition is of course fully in line with the whole abductive research process whereby I seek to find the results that best correspond to and explain the observed anomaly. External validity is of course a matter of determining to what extent my results are of use to the recycling situation in general. What I safely say is that the external validity is solid for the studied region, but I shall have to admit that I do hope to contribute to the development of models concerning recycling determinants and individual decision making on a broader scale. What kind of researcher does not nurture such hopes deep down? Thus it is my hope that my study has accumulated enough credibility (or money in the bank as one of my

mentors would say) to encourage testing my results on other fields of enquiry facing the same categories of problems. This ambition of generalisation and my results would also do well to be contrasted against the chosen theory and established *modus operandi* of the business.

Since I hereby imply that the study has a decent degree of validity, I should also argue that it is reliable and replicable. Extensive documentation, periodic reporting and electronic storage of virtually all data collected during this period is meant to enable a replication or repeat study if deemed interesting enough. Through this, a good deal of our mistakes and side tracks should be possible to avoid. In this I would like to call upon the same arguments as above when defending the validity of the study. Our gradual and systematic triangulation of the problem should ensure that repeat studies should be able to attain similar or comparable results. Statistically speaking the reliability and internal consistency is ensured by our SPSS data analysis. However, it should be noted that the “target” is a moving one, and that in turn is also an important realisation – or conclusion even. Studies conducted in the same spirit as mine should have ample opportunities to continue to fill in information and help complete the “Zwicky box” of recycling previously touched upon. This wicked problem is by no means fully investigated yet, but with the aggregate research of remaining aspects our understanding of all the complex facets of recycling determinants should become increasingly more complete. The problems of reaching high levels of compliance in public policy programmes is a universal problem and the hindrances on the path to such a stage is likewise the same as in our study.

2.7.3 Internal control

In order to ensure a measure of internal control throughout our research, we have worked in close liason with the regional recycling company at all times. This has allowed us to select for example the geographic areas best suited to our current research interests at all times. In addition to this we have constantly been working on the selection process in order to ensure that areas are contrasting. For each “bad” area, a “good” one, for each tenement area, a villa area, for each experience area one inexperienced etc. This was instrumental in facilitating the experimental design that we ascribed to from the very start. A design which ensured us the possibility to isolate systemic problems or variations in the material.

	Tenement area	Villa area
Better than average recycling		
Worse than average - recycling		

The alternative, that is a complete investigation at all times, directed at the entire populace would have ignored both local expertise and our own developing understanding of the wicked problem at hand. In addition, such a design would have made it more difficult to separate different areas from each other. It would also have meant that endlessly repeated testing of demographic factors. As things were conducted now, this could be reduced to a minimum just to validate the selection process. Searching for the sometimes minute anomalies embedded in the material, the selected material made it possible to pinpoint areas where expected problems were accentuated. Trying to find the same determinants operating on an aggregate level would have, firstly defeated the advantages of the Zwicky box approach and secondly made it difficult to isolate what we were looking to study. An analogy taking this to its extreme would be a zoologist looking to study the feeding habits of beluga whales taking the entire globe as his study object. If we know that it is beluga whales we want to study we will of course direct our attention to areas where they are known to exist, and enlist the help of the locals to pinpoint their exact location. The latter is what we have done here. Residual differences in recycling rates in say 70% RR neighbourhoods and 90% RR ditto were the only ways to locate and study behaviour on the fringes of the scale. This approach was especially successful in our study of pre- and post-composting campaign areas, since it combined experience in selecting interesting areas with the advance of a new policy element. In this way we managed to get enough material to be able to research this subset of determinants. Something which would otherwise have been impossible to do given our scarce research for field research.

The semi-experimental design also increases our ability to go forward in researching the matter of causality. Temporal causality for example is therefore relatively clear. The state of recycling before and after the big composting reform is well charted and to that comes the role of different types of knowledge which we have been able to track throughout the research period since we could assume that the compost fraction was about

to undergo major policy changes. This leads me to reflect on the work we did on covariation of variables which is a part of the causality debate that we have put a great deal of effort into. This was done using the statistical methods used and presented in the appendix as well through the reiterative efforts of our field work. Aspects of knowledge as a determinant of compliance is a case in point here. It was a basic assumption at the onset of the programme that “grass-roots knowledge” would play into the equation, since this is often what sets a limit as to what can and cannot conceivably be done within a public policy programme. It soon showed that this seemed to be correct and that a distinction between actual/measured and perceived/self-measured knowledge provided increasing abilities to explain observed behaviour. Being an integral part of the later compost investigation this distinction provided new insights into how these variables covaried with other independent variables and explained the dependent variable.

2.8 Introducing symbolic regression

Throughout my years as a PhD-student statistics has been an integral part. I have “lived” and worked with SPSS as one of my dearest research tools. However, the frustration at the inability of SPSS (and any other statistical package) to take into account and help me describe the often complex and non-linear. When you literally spend 6 years with a limited set of research data you being to understand and see even the most subtle changes and potential correlations within this data. For me the role of statistics in this perspective is to support me, to help me to find and to put into mathematical terms observations that I already know or suspect exist within my data.

My two favourite companions in this has been factor analysis and cluster analysis. Factor analysis for its ability to find and help me understand how determinants or variables connect and interact. Cluster analysis for its ability to “dissect” the populace and categorise the individuals and their mannerisms. Where the factor analysis is cold, unforgiving and appealing to the stricter side of a researcher, the cluster analysis is inclusive, fuzzier and appeals to the creative side of a researcher.

However, in the end there is strong peer-pressure for all of this to emanate in a regression describing the overall results in a neat mathematical form. This is the convention, and when it works out it produces elegant equations. From my perspective these equations on the one hand tend to

produce linear relationships where the data are clearly not linear, and equations that might produce a mathematical “fit” but at the same time disregard the non-mathematical nature of the area studied.

2.8.1 Enter symbolic regression...

Although Symbolic regression has been proposed as a research tool for use in business and economics (Chen, 2002, pp. 62-63) it is only with very recent advances in computational software and multi-core processing power⁸ that Symbolic regression has become a viable option. With the Eureka software (*Eureka* | *Cornell Computational Synthesis Laboratory*) a first set of tools for this has been released to the scientific community. In short symbolic regression allows the computer to search available data freely for the best possible fit, be it linear, curve linear or non-linear. Where traditional regression methods use a set of equations of given form to the parameters, symbolic regression (Schmidt & Lipson, 2008, p. 81) searches BOTH the available parameters and all manner of conceivable form equations simultaneously.

The advantage is obvious, instead of being constrained by a limited set of potential equations (often linear) and the forced use of all data, symbolic regression starts off by searching for simple curve fits and then increases the complexity of the fit equation, discarding and adding parameters from available data to minimise the error and maximise the curve fit. This means trying out literally billions of potential equations comparing the fit of each newly found equation the previous, gradually improving the usefulness of the resultant equation with each of countless generations of equations. This process is described as a means to “find natural relations where they exist, with minimal restrictions on their analytical form” (Schmidt & Lipson, 2008, p. 81).

The method is intended (and proven) to be able to find underlying physical/natural laws in experimental data (Schmidt & Lipson, 2008, p. 83) , such as Newton’s 2nd law etc. In addition the resilience of the method to “noise” (Schmidt & Lipson, 2008, p. 83) in the data and its ability to model complex phenomena (Schmidt & Lipson, 2008, p. 84) with a wide range of variables and cases make it interesting to try out even outside the field of physics.

⁸ Stemming from research into artificial regression (AI) and made possible by the quantum leaps in the computation powers of contemporary computers

Part of the elegance of symbolic regression method is its ability to combine solutions that are accurate and parsimonious. Thus the model is accurate (Schmidt & Lipson, 2008, pp. 83-84) in the sense that it produces the best possible predictive fit to the data, and parsimonious in that it tries to optimise the complexity of the resulting equation in terms of the number of terms in the expression. In the software this is presented graphically in terms of colour coding of the solutions in terms of accuracy and the number of expressions used.

2.8.2 The shortcomings of symbolic regression

The shortcomings of symbolic regression rest first and foremost with it being novel and untried outside of physics. The method (Schmidt & Lipson, 2008, p. 81) is best at finding explicit and differential equations, and less apt finding conservation laws and invariant equations. Still, that limitation still puts symbolic regression on par or ahead of the existing/prevalent software used in this field, such as SPSS.

On a more practical note, there is no telling WHEN a computation of the symbolic regression is done. In my own experience, using my data with less than a dozen variables and less than 300 data points for each variable, a useful solution is usually found within 5-10 minutes or around 5 billion reiterations. In the tests done by Schmidt-Lipson for physics data anywhere between a couple of minutes to 30 hours (Schmidt & Lipson, 2008, p. 84) was needed to find known physical laws in empirical data. I have tested allowing the software run on a 4 core networked system for 24h without significant improvements on my empirical data beyond the 30 core-hour mark, allowing me to infer that perhaps the parsimony of the resulting equation is more important than the best theoretically possible fit (which may yield totally unworkable equations including 30 or more expressions).

2.8.3 Interpreting the results of symbolic regression

This brings me over to the interpretation of the resulting data. An equation with too many or difficult to explain expressions does not help the researcher forward in explaining the data. Striking the right balance here is important. Explaining a curve fit which perhaps includes multiple cos/sin elements might be very hard, since to my mind I should be able to “put words” on each and every element of the equation. Else, I have just produced a mathematical fit with little or no explanatory power. In this context it should also be noted that symbolic regression can be regarded as

either completely merciless or very succinct with regard to your hard earned data. If a variable does NOT help in establishing the curve fit it WILL NOT be included in the final equation. This became clear to me when using the same data set to test for a) an overall function for a whole data set and b) a function covering a theoretically motivated part of the same dataset. Eureka returned very nearly the same equation on both occasions, having taken into account and then discarded all but two of the variables.

- a) Recycling rate = $25,4 + 0.20 \cdot \text{dirt} + 0.54 \cdot \text{smell}$ (result with all 8 variables included)
- b) Recycling rate = $23.2 + 0.24 \cdot \text{dirt} + 0.53 \cdot \text{smell}$ (result with just 4 variables included)

This to me is a clear indication as to the resilience and robustness of symbolic regression in finding the best possible curve fit in complex data sets. I noted above that I find Eureka to be merciless and I maintain this since it so easily discards variables not “needed”. This is in stark contrast to the many ways in which data can and should be adjusted in e.g. SPSS in order to facilitate the best possible regression. Eureka really DOES “kill your darlings”, thus my verdict on its mercilessness. I find this to be especially refreshing though, as is the ability to model more complex curve-linear relationships. A case in point here concerns the oscillating relationship between recycling rates and the time spent on recycling. It had been the impression of the research group for the past three years that:

A) Persons waver with regard to their recycling performance. Uncertainty on how to best recycle and changes to the recycling system offset and reset citizens ability to be efficient recyclers. Improvements are followed by setbacks which in turn are offset by increased experience and so on.

B) These oscillations not only become smaller with increasing recycling performance, they also coincide with sharp increases in recycling rates among the more experienced recyclers, which in turn risk becoming increasingly inefficient as recycling rates begin to soar around the 80-90% level.

These two relationships have been clear to us on “rule of thumb” level and the naked eye could quite possibly make out such a possible relationship when time used and recycling rates were plotted against each other. However no measure of regression in SPSS could put our thoughts into an

equation properly expressing this. With Eureka it took less than 10 minutes to produce the following equation where BOTH the oscillating factor A) and the diminishing marginal utility B) were neatly modelled in the same equation.⁹

$$rr = 86,6 + \frac{67,6}{-0,28t - \sin(\hat{x}) - 1}$$

To conclude I would like to agree with Schmidt – Lipson in saying that the relative automation of the Eureka system does indeed NOT diminish the role of the individual scientist. On the contrary it allows us to concentrate on the HUMAN interpretation of our data and the phenomena we are studying.

2.9 On the chosen method in retrospect...

In retrospect it is easy to say that a more coherent approach would, at times, have been desirable. If so, it would have been possible to get a greater degree of continuity in our field work and theory development. The financial limits were such however as to infringe upon our ambitions, allowing field work to be conducted only during short intense periods often using students extensively to facilitate field work. Many hours of weekends, holidays and overtime was spent in order to allow the project to move forward. As stated in the first paragraph of this thesis, I am greatly indebted to all of the good hard working students working in close cooperation with us, handing out surveys, collecting raw data, transferring paper data into excel and SPSS etc. I hope and trust that the bachelors and master thesis they got out of our cooperation in no small way was compensation enough for all the long working hours put into our mutual project. The way in which we have handled this intermittent research has been to document our progress as extensively as was possible.¹⁰ Our cooperation with the regional recycling company and later SITA, as well as research colleagues lead to internal reports becoming an intrinsic part of our progress. These reports

⁹Details are founds in Chapter 0

¹⁰ Some material was irrevocably lost in my massive computer crash in 2003 when the same virus also infected and destroyed the back up. After this “once in a million” incident was repeated in 2005 I have become overly cautious regarding backup data. Since then all material is backed up on an external HD, a USB memory stick (stored in different locations) and since summer 2007 using the Norton 360 online backup service. I can only hope that this will save us from similar disasters in the future.

further served as opportunities where the veracity of our claims could be examined by our peers.

It could also be argued that a more concerted or unified effort could have allowed us to take more a holistic approach. A more all encompassing field study, instead of our piecemeal approach, could also have made it possible to avoid some of the cul-de-sac's that we have experienced. Thus it cannot be ruled out that such an effort might have made it possible to make better use of our resource. On the other hand, more of a "one-shot" approach would also have meant that some determinants could not have been ruled out as effectively from our Zwicky box.

Returning to the issue of using students to conduct substantial portions of our foot work as a part of their bachelors or master's thesis. It should be noted that this is a method which we highly recommend others to use as well. Of course a major caveat is that to take on a previously more or less unknown as a "research assistant" is always a risk. It has been noted that some students thus employed turned out to be of little or no practical/theoretical use during their 10 weeks in our group, but this has been the exception. The individual student is normally motivated by the close cooperation offered by an established group of researchers and can be expected to grow considerably on both a personal and academic level during the period. Using cautious guidance even the simplest of research ambitions can be made to benefit the overall effort without stifling the student's lust to explore. Turning our research questions into "theirs" is something most or few students even notice, much less are hindered by. Such adjustments in methodology are what any student would be expecting to face under any circumstance to conform to academic standards. It should be stressed that what analysis the students then make in their own reports of our material is their own. The analysis, made by the research group and me, of the material often differs in substantial ways due to differences in statistical prowess, preconceptual ideas or topical knowledge. On the other hand, it should be noted that the fresh perspectives provided by students can sometimes alter how the senior veterans regard findings and render new insights. The most important aspect of this however was how this method facilitated extensive field work on a scale that is much larger than our budget suggests.

3 High-level theory – communities and individuals, a way to apply Self-determination theory

During the course of my work on this thesis it became increasingly clear to me that one of the most pertinent conflicts in the material to shed a new light upon was the intrinsic conflict between the collective of many or the community; and the individual citizens which make up this collective. Identifying that Self-Determination Theory has become increasingly prolific in business research I modify what I see as the gist of this theory by pitting the communitarian approach of Amitai Etzioni against the strict individualism of Ludwig von Mises. I thus end up in a discussion of the contributions of both in my work. This chapter thus addresses my thoughts on this divide and the implications it has for business and policy research in general and my work on recycling.

To me theory is the driving engine of research. It is the means by which we reach the destination; it is the facilitator of the journey. To some it is the engine that fascinates and where it might take us. To me it is a constant search for the best possible engine to take me to or help me explore what I have found – indeed, the engine helps complete the journey, but the journey itself is my core focus. As a result I tend to test and try out different theories and even set them against one another to see which ones help bring me to the target in the best possible manner. While some might perhaps take this as a disinterest in theory, I regard it as the very opposite. While I am not very sentimental about a particular theory and quite content to replace one if falsified, I am still humble in the face of a well researched and designed theory. As the reader may surmise this goes hand in hand with the abductive method. Keeping an open mind and trying to be well versed in

all the theories and models of a field is necessary for such an approach to function.

In this context I early on decided to posit applied contemporary research in my field against a set of hitherto unused and diametrically opposed theories. Seeing how recycling is both an individual action and a larger concerted group effort, this distinction lead me to pit Praxeology (Rothbard, 1997) and Communitarianism (Etzioni, 2001, pp. 97-98) to see how these two systems of thought would help explain observed trends. Applied research, as represented in journals was initially regarded as fairly homogenous in this respect. However, in keeping with the division between an individual and group focus the same division was possible to identify as my work progressed. While this division and the resulting matrix (below) may seem as a result in its own right, I choose to present it in unified form here to help the reader understand my train of thought. It should also be noted that while the differences between praxeology (Mises, 1996) and communitarianism (Etzioni, 2002, p. 363) are great and intentional, the differences in the applied field are much smaller and not part of any conscious attempt to differentiate between the two.

Table 6. *Relation between different theoretical foci*

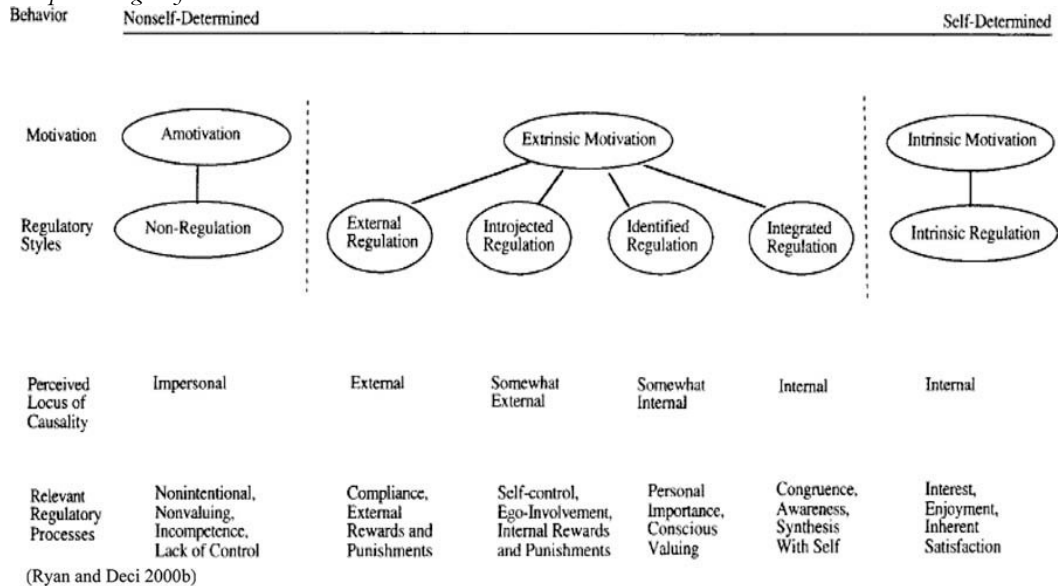
	Individualist focus	Group focus
Epistemological theory (ch3)	Praxeology----->	<-----Communitarian
Applied theory (ch4)	Stewart Barr--->	<---Tonglet TPB

As explained above I take my stance with abduction or reasoning to the best possible explanation as my approach to research. So it is only natural that this permeates my vision and approach to theory as well. This is the reason why I widen the theoretical comparison to juxtapose, on the one hand a communitarian and praxeological approach and on the other contemporary research into recycling in this chapter. The latter can be read on its own, for applied research has its own virtues, but I find that by employing, what is essentially different epistemological perspectives, it is possible to see this research in a new light. Understanding applied research of end-users behaviour either from a community perspective or an individual perspective renders divergent insights. My aim here is therefore to guide the reader along the same paths of theoretical exploration as I once did, to follow the same paths and perhaps also make the same discoveries. I start by presenting my take on communitarian and praxeological theory and continue by recounting my ongoing read of applied research in my field.

3.1 Self-Determination Theory

Since its inception in the early 1970's (Deci, 1971) Self-determination theory (hereafter SDT) separates the content of goals/outcomes and processes through which these goals/outcomes are pursued (Deci & Ryan, 2000, p. 229). In so doing, SDT takes into account to what degree psychological needs are met by striving to attain goals. This separation between goal pursuit, depending on what and how it fulfils needs is the crucial element of SDT (Deci, 1972, p. 228; Deci & Ryan, 2000, p. 227). How the individual internalises the basis of the activity studied is at the core of SDT and a strong distinction is made between intrinsic motivation (to the far right in the figure below) the next lower step "Integrated Regulation", where most of the basis has been internalised, but fully. This distinction constitutes an interesting delineation in the theory and is part of its allure.

Graph 1 Stages of internalisation in the SDT model



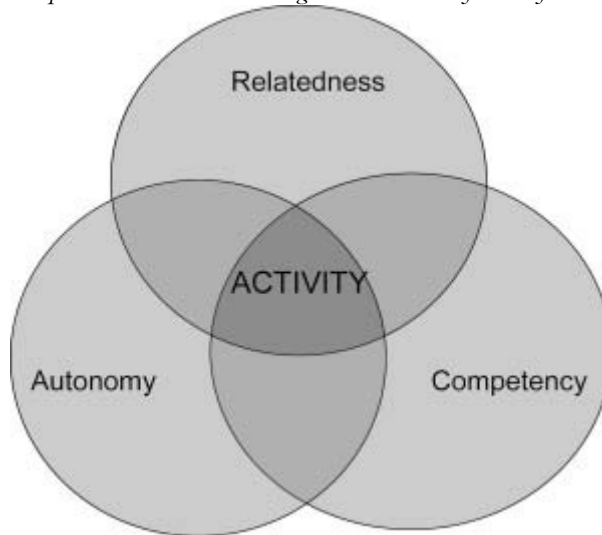
Source: (White & Thompson, 2009, p. 565)

SDT has surfaced as an increasingly important driver of business research, generally in marketing research and more specifically in social- or public-marketing research. This application on business and organisation aspects was also a part of SDT from the very onset (Deci, 1972). To me it seems that the reasons for this have to do with an increasing concern, both among European and US business researchers that social marketing efforts were

perhaps turning increasingly in favour of the state over the individual. SDT offers explanations as to why this may not be sustainable, while at the same time offering insights into how intrinsic drivers may help attain the same societal goals without coercion.

At its core I see SDT as a model which argues that long-term change is only sustainable when motives are internalised in the individual and extrinsic motivation is reduced to supporting the development of autonomy in the individual. Three components interact to explain individual action. Firstly the individuals Autonomy to make choices and control her own decision making process, secondly the Competency of the individual to attain results with regard to decisions, and thirdly Relatedness which concerns the social context in which the individual makes these choices and develops her competence.

Graph 2 Venn circles describing the interaction of SDT-factors



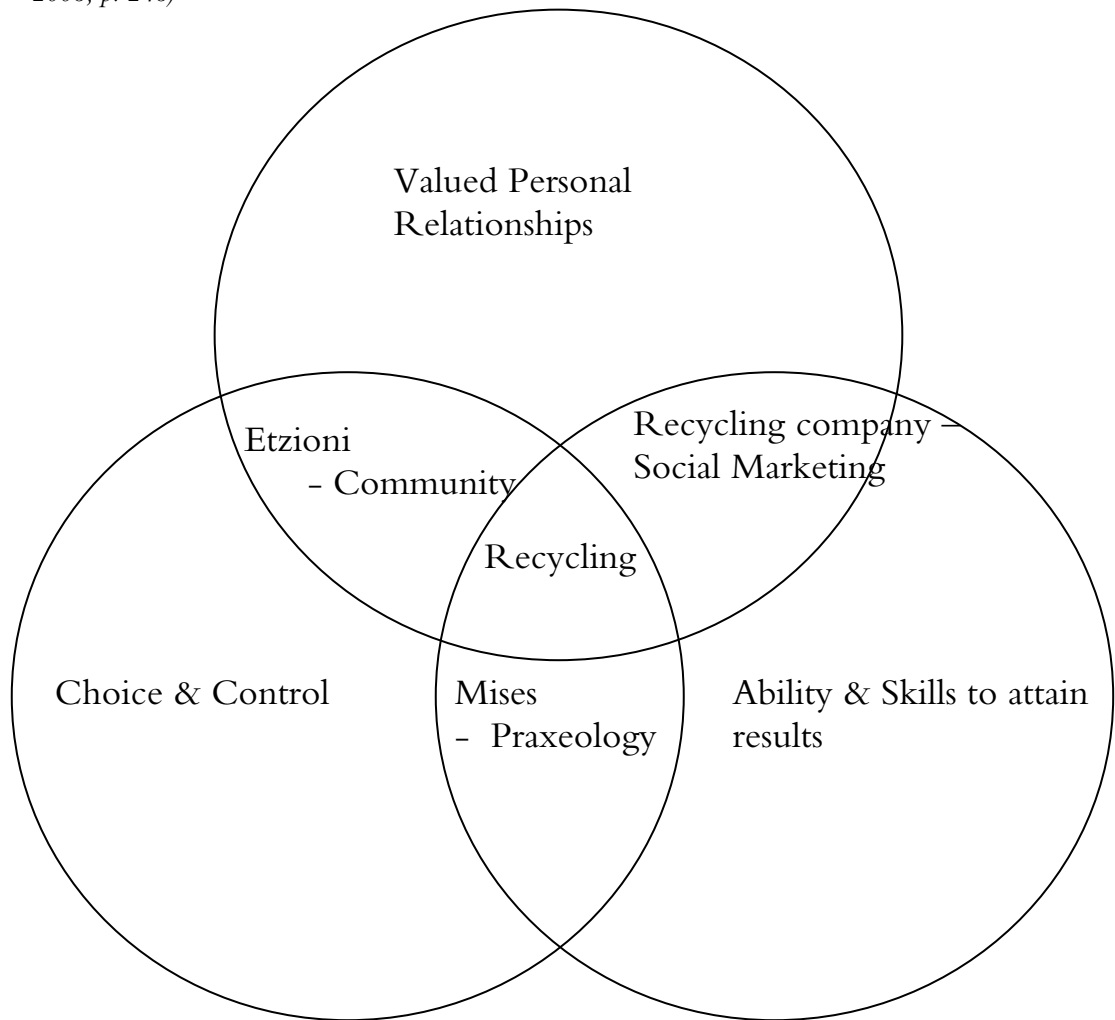
Source: (Webster, 2008, p. 248)

In business research, SDT has been used in various fields; most notably in studies pertaining to workforce motivation (Gagné & Deci, 2005) and management (Pieper, 2010), but also in marketing (White & Thompson, 2009), entrepreneurship (Harris et al., 2009) and even recycling studies (Moller et al., 2006).

The Deci and Ryan (2000) article on human motivation set the stage for a more prolific use of SDT outside its psychological origins. Since then SDT has been used to show how job seeking behaviour is influenced and is possible to influence (Vansteenkiste et al., 2004) in terms of societal policy and individual programmes. It has also been used to explain the mechanisms behind changes in consumer behaviour where the consumer's realisation of her own mortality has been changed (Arndt et al., 2004). The latter is of interest in that it shows us how socially beneficial behaviour may be induced without coercive action on the part of society (Arndt et al., 2004, p. 210); with the central thesis being that greater results may be imparted by empowering the individuals. The importance of achieving this on both a private and work-related level was further elaborated in Gagné & Deci (2005). Since recycling is commonly associated with a perceived benefits of participation I am also pleased to see that SDT offers insightful explanations of the "happiness paradox". In short SDT posits that while both the thwarted fulfilment of basic psychological needs AND the internalisation of a materialistic culture may lead to the happiness paradox, it is only the first condition that is the necessary and sufficient condition (Pugno, 2008, pp. 1341-1342). Also of direct consequence to my research is the insights offered by SDT on volunteer motivation, since much of the studied recycling programme was based on such efforts. Here the theory offers insight into the design of such programmes to benefit both the volunteer and the task to be performed by strengthening the autonomy of the volunteers and balancing the control which they exert over their tasks (Millette & Gagné, 2008, p. 20). In terms of holistic sustainability, SDT has also been shown to have explanatory power on the participation rates of otherwise disenfranchised citizens such as the elderly (Webster, 2008, p. 241). Again an important aspect when recycling is concerned, since the disenfranchised are often harder to reach in public policy programmes (Jensen & Nielsen, 2001; Martin et al., 2006). Long-term commitment to ideas and values is at the core of recycling and here the theory again offers insights into how the internalisation can come about without the use of coercion or threat (Stone et al., 2009, pp. 22-23).

All in all, the business related research done within the fold of SDT shows that it has something to offer. What strikes me as perhaps most interesting concerns the interaction between the SDT-factors themselves. It is here that I see how the parts of my theoretical puzzle start to fit together.

Graph 3 A modified SDT Vann diagram as used in this thesis modified after (Webster, 2008, p. 248)



Autonomy and Competency deals with the individual's ability to combine her degree of choice and control over the situation with her actual skills and ability to reach results, and this in turn is precisely what I see the Praxeological theory of Ludwig von Mises doing so well. When Competency and Relatedness meet, or when the individuals degree of control and choices are compared to the social context, I see the

Communitarian approach of Amitai Etzioni to be at its fore. Finally, when the recycling company OR the community of which the individual is a part are confronted with the individual's skills, we contrast Relatedness with Competency in the SDT model – and these three all in turn influence recycling rates. While the latter intersection can be said to represent the public policymakers' efforts at implementing policy, the two previous need a more solid theoretical basis if they are to offer us insights into the mechanisms at hand.

3.2 Filling the gaps - Communitarianism & Praxeology explained!

Many Swedes probably retain fond memories of the garbage chutes that dotted the stairways of apartment buildings not more than 10 years ago. If for nothing else, because it made waste go away quickly and without long walks to the crowded, stinking recycling room which some may find dominate the image of waste management today. At the same time most of us realise that recycling is environmentally sound, and that it is worth doing; at least as long as it doesn't interfere with something more important...

To Swedish recycling companies this is an everyday headache. How are they to combine a reasonably rational collection system with a convenient end-user system while the government increases environmental standards? The equation can hardly be solved, and this conundrum is at the very core of this text. Something has to be done, somehow new approaches to the entire problem need to be found in order for this business to make ends meet.

My insistence on contrasting a group vs individualist perspective carried with it a number of theoretical implications. However the insistence as such should be deliberated upon as well. Applying a "business perspective" would have been tempting. Superficially such a decision would have anchored the study in an ongoing scientific discussion. But would it? I maintain that this would have only given us an illusion of control. First of all, it would not have been an approach in line with an abductive method, but that choice of method may of course be questioned as well. So let us assume a more deductive approach and some of the more viable alternatives available to me.

Theories of technology adoption, such as envisioned in Gabriel Tarde's "Les lois de l'imitation" (Tarde, 1890) and popularised in the business

discourse through Everett Rogers “Diffusion of Innovation” (Rogers, 2003) would have been one venue. In a sense innovations in recycling systems constitute an example of the sort of phenomenon described by both Tarde and Rogers. In particular Tardes insistence on repetition being the mother of diversity is appealing to me as it mimics what can be seen in the daily reiteration of recycling behaviour and the plethora of behaviours we have observed. Rogers terminology is hard not to touch upon since it is sort of an industry standard in the field of innovation diffusion. However, I was afraid that the underlying optimism and endorsement of innovation as a concept would obscure the inherent resistance to recycling innovation that I encountered early on in our first empirical studies. My early adopters could very well be in the avant-garde precisely because they disprove of the innovation, but seek to manage it by staying ahead of the mainstay. If so that could of course be not only an interesting observation but a major contribution to our understanding of “Early adopters”. However, this consideration was precisely the reason why I did not want to use Rogers model. Improving on the “Diffusion of innovations” model was not my aim, but to understand the full spectrum of motives belying recycling.

Another “rear guard action” that I have been forced to conduct concerns the applicability of a “Schumpeterian” perspective on my research. Again, such a perspective, with its focus on innovation, cyclical transition of behaviour, and a focus on entrepreneurs as drivers of change may seem to have much in common with the topic of my thesis. As was the case with Rogers, I acknowledge the potential good of adhering to a more widely used method of thought. But, on the other hand, I view see this mainstreaming of my frame of reference as a threat to my possibilities to see what is truly new in my material. To the extent that these perspectives and my results coincide I shall be glad to revisit them in later works. Everett Rogers and Joseph Schumpeter can be found as references in the applied research in my field already and part of my approach is to contrast the already known/seen with perspectives less often used. That, to me, is a contribution – to contrast as opposed to reiterate!

However, let me deliberate on what I saw as the potential alternatives.

So what is my rationale for positing communitarianism and praxeology then?

Well in short, I proposed that by combining the communitarian perspectives of Amitai Etzioni and the praxeological axiom of Ludwig von Mises we may gain critical understanding of how to view this problem. My

reasoning for contrasting these two systems of thought was that I envisioned a communitarian approach to serve us well in explaining the bulk of recycling behaviour; i.e. the very situations where aggregate or group behaviour is the cornerstone. However, this advantage might put communitarianism at a disadvantage when explaining marginal or extreme recycling behaviour; where individual actions give a marked difference. The latter would then be a situation where praxeology would offer an explanation. So the combination would ensure enough explanatory power to cover all observations, while at the same time give me a chance to test the validity of either model in a broader context than that envisioned.

In spite of being on the verbose side, there is a crisp and alert side to Mises' work, his texts are enthralling and the absence of mathematics, while off-putting to many non-Austrian¹¹ economists, is often appealing to social scientists. In dealing with recycling, a largely collective concern, I soon felt the need to reacquaint myself with Mises. I wanted to see whether his theories could offer insights into the issues of attitudes, social- and mass-marketing that I focus on. The answer soon appeared to be at the very core of Mises production, in his magnum opus "Human Action", where Mises delivers his axiom of all human action. Where others would go on indefinitely to chase down yet another set of determinants of recycling behaviour, Mises offers a theory which enables a radically different perspective. Firmly at the observable outcome of thousands of individual actions. Since this is how recycling companies study their own business every day; it seems reasonable that there should be something to be gained from using it as focus for my research as well.

Amitai Etzioni on the other hand offers a set of theories with an ability to help us understand and explain what we see on a daily basis among the masses. As our cooperation in the recycling research program evolved I came to understand increasingly how communitarianism could contribute yet another contrasting understanding of recycling behaviour. Utilising this perspective we note that recycling is, at its very core, a collective action. Only when done by a group, or possibly a majority, does it have any real effect. This is inherent in its nature and so it follows that the combined effort of individuals must be understood to explain shifts in behaviour.

At a very basic level recycling is thus a community concern, displaying all of the characteristic elements of communitarianism. However, as with most

¹¹ "Austrian" as in the school of Austrian economics, and NOT the economics of the country of Austria!

community concerns, participation is only attractive to a certain degree. Individual incentives to participate depend on a number of factors, but always decline as higher levels of participation are required. Communitarianism does not explain what happens when someone opts out, why this happens, or why ardent participants suddenly act out against a common principle and protest against it. Nor does it help recycling companies understand what they need to do to further increase already high levels of compliance.

This is where Mises praxeology comes into the picture, and a balance or combination of the two perspectives seems promising!

While both communitarianism and praxeology separately help explain recycling behaviour in its infancy and as a mass movement, I will argue that only a combination of the two helps us understand recycling in a Swedish context. In addition, praxeology's focus on the individual level helps us understand the more subtle aspects of individual response to higher demands on compliance. Communitarianism on the other hand, may well hold sway over praxeology at lower levels of compliance since it neatly aggregates majority responses to general/mid-level compliance.

I shall endeavour to show how these two systems may complement and complete our understanding of all levels of compliance in recycling.

3.3 Communitarianism

Communitarianism does not contain one, single theory of society, but is rather the result of the ongoing research efforts of many scholars in the field. I have chosen to emphasise the communitarianism of Amitai Etzioni. The reason is twofold, firstly because he has constantly idealised Sweden as a role model for the communitarian movement in his published works, and secondly because of the strong focus on the practical aspects of societal governance in his texts. While the former is convenient and makes his theories more applicable to the Swedish setting, the latter is essential to research that purports to say something of society and the societal governance studied.

3.3.1 Communitarianism – defined

Defining communitarianism is no easy task, as it is a lively discourse, and Etzioni himself has added and changed the details of the concept throughout his research. However, some elements have remained near

constant during the last 30 or so years, and I will present my understanding of communitarianism as it stands today.

At the heart of communitarianism is the community itself. A self supporting unit within society, which may be a part of society or, if large enough, the very characteristic of society. Regardless of its size or importance it has four components.

Etzioni's 1968 definition of Community (Etzioni, 1968)

A community is a societal unit which maintains its:

- a) own boundaries
- b) inner structure
- c) political organization
- d) independence from external units

The borders maintained may be physical, mental or both, but define who belongs and who do not belong to the group. This group, once defined, is capable of maintaining some level of inner structure, which in turn is strong enough to support a political organisation with which to channel the will of the group. This clearly defined group (Etzioni, 1968, p. 554) may then declare its de facto independence from other groups in society. Etzioni then goes on to declare that this is not enough, for a community to assert its position it has to be politicised. Displaying within itself integrative powers

A political community (Etzioni, 1968, p. 554) :

- a) has sufficient coercive power to counter members or coalitions of members
- b) has a decision making centre which is able to affect resource allocation within the community
- c) is the dominant focus of political loyalty for the majority of politically active citizens

This addition to the community definition puts Etzioni's 1968 definition close to traditional state definitions and excludes an entire spectrum of groups which might fit well into the first 4 aspects of the definition. In more recent text Etzioni reduces the above to a mere two points. The first, a web of affect-laden relationships among a group of individuals. Relationships that often crisscross and reinforce one another (rather than merely one-on-one relationships or chain-like individual relationships.). The second, a measure of commitment to a set of shared values, norms and meanings, and a shared history and identity (Etzioni, 2001, p. 359) – in short, to a particular culture.

Etzionis 2001 definition of Community

- a) A web of reinforcing relations
- b) A commitment to a set of shared values

Indeed, I argue that when considering Etzionis later texts he downplays the political dimension (Etzioni, 2002, pp. 96-97, 99) and emphasises the commonality (Etzioni, 2001, pp. 362-363) of shared positive values in communities more than anything else. This enables us to regard benign popular movements as communities or proto-communities, and in turn a group of neighbours taking a mutual interest in recycling as a recycling community. A development foreshadowed in his 1968 definition (Etzioni, 1968, p. 555) as he writes that loyalty is required only in matters of politics and not for example in religious matters. Thus clearly limiting the scope of community and shifting its focus to shared values. These shared values clearly have a parallel in attitudes towards recycling. Ultimate values and end goals need not be shared by all members, as long as there is consensus on prevailing political themes (Etzioni, 1968, p. 555). This addition has direct implications on recycling for example, where it is often the case that individuals share in the immediate theme, but are uncertain or ambiguous about the end goals as presented by government or recycling companies. Regarding groups of recyclers with shared values and goals for their recycling activities as communities in Etzioni sense clearly helps us to explain for example why recycling rates differ between areas.

While both definitions primarily apply to larger society wide communities, even Etzioni shows that they are also applicable to smaller subsets of society (Etzioni, 2001, p. 363) which share (Etzioni, 2002, pp. 97-98) the above traits. I will argue and demonstrate that communal recycling in Sweden can be regarded in this light and that this has far reaching implications for possibilities to achieve government goals in this respect. This is relevant since Etzioni also emphasises that when an underlying sense of community is missing, societal efforts may have to rely on laws and regulations which have little or no underpinning from a common moral ground. Etzioni cites the US prohibition on alcohol in the 1930s, and the current “war on drugs” (Etzioni, 2001, p. 360), as his two examples. To those two we might add recycling, since it shares in the characteristics of the above except perhaps in its inherent nefariousness. This interchange of morals and law is interesting as the communitarian hypothesis is that a good law is one sprung from a common moral, whereas a law which attempts to transform individual understanding of morals is only feasible in theocracies or totalitarian regimes

(Etzioni, 2001, p. 360). The immediate result is a duality to which Etzioni frequently returns, where Moral Anarchy is at the opposite of Moral Totalitarianism, with the Communitarian reaction in the middle (Etzioni, 2001, 2002, p. 361). The end result has far reaching implications for what achievements are possible for societal organisations such as recycling. Whether recycling is sprung from a common moral ground or a law trying to transform public morals may be debatable, but that it resides along this continuum and that the dilemma to which it belongs is interesting is clear.

3.3.2 Three types of society

Three archetypical societies emerge in Etzionis writings, including his communitarian vision, there is also the holistic society and the liberal society (Etzioni, 2002, p. 90). These are essential to the definition of communities and I will use these three to describe various facets of the recycling system, and therefore need to deliberate on their characteristics and differences.

Differences are manifest in the views on the role of governments, values, fostering citizens and individuals as well as their rationale. This is all interconnected and Etzioni's view on government is a bit surprising as he does not go into details about the specifics of each system. Instead he focuses on how each type of government approaches core values in society. Succinctly put Holistic society has the ambition to foster citizens in all manner of values above and beyond the core values. As an effect Holistic society refers to any system which limits pluralism through its policies, thus including every form of government from the social conservative to the theocratic. Differences in degree exist of course, and it is clear that theocratic systems which turn obedience and submission into virtue form the end of the spectrum. At the other end of the spectrum Etzioni posits Liberal society¹² which is defined by its lack of interest in fostering citizens, its lack of core values beyond participation in civil society.

¹² Perhaps even Anarcho-libertarian

Table 7 Characteristics of the three principle societies envisioned by Etzioni

Society	Value relation	Characteristic	Typical state	Extreme form
Holistic	Value-normative	Absolute preferences – forbidding of differences	Holistic government	Theocracy
Communitarian	Value-sharing	Open about core preferences – accepting of differences	Limited government	Welfare state
Liberal	Value-neutral	No preferences – embracing differences for the sake thereof	Night-watcher state	Anarcho-libertarian

To Etzioni this form of relativism and indifference to good or bad, makes society unruly and open to totalitarian forces once again (Etzioni, 2002, pp. 93, 97), even though Liberal society came about as a response to the excesses of Holistic societies. In the middle of the spectrum is Communitarian society, where society Etzioni takes each society’s approach to music as an allegory. Communitarian societies may promote musicality as such unlike Liberal society which promotes nil, while not favouring any particular form of music over another as in Holistic society (Etzioni, 2002, p. 92). Extending this comparison to recycling Communitarian society promotes recycling as such, but allows it to take on many forms, whereas Liberal society promotes nothing and Holistic society promote one particular and absolute approach to recycling. These archetypes and the extremes to which they may lead offer interesting insights into what different policy measures in recycling may take us.

3.3.3 Attaining societal compliance through Moral voice

Once defined the above three forms of society have different ways of promoting desired behaviour. However, regardless of the scope of influence desired all societies share three mechanisms to nurture virtuous behaviour.

Initially individuals are influenced through “agencies of socialisation”, i.e. families, schools, churches, voluntary organisations, which are primary and

an integral part of most human existence. Secondly through “agencies of social reinforcement”, i.e. organisations which support the values induced by the first order of agencies, such as peer groups, friends, community leaders, etc. This is where values are reinforced and confirmed. Thirdly, societies influence their members through “societal institutions” (Etzioni, 2002, p. 92), where a set of values is intrinsic to the concept as for example in marriage. In recycling socialisation through ones family, schools etc is an important basis for compliance, and clearly this basis is reinforced by the secondary agencies of “social reinforcement”. If your friends or the community in which you live do not support or partake actively in recycling then the odds that you will deteriorate. The “societal institutions” Etzioni talks about, in this case correspond to long term societal efforts with a high degree of acceptance, like for example the refund system in the Swedish case. However, the essential component is that in all three mechanisms influence is dealt with by Etzionis concept of Moral voice which engages in ongoing perpetual Moral dialogues.

All new or changed values thus have to take into account older patterns in society, and this process forms what Etzioni terms the ongoing Moral dialogue. A Moral dialogue is any argument where the proponents discuss right and wrong and how this relates to traditional values. Thus tradition is the reference to which all new moral dialogues are linked. This is an interesting distinction made by Etzioni as it emphasises tradition at the expense of facts and rational deliberation unless the facts and deliberations support or contend tradition. That latter facet is especially interesting as it suggests that new systems have to be built while taking into consideration older perspectives that support the modus operandi of the new. Construing a new recycling system would therefore be no different from a communitarian perspective. Most new behavioural patterns draw upon older widely shared notions or morality and apply them on the new situation. Consequently identifying and appealing to established morals adds to the likelihood of success of a new societal project such as recycling. In this sense Etzioni concludes:

“[moral dialogues]... differ from rational deliberations the way ethics differs from engineering.”! (Etzioni, 2001, p. 368)

As a result moral dialogues provide guidance to rational deliberation so that the end result is satisfactory and in line with expectations. However, it should also be noted that the end result is particular to every situation and it need not be a good or benign end result. People may still opt to act against

the norm, and decide that the best course of action is to tax evade, drive too fast or not recycle. Due to the uncertainty of the outcome Etzioni argues that the Moral dialogue must also be accompanied by a criterion for moral judgement. When old conceptions are challenged by new situations moral guidance can provide a positive shift. However, for this to be effectual it needs to be a position, near deontological in character and self-evident to most people in that community (Etzioni, 2001, pp. 368-369). This position lends new depth to the old maxim in recycling that “It should be easy to do the right thing”. Usually this is interpreted as a signal that the technical/practical sides of a recycling system should be prioritised and user-friendly. However, applying Etzionis insights onto this maxim tells us that the “ease” has just as much to do with the inner moral dialogue taking the preferred decision! While it is of course preferable that the act of recycling should be an easy one, the moral voice of the individual should likewise be helped on its way to reach a decision to recycle or not.

Etzioni views moral voice as a mediator between an oppressive system and a liberal one, and even regards moral voice as the best defence against oppression. This is also where Etzioni points to the main difference between a liberal society’s view of mankind and a communitarian view. Whereas any external pressure would be to the negative if man was entirely good by nature, some external influence is necessary if we consider man to be less than good. Etzionis communitarianism therefore presupposes that rational man can only exist in the context of a social order (Etzioni, 2002, p. 94).

Moral voice in itself is not coercive according to Etzioni; it turns coercive depending on the setting. If anything, the moral voice in contemporary western societies is too conflicted, too hesitant or weak to provide guidance in the communitarian sense (Etzioni, 2002, p. 94). In fact it is central to Etzioni that western societies are afraid to speak out as to what norms and values are to be regarded as normatively better than or preferred to others. To Etzioni it is the fallacy of modern society that it does not differentiate between good voluntary associations and bad ones. Instead all associations which make us better citizens; that is, better at taking part in civil society, are regarded as equal, when indeed some organisations which provide more proficient citizens may be counter or neutral to training “good” citizens. Etzioni argues that while a bowling club, or even a racist organisation may both foster “active” citizens they do not foster “good citizens”(Etzioni, 2002, pp. 96-97, 99) (Etzioni, 2001, pp. 362-363). Communitarians argue that for oppressive Holistic society to be avoided, liberal neutrality or relativism with regard to the values taught by organisations cannot be

overlooked. In addition, the moral void which ensues when society no longer has any say in what is good or bad is readily and easily filled by religious fundamentalism (Etzioni, 2002, p. 103). Even this has a bearing on our understanding of recycling. A recycling system which fosters “active” but counterproductive participation is inertly flawed, and a system which tries to foster a desired behaviour, but fails to induce “action” in Etzioni’s meaning is also useless. The policy design challenge thus lies in combining these facets to find a system which both activates AND encourages participation without resorting to oppression. So the goal is set, but the means have to be established, and this is done by careful modulation of the moral voice.

3.3.4 Different tones of voice

In turn this social order and moral voice influences citizens through a set of principle measures: **persuasion, cajoling, censure and force** (Etzioni, 2002, p. 94). I would think of these as four tones inherent to moral voice, four levels of pressure applied through moral voice differing depending on the type of society using it. To Etzioni’s list I add **education**, since it is stressed elsewhere that it is a part of these tonalities of Moral voice, perhaps I may liken education to the “timbre” of the tone of voice (Etzioni, 1968, 1975, 1988, 2001, 2002, pp. 199-200, 535).¹³ This is where communitarianism turns really interesting as it offers the possibility to create a very distinct model of how citizens are influenced. If we analyse the meaning of these mechanisms in conjunction with the three forms of society defined above we should get a workable model of the different forms of influence available to societies to compel their citizens.

I therefore propose that these five principle measures of influence be ordered from the weakest to the strongest Moral voice forming the following scale.

Weak Moral voice				Strong Moral voice
Cajoling	Education	Persuasion	Censure	Coercion

Next, I assume that it is reasonable that the five mechanisms above are used differently when applied in different societies. To test this hypothesis I conducted a simple cluster analysis of the synonyms for these five key words, using a recognized on-line service (*Semantic Atlas - English-French /*

¹³ More specifically: Etzioni (1999) p.92. E2, Etzioni (1971) p. 337. Etzioni (1968) pp. 199-200, 535. Etzioni (1988) pp. 196-198. Etzioni (2001) p. 368. E3

French-English Bilingual Dictionary English French Spanish Synonym Dictionary and Translation). I decided to test the outcome of a three cluster analysis' to see whether this gave rise to a division of synonyms that provided a further understanding of the sublime differences between the groups of synonyms.

For example, where a Liberal society would try to cajole its citizens to recycle through flattery: “No matter how you recycle, your recycling efforts matters”, a Communitarian society would try to induce voting behaviour: “We all recycle to preserve nature, why don’t you recycler too – it’s the right thing to do!”. Finally a Holistic society would go one step further by trying to coax citizens into voting: “Recycle for the sake of society, you know we are right!”. In the matrixes below I elaborate on the examples

Table 8 “Tone of voice” used depending on type of society and moral voice.

Typ of Society	Weak MV				Strong MV
	Cajoling	Education	Persuasion	Censure	Coercion
Holistic	Coax	Indoctrinate	Impel	Condemn	Repress
Communitarian	Induce	Cultivate	Assure	Reprimand	Pressure
Liberal	Flatter	Enlighten	Allure	Deplore	Intimidate

Source: Interpretation of verbal cluster analysis performed through (*Semantic Atlas - English-French / French-English Bilingual Dictionary English French Spanish Synonym Dictionary and Translation*), see Appendix 1 for a more complete list synonyms and clusters formed.

Table 9 Examples of the “Tone of voice” used in different recycling contexts.

Typ of Society	Weak MV			Strong MV	
	Cajoling	Education	Persuasion	Censure	Coercion
Holistic	Recycle for the sake of society!	100% recycling of bottle caps yields enough steel to produce 2200 cars!	We need to increase recycling to save the planet!	Non-recycling is unacceptable! It goes against what has been agreed upon	Haz-mats in the compost mean we will initiate a police investigation !
Communitarian	We all recycle! Why don't you?	You can improve recycling rates by...	You have done well so far – keep up the good work!	Your recycling behaviour is sub-par. Improve!	Putting haz-mats in the compost results in the whole block being fined!
Liberal	Your recycling matters!	Paper can be recycled 7 times!	Recycle! We will help you with equipment!	It is sad that this apartment block hasn't improved its recycling rates!	If you keep putting haz-mats in the compost you might be fined!

I was positively surprised to see that for each key-word, the three cluster analysis rendered results which easily translated into three levels of harshness. Three statistically and verbally distinct sets of synonyms that readily transfer into the model above. I would hold that this matrix is a viable and testable basis for further investigation into the mechanisms of compliance in many fields other than recycling. Later I will return to this model and put it to the test to see if it has a practical operability as well. I will also return to it later in this paper as I attempt to create a synthesis between communitarianism and praxeology. For now, suffice it to say that I addressed this problem since I hypothesise that from Etzionis framework we may receive hints as to what measures are appropriate or even possible at different levels of recycling. Being sensitive to this ordering of the methods we also become aware of what a recycling system looks like which starts to shift over to a holistic/coercive position. This may serve as an important signal in our empirical work and a means of categorising different recycling solutions.

Table 10 My focus as a function of recycling rates and tone of voice

Moral	Sanctimonious Altruism			3. Trust	4. Obsession	90%+
	Rational Altruism			3. Trust		60-90%
Calculative	Agreements		2. Carrot			0-80%
Alienative	Submission	1. Stick				0-30%
		Force/Fear	Economy	Knowledge	Propaganda	Recycling rate
Etzionis original terms		Coercive	Utilitarian	Normative		

3.4 Praxeology - an axiom revisited

3.4.1 Praxeology – defined

Praxeology (P), as defined (Mises, 1996, p. 26) by Austrian¹⁴ economist Ludwig von Mises, is a tool to facilitate our understanding of human actions. While normally applied to economics and more specifically the workings of the market, it is my intention to use it in a broader context. As an axiom of human action it offers new insights into the workings of individual compliance with government programmes. In its capacity as an axiom, praxeology should be seen as an “a posteriori” construct of universal observations of the human mind and human action (Rothbard, 1951, p. 181). Even more so since it offers a novel perspective on environmental compliance issues, not normally taken into account by main stream literature.

With its origins in Austrian economics, praxeology is even more suitable in situations where marginal effects are to be understood. While most recycling behaviour can be described using theories of planned behaviour, statistical surveys of determinants and their like, understanding, explaining or even describing recycling behaviour at the margins of compliance is difficult. The communitarian approach lends us insights that lead up to the margins, but as compliance approaches 100% the addition of a more fundamental theoretical foundation is needed. Referring back to the previous chapter I would say that when a system in Etzionis terms nears the extremes we would do well to look to praxeology to see how this perspective may help us to understand the workings of recycling on the margins.

By adopting a praxeological approach we need no more concern ourselves with anything but the observable actions of humans themselves. We can limit ourselves to WHAT people DO. The psychological issue of WHY people do things is already covered by the axiom, and any psychological explanation is reduced to a verbal superstructure to the actual, praxeological reason for action. HOW people go about their environmental chores is a technical issue and serves only as a means to observe action and to explain

¹⁴ Again; “Austrian” as in the school of Austrian economics, and NOT the economics of the country of Austria!

the manner of problem solving among individuals. Furthermore the complex ethical issues pertaining to the environment and how/what people SHOULD do, with which Communitarianism is preoccupied, only concerns praxeology in as much as it is vectored into the decision to act. Finally actions of the past are reduced to means and ends adopted at the time and in that particular context of action. A context which is constantly dynamic and ever changing – yet another characteristic of praxeology which makes it singularly well adapted to the study of human action in the field of environmental issues (Rothbard, 1997, p. 13). What this tells us is that by applying praxeology we apply a value free tool, that does not judge the action taken by the individual, only notes it and from it infers the preference of the individual at the time of action.

So how are we to understand praxeology in the context of this thesis? The following is an attempt at categorising the different elements of Praxeology as I understand them into one set of conditions. It should be noted that other scholars may identify other sets of conditions, and that my list is derived from the particular usage I opt for in my research. For example, I divide the issue of improvement (2 & 4) into two different aspects in order to highlight the difference between the ambition to improve and the possibility to improve.

Components of the Praxeological Axiom of Action

1. Understanding of the situation at hand
2. Search for improvement
3. Focus on the future
4. Perceived possibility of improvement
5. Choice of means with respect to goal
6. Decisions made on ordinal basis
7. Marginal utility of additional action

3.4.2 Understanding of the situation at hand

At the core of praxeology is the meaning or understanding of the situation at hand with which the individual ascribes the situation (Mises, 1996, p. 26). Whether this is the only objectively correct understanding or not is irrelevant as it is the only interpretation available to the individual at the time (Callahan, 2005, p. 233). However, as with language skills, modern Austrians maintain that the human mind is hardwired to rapidly understand and evaluate economic valuations and principles (Smith, 1999, pp. 198, 201–202).

To me this is an appealing characteristic of praxeology since it puts emphasis on the free will of the individual and his/her actions. The understanding may be faulty from our perspective as observers and the individual may regret or take back her position at a later time, but that does not detract from the fact that it was perfectly rational at the time of its inception. What is done is done. In this context, littering for example is an action taken on the spur of the moment and thus subject to a lightning fast understanding of the situation at hand. Recycling, as the more complex action, is also done in context of the place and circumstance where and when it is performed.

3.4.3 Search for Improvement

As soon as an understanding has been established the individual searches for improvement of the conditions affecting her. This is essential to praxeology; every conscious (Mises, 1996, p. 47) action is undertaken with the hope of attaining some higher level of satisfaction, and every action is done so due to uneasiness with current affairs and the ability to envision a better state (Mises, 1996, pp. 13-14).

Again, praxeology is very positive of the human spirit. Whether whimsical or premeditated every action is undertaken with the hope of improving the condition identified. The rationale may be complex and may change with time, but whatever drove the individual to undertake the action observed did so with the ambition to improve. This is also at the very core of any recycling action, we do so to dispose of waste, which in itself is an improvement on a state of uneasiness. However, we also need to understand that the uneasiness which compels us to dispose of waste need not be connected to a “correct” disposal in terms of the recycling system. Applying the axiom in full means that “correct” disposal is performed only when it in itself allows the individual to avoid or alleviate uneasiness!

3.4.4 Focus on the future

All actions are thus undertaken with an aim at the future, at improvements that can be projected to achieve a better state of affairs once the action taken is implemented (Mises, 1996, pp. 58, 100-101). Time perspectives are thus critical to human action.

This aspect of praxeology sets conscious human action apart from other observable action. This further strengthens the focus on conscious action on behalf of the individual; every action represents a need to project, to envision, no matter how short the time frame, the outcome of the action to

be undertaken. This is no little achievement or aspiration, and foreseeing the future is risky indeed, nevertheless action demonstrates the assessment made of future outcomes no matter how flawed it may be. It should be noted that in the Austrian discourse the ability to this slightly more accurately than others is what sets a successful Entrepreneur apart from the rest of the population (Mises, 1996, pp. 83, 217, 249, 582-583). As with chess players, the ability to foresee the future varies, but all have the opportunity to draw from past experience when making new or repeated choices.

In the choice to recycle or not the ability to draw upon previous experience is also important. Opting out has to be weighed against the risk of discovery and meticulous recycling is to be weighed against the time it takes and other possibly beneficial actions forsaken. The time frame in which the future focus operates is also vital. Does the individual perceive improvements in the near or far future? The rationale of recycling is sure to change depending on this. Here past experience and future prospects are masterfully mixed and taken into account before the action is undertaken.

3.4.5 Perceived possibility of improvement

The above conditions are not sufficient to warrant action however. In addition the individual must be able to attribute some measure of possible success to undertake the action, although it is always speculative. If not wholly able to remove the cause of dissatisfaction, action should at least have some chance of alleviating unease (Mises, 1996, pp. 14, 672).

In my view this perceived improvement is critical, and responds well to critics who ponder the issue of inaction, as a form of action. When no action is undertaken, there are two principle reasons. Either action provides no improvement irrespective of the chances of success, OR action is unlikely to yield improvement precisely due to the low chance of success. This too has a direct bearing on recycling, since the perceived benefit from recycle ranges from a) the aloof targets concerning the well-being of the planet to b) simply disposing of waste and all manner of mixtures of motives in between.

3.4.6 Choice of means with respect to goal

This mixture of potential motives leads us to consider what means to employ with regard to the envisioned goal of action. From a praxeological position it is necessary to reiterate that whatever means chosen to attain the decided goal are the least costly in the eyes of the actor (Callahan, 2005, p.

238). Thus no matter how frivolous a choice may seem, it reflects an attempt to increase satisfaction as it is understood by the actor (Mises, 1996, p. 243). In the long run the choice made may turn out to have been faulty or suboptimal, but at the time there is no reason to question the attempt at the time to reduce discomfort of some sort (Mises, 1996, p. 20).

This is important precisely because it sees rationality for what it is, conditional and contextual, fully dependant on the situation and not on post-hoc explanations. Thus if we are unable to understand or rationalise an observed behaviour, it is most likely because we are failing to understand the individual at the time of her action. This again mirrors very well the anomalies seemingly observed in recycling behaviour. What seems like irrational behaviour is dependent on the conditions under which the action was undertaken and the understanding of the context by the individual carrying out the action. Thus cheating on the recycling system is best understood as an action undertaken to alleviate some other grievance or discomfort, where the opportunity cost of this other circumstance weighed heavier in the eyes of the individual than non-recycling.

3.4.7 Decisions made on ordinal basis

According to praxeology, human actions are carried out one at a time and in order from the most pressing measure of unease towards lower issues of dissatisfaction (Mises, 1996, pp. 119, 201). Although the decision-making process may be rapid, all actions are a part of one and the same scale, and actions taken reflect upon this scale of urgency. It is thus possible to prefer 15 units of r to 7 units of p, while at the same time preferring 8 units of p to 15 units of r. This ability to order alternatives rationally also receives support from neurology (Smith, 1999, p. 132).

In essence this minute addition to praxeology is critical as it highlights why even the most productive of persons at times errs from her path. When more basic needs call to attention, it takes considerable resolve not be distracted as we all know. No matter how pressing a deadline looms, an unfamiliar smell, a physical need or a call from a long lost friend is almost certain to distract. This puts our attention to the priority and resolve with which individuals approach different matters.

From the perspective of recycling this sheds light on for example littering as an errant recycling behaviour. However well intentioned the individual is when about to discard a small piece of waste, there is a great risk that even a seemingly minute distraction, more imminent or immediate, will distract

from the desired behaviour. This applies even when the action is part of a routine behaviour. From a praxeological point of view a routine action is merely an action accorded a higher urgency than would otherwise be warranted or expected. Once distracted, the ordinal structure of upcoming decisions may well be off and the intended recycling action forgotten. This would shed light upon why the physical order of a recycling area is so important to the decision to recycle or not. At the same time it indicates that there may indeed be a very tangible upper limit to the effective participation in public policy programmes.

3.4.8 Marginal utility of additional action

The above leads to the inevitable conclusion that with every source of unease acted upon the remainder is increasingly less important. Even more so when several similar sources of dissatisfaction have been accumulated. Thus satisfaction with further action is diminished and action is less likely. Any action will be discontinued once the actor determines that additional effort no longer compensates for alternate actions (Mises, 1996, p. 132).

Although Mises warns against its uncritical use (Mises, 1996, p. 125), the Weber-Fechner¹⁵ law illustrates the point made. As a general supposition, the perceived sensation of an activity increases at an arithmetic rate, whereas the stimulus needed increases by a geometric rate of progression.

Sample of a difference between arithmetic and geometric rates of progression

Sensation	1	3	5	7	9	11	13	15	17	19
Stimulus	1	2	4	8	16	32	64	128	256	512

Thus when an activity goes from being novel to mundane, the stimuli needed to induce further satisfaction needs to increase dramatically if the individual is to continue doing it. Or conversely, other activities may take precedence and relegate the original activity to a later date while preferences are being reset. Not only does this have great ramifications on the macro level as recycling rates increase, it also affects the individual's willingness to

¹⁵ Today the Weber-Fechner law is generally replaced by Stevens power law, which differentiates between stimuli and their effect/progression.

(The Weber-Fechner law)

(Stevens' formula)

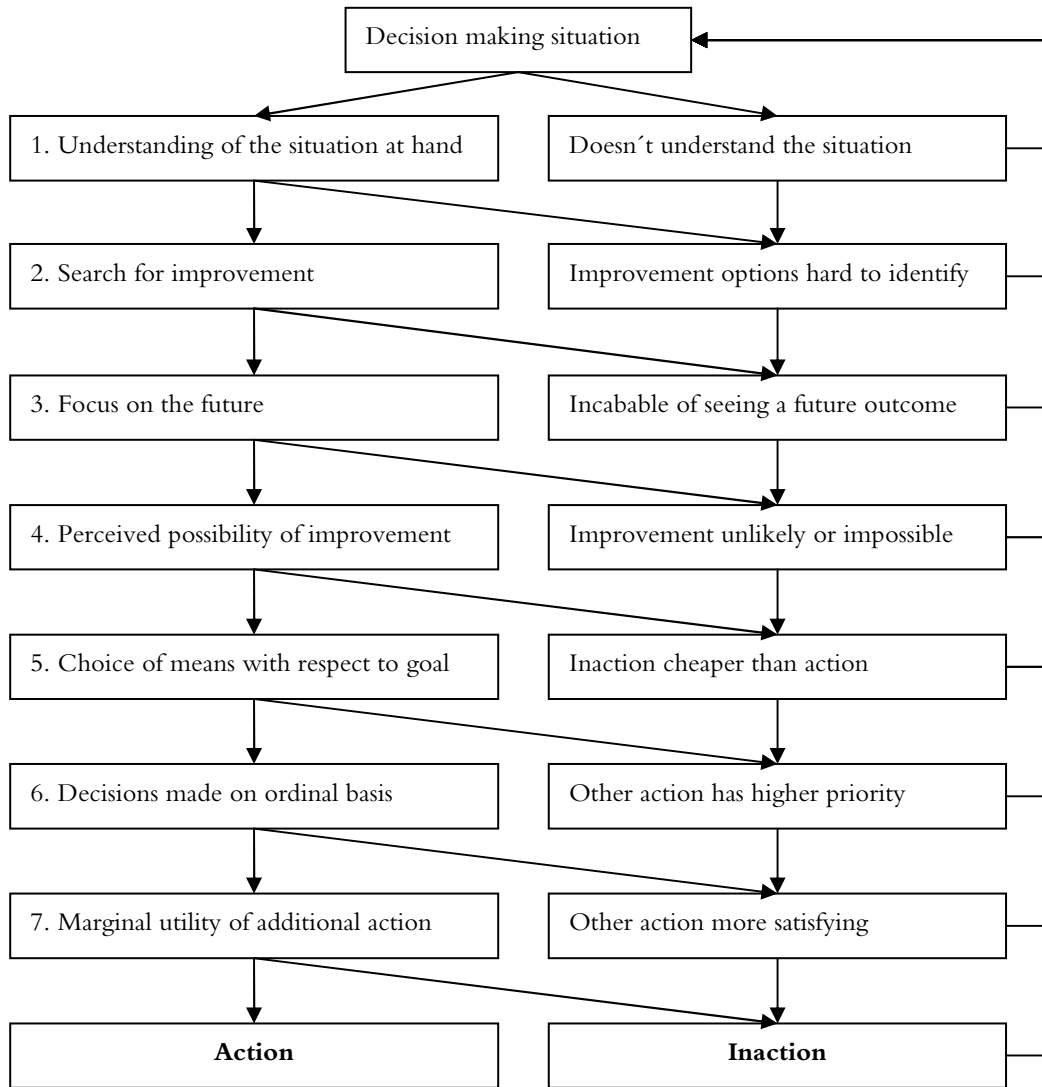
However, Stevens power law is even more "Austrian" in the sense that it takes into account dynamic and changing preferences depending on the particular form of stimuli! Maybe the time has come to formulate the a-exponent for different forms of recycling?! *(Stevens' power law - Wikipedia, the free encyclopedia)*

recycle large batches of waste in a single go. The two levels are interconnected of course, the former essentially being the aggregate of the latter. However, this also indicates that repetitive actions or excessive demands resulting in repetitive action may result in increasing difficulties in increasing participation. If we understand how individuals think about recycling we should also be able to determine whether it is the repetitive nature of recycling a little piecemeal over the course of a day or a week or the repetitive nature of recycling a larger batch of waste in a longer but continuous series that affects recycling rates the most. Both principle ways of recycling are in themselves repetitive when the aim is a recycling rate in excess of 80 or 90%, but the nature of how it is done should determine the outcome if praxeology is to be a guide.

3.4.9 Effects of praxeology on decision-making

In conclusion I have made a flow-chart to illustrate the relations between the seven components of the praxeological axiom. It should be noted that this is a continuous reiterative process in the human mind, near instantaneous and always active. As soon as no progress is made in the flow-chart or inaction is the end result, the process restarts and continues over and over.

Graph 4 Flow-chart of decision making as understood in praxeology



3.4.10 Praxeology – in context

According to praxeology, the act of recycling would thus be done to alleviate discomfort and remove sources of dissatisfaction. This is at the very heart of all waste management and therefore easily understood; waste disposal in some manner is a fundamental human need and action. What is more intricate is the extent to which an individual decides to recycle, an action much more complex and in excess of mere disposal. Every level of participation is unique and singular to that specific person, and that specific recycling fraction in the context of the action undertaken.

A person, who conscientiously recycles all of his newspapers one day, may return the next day only to find that the paper recycling bins are all full. A situation over which she has no control. He then decides to put the paper in with the household refuse instead, as this action still alleviates the immediate problem while not being overly in conflict with any ethical consideration towards the environment. An additional effort to make room for his newspapers in the correct recycling bin has to be weighed against the opportunity cost or effort already spent on recycling the newspapers and any other desirable actions. This is not at all irrational, nor is it a sign of some sinister plot to undermine recycling, rather it reflects a perfectly rational personal contextual understanding of the situation and an effort to reduce a source of unease while expending as little in the way of resources as is possible while maximising potential gain. And while this conduct holds true on that particular day, the next day preferences may have reverted based on a dynamic shift in the persons understanding of the recycling situation. Only the observed action can tell us.

The above applies to basic recycling, with lower levels of recycling. But how are we to understand the forerunners of recycling. Those whose primary motivator is purported to be altruism? Well, from a praxeological point of view Mises writes that:

If action is primarily directed toward the improvement of other people's conditions and is therefore commonly called altruistic, the uneasiness the actor wants to remove is his own present dissatisfaction with the expected state of other people's affairs in various periods of the future. In taking care of other people he aims at

alleviating his own dissatisfaction. (Mises, 1996, p. 496)

Thus recycling at the higher levels constantly contends with a rather complex mixtures of goals and considerations. Recycling for the sake of others, for altruistic reasons, is still a matter of acting to alleviate an increasingly smaller source of discomfort. Clearly praxeology fits snugly into the dynamic and ever changing nature of recycling. To summarise, Praxeology offers a plethora of avenues through which individual behaviour may be understood and influenced. Emphasis on the last, marginal actions offers us a tool to elaborate upon the communitarian model, to understand what takes place on the margins of behaviour.

3.4.11 A combined model

It is now time to combine communitarianism and praxeology to develop a tentative unified model of recycling behaviour. I suggest that both communitarianism and praxeology help explain lower and mid-levels of participation in recycling, but the vast majority of research devoted to the study of determinants etc speak in favour of using a communitarian approach to discuss this. It enables me to communicate with my own discourse and put my work into context. Having said that, I need to move away from communitarianism to explain what I see when the recycling system begins to display problems. Problems concerning decent recyclers suddenly breaking the rules of recycling; recycling companies having problems increasing recycling levels for certain fractions, etc, etc.

The above are not the problems of a fledgling system, where teething problems of a technical nature account for much of the frustration. These are the problems of a technically mature recycling system, with experienced recyclers and internationally high levels of recycling. Whereas the first set of problems arises where there is yet to be a community of recyclers or recycling, the second set of problems arise ONLY when there is a community in place. As such these problems may be seen as “luxury problems” by scholars and practitioner in countries where recycling is still in its infancy. But we need to remember that many recycling fractions depend fully on near perfect compliance to be environmentally sound. Used batteries, old pharmaceuticals and even compost recycling include waste which springs to mind. Dumping used batteries or old pharmaceuticals into the compost recycling bin is devastating even if only a tiny fraction of all recyclers do so!

This sheds light on why an increasingly more refined recycling system needs to pay attention even to luxury problems of compliance. It is clear that when the required compliance level causes even the most ardent recycler to fail on occasion, and many thousands of recyclers are urged to better themselves even further we can no longer regard recyclers as a unified group, we need to see to what motivates single key individuals.

3.4.12 Assumptions on compliance rates and populations

When compliance rates are discussed in waste management it is normally in the form of recycling rates. These rates are specified as measured collection of a certain fraction of waste from the collection system divided by the known input of that same fraction of waste into the system through consumption.

Recycling rate = Amount of fraction properly recycled/Total amount of fraction consumed in society

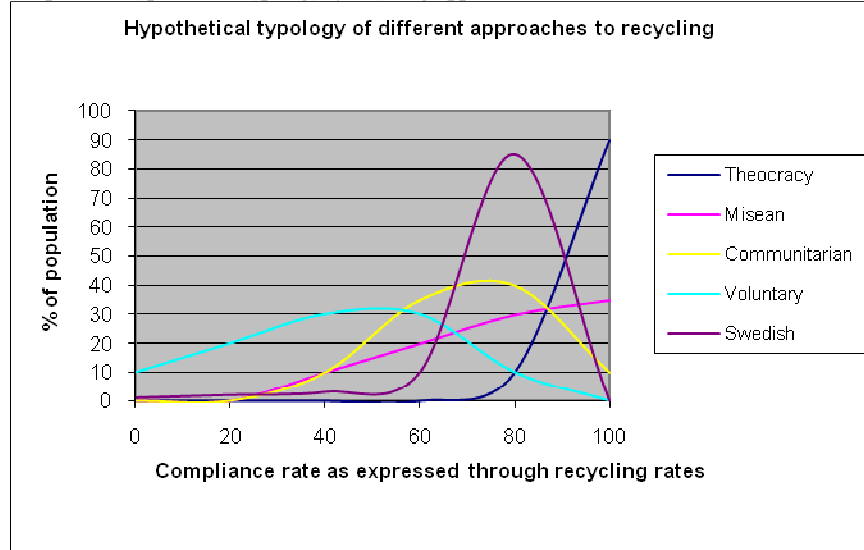
For the sake of simplicity the recycling rate is regarded as a measure of aggregate compliance in society. Such figures are available at the national level and at times also at the regional level. Where they are lacking it may be possible to get at least a rough assessment of the compliance levels by measuring the residual/unsorted waste being processed as opposed to the sorted/recycled waste.¹⁶

The overall Swedish household recycling rate was a record high 86% in 2003 (RVF, 2004) a high rate in an international comparison and ranged from around 68% for plastics to 95% for glass in 2007 (Wiquist, 2008).¹⁷ This means that most of the population is good at recycling, and according to our studies (Klingberg & Kågström, 2005b, a) very few Swedes have low recycling rates. Conversely very few Swedes are perfect or even near perfect recyclers.

¹⁶ Including what is thrown away along roadsides and in the forest...

¹⁷ This still gives a total recycling rate for 2007 in excess of 80% - authors estimate from available figures.

Graph 5 A hypothetical typology of recycling approaches

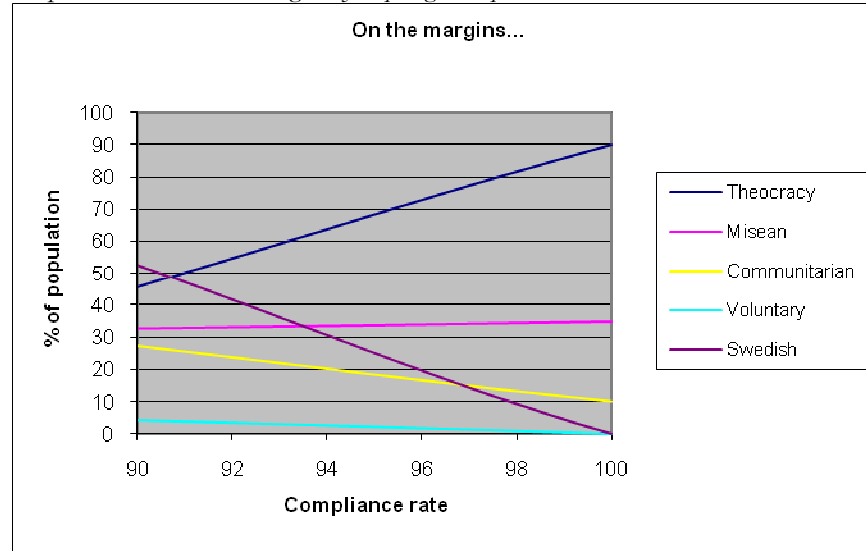


This results in a very even, bell-curved compliance around 80-86%. Taking into account other solutions, completely voluntary recycling systems such as the British or several US systems, get an even distribution of different recycling rates in a population. Using Etzionis terminology a voluntary system would translate into a Liberal society. An extreme Holistic society – a Theocracy centred upon the issue of recycling for the sake of the argument – would probably get extremely high compliance rates with few stragglers. Etzionis ideal Communitarian society where citizens are motivated by mutual values would probably mimic the Swedish system. Depending on the emphasis on recycling as an instrumental value it might be perceivable that a Communitarian society would have more perfect recyclers and perhaps a few more stragglers. For the sake of the argument, a flatter version of the Swedish bell curved is used.

Finally, the Misan – praxeological ideal – where individuals are motivated to act because it suits their preferences or alleviates some source of dissatisfaction, remains. I opt to put its compliance rates on the margins as the highest, save for the Theocratic compliance rate. The reason is that I can envision a Misan compliance rate as low as the voluntary or as balanced as the Communitarian. In this case it all depends on the perceived cost of action to the individual. If made sufficiently low compliance rates might soar. A case in point is the collection system for PET-bottles and

aluminium cans which all give a refund. Recycling refundables is “Kärt besvär” or “Love's Labour” most Swedes, and if you don't want to you can be almost certain someone else will recycle them for you.

Graph 6 Division on the margins of recycling utility



What becomes keenly interesting however is marginal behaviour. It is interesting because we have observed many strange behaviour patterns among high level recyclers and to recycling companies near perfect recycling is absolutely essential to some forms of recycling like haz-mats or major appliances (e.g. white goods/fridges). Though a matter of conjecture I suggest the above magnification as a rendition of how recycling develops under different scenarios. Much may be gained from approaching recycling with alternative strategies once higher levels of recycling have been attained. Although the exact numbers are hard to predict the trends deduced from the above discussion should hold. A reinforced communitarian approach is most likely to attain better results than current or voluntary systems, and a Theocratic system may render even better results than an appealing Misan system. A caveat is in order though... The costs of recycling will be redistributed as soon as shifts are made. It is therefore necessary to look at the principle mechanisms of improvement offered by Communitarianism and Praxeology.

3.4.13 The contributions of Communitarianism & Praxeology

Once we establish that whatever possibility for improvement/increased recycling remaining is dependent on changes in marginal behaviour we need to look at the options offered by the systems studied in this text. As we have seen Communitarians stress the importance of moral values, and increasing the moral value of recycling would seem to be a sustainable way to increase compliance rates. The Swedish system is already highly dependent on individual commitment to the recycling system and Communitarianism stresses the importance of balancing values, fostering only core values and not holistic values. Praxeology meanwhile stresses the importance of individuals seeing action as competitive and easy to undertake, with perceived cost in focus.

In order to illustrate these avenues of improvement I have designed an example which illustrates the different systems of thought and their effects on the margins of recycling. The example consists of series of typical household chores that compete with recycling and waste management in day to day operations. In order to conform with Praxeology the chores are listed in an ordinal manner and consist of perceived priorities and costs and a composite value, indicative of the order of execution.

Typical household priority

	Priority, once identified	Perceived cost of action	Order of execution
Going to the WC	1	1	1
Fetching kids at daycare	2	5	3,5
Talk to neighbour	7	2	4,5
Cook	3	7	5
Excercise	5	6	5,5
Watch TV	8	4	6
Meet friends	6	8	7
Shop for groceries	4	12	8
Call grandma	12	3	7,5
Sort trash	9	9	9
Recycle	10	10	10
Housecleaning	11	11	11

In a communitarian system the moral value of sorting and recycling would be emphasised through various specially designed measures. If we assume that a moderate measure of influence is applied sorting and recycling jump up three positions in the priority ranking.

Ranking after Communitarian moral values applied

	Priority, once identified	Perceived cost of action	Order of execution
Going to the WC	1	1	1
Fetching kids at daycare	2	5	3,5
Cook	3	7	5
Talk to neighbour	9	2	5,5
Excercise	5	6	5,5
Watch TV	10	4	7
Call grandma	12	3	7,5
Sort trash	6 (old value: 9)	9	7,5
Meet friends	8	8	8
Shop for groceries	4	12	8
Recycle	7 (old value: 10)	10	8,5
Housecleaning	11	11	11

This puts us in a situation with sorting now on par with calling grandma and likely to be done before meeting friends and shopping for groceries. The act of recycling remains second last though.

In a Misesian solution, the recycling company provides citizens with better recycling receptacles, higher collection rates and other clever technical solutions – all of them designed to reduce the perceived cost of recycling. Again, both sorting and recycling jump up three positions, but this time in the perceived cost of doing the action.

Ranking once the perceived cost has been reduced in accordance with Misesian ideals

	Priority, once identified	Perceived cost of action	Order of execution
Going to the WC	1	1	1
Fetching kids at daycare	2	5	3,5
Talk to neighbour	7	2	4,5
Cook	3	9	6
Watch TV	8	4	6
Excercise	5	8	6,5
Call grandma	12	3	7,5
Sort trash	9	6 (old value: 9)	7,5
Meet friends	6	10	8
Shop for groceries	4	12	8

Recycle	10	7 (old value: 10)	8,5
Housecleaning	11	11	11

This gives us the exact same priority as in the communitarian version of the example, save for where in the mind of the individual the change took place. However, the great change comes if the two models are combined, in which case the effect are augmented and result in the order of execution shown below.

Combined Communitarian & Misesian shift

	Priority, once identified	Perceived cost of action	Order of execution
Going to the WC	1	1	1
Fetching kids at daycare	2	5	3,5
Talk to neighbour	9	2	5,5
Cook	3	9	6
Sort trash	6	6	6
Exercise	5	8	6,5
Recycle	7	7	7
Watch TV	10	4	7
Call grandma	12	3	7,5
Shop for groceries	4	12	8
Meet friends	8	10	9
Housecleaning	11	11	11

On the order of execution of action

If we accept the table above as the priority at hand, our next concern deals with how these actions are carried out. We have made sorting and recycling much higher prioritised but we still need to remember that this is an ordinal scale and that actions with a higher ranking always take precedence. That is, if the first four actions on our list have been carried out when the need to go to the WC arises again, it immediately takes precedence. If we need to eat once more before we take care of our waste, that too has precedence, even though already carried out once or more. As time passes, waste accumulates/becomes unhygienic and since preferences are dynamic this action will gain in priority with the passing of time. Regardless if the preference table is reset by other more urgent needs, the need to dispose of waste will increase. Sooner or later the trash must be emptied! However, this increase in priority takes place entirely on the Misesian side of the equation. It is not the Communitarian value of recycling which increases, it is the immediate and most tangible source of discomfort which needs to be alleviated which increases in magnitude. (Add to this Prospect theory and the model becomes even clearer – there is an important difference between earning and avoiding a cost on the one side and paying or forgoing an income on the other! E.g. getting a refund for a bottle and avoiding fines or the cost of a messy/smelly home vs dumping the bottle with regular waste, risking a fine and forgoing the reward of a refund.)

To my mind this only strengthens the need to take into account praxeological considerations. If waste management is important why let it compete with basic household chores for attention. Alleviate the burden of recycling so that it may take precedence in the minds of the individual user.

This rationale becomes even more apparent if we look at aggregate or compound groups of actions. Since time is limited we might have to group certain chores together to get them done in rational order. Looking at the priority above then, let's compare two compound actions.

A	B
Talk to neighbour	Fetching kids at daycare
Cook	Recycle
Watch TV	Housecleaning

In this case we only have time to do A OR B, not both or parts of either. Keeping in mind the ordinal scale and the order of execution, which alternative will be carried out? It might seem that the aggregate utility of A is higher than B, but applying the axiom of praxeology we will choose B, not A. This is so since we cannot overlook the higher priority item in that list, even though the overall priority may seem higher in alternative A.¹⁸ The ordinal scale never tells us how much higher the priority is of one alternative over another, just that it will take precedence. Thus the highest priority in a compound of actions determines the priority of that alternative. Mises state this clearly:

What counts always and alone in valuing a compound of several units is the utility of this compound as a whole, i.e., the increment in well-being dependent upon it or, what is the same, the impairment of well-being which its loss must bring about. *There are no arithmetical processes involved, neither adding nor multiplying; there is a valuation of the utility dependent upon the having of the portion, compound, or supply in question.*(Mises, 1996, p. 128)

To me this adds significantly to the communitarian argument, the realisation that decisions are often made in a larger context. If faced with a

¹⁸ Replace "Fetching kids at daycare" for "Going to the WC" to increase the clarity of the example further!

choice of obeying a statute or behaving morally, such action must take into account what else is also forgone or gained by said action. How, and with what else that action is seen as grouped is also relevant to the outcome. Recycling and many other actions which the community may benefit from have to be seen in their context. What else does it compete with, what is lost and gained by recycling? Regardless of whether we think sorting waste and recycling to be good or bad, we need to explain the price of sorting waste and recycling for what “they are, not as they would be under different conditions.”(Mises, 1996, p. 96) This puts the spotlight on the context of recycling and the distribution of the relative costs of recycling. When recycling is unobtrusive enough to be possible to group together with any other competing household chore, then it will also be possible to reach the highest recycling ambitions.

3.4.14 The Trilemma of recycling

So far I have discussed the individual level, if we now briefly switch over to the systemic level the above discussion can be described in the form of a trilemma. In an attempt to describe the distribution of relative costs I have coined what I call the “Trilemma of recycling” (ToR). In short, no matter how we tune our recycling systems we can never maximise more than two out of three of the following aspects.

Environment vs Convenience vs Cost of system

1. A good environment & a convenient recycling system lead to an expensive system
2. A good environment & a cheap system leads to a individually demanding system
3. A convenient & cheap system leads to environmental loss

One could say that the prevailing Swedish system for example leaves 14% (100-86) of the costs of waste management for the environment to carry. It also stresses the role of each and every individual in maintaining and caring for the environment. Depending on whom you ask the exact distribution of cost could vary up or down, but even recycling companies agree that individuals bear the brunt of costs for recycling. This should not be confused with cost individuals pay for waste management services.¹⁹ This leaves us with a recycling system which is fairly good for the environment,

¹⁹ We have shown (Klingberg & Kågström, 2005a, b) that individual consumers see monetary costs of recycling and the individual burdens as separate, and that individuals are not very cost sensitive if the system becomes more convenient.

not too overbearing on tax-payers but heavy on individuals. This is very close to the Communitarian ideal, but I would envision that Etzioni (a firm environmentalist) would be glad to see society take a greater part of the burden.

Sample divisions of relative costs in the Trilemma of recycling.

	Theocracy	Misean	Communitaria n	Voluntary	Swedish
Individual	90	15	50	20	62
Waste M	10	80	40	30	24
Environment	0	5	10	50	14
Loser	Individuals	Waste M	Even distrib	Environmen t	Fairly even

The Theocratic alternative sees the environment as the holiest of holy and thus designs a system which reduces environmental damage to nil. Some measure of central waste management would be feasible, but the brunt of all costs would probably be put upon the individual believer. It should also be noted that this only refers to relative costs, the absolute cost in terms of loss of freedom and individual suffering is conceivable much higher than in any other system.

Finally to optimise the Misean alternative it would have to strive to balance the instrumental environmental goal and individual costs in order to attain higher levels of compliance. The waste management apparatus would probably need to expand significantly, but if all other venues are closed and high compliance rates remain the focus then maybe this is the only alternative. As to the absolute cost of this system, it is conceivable that a competitive market solution would reduce the total absolute cost of this solution relative the other solutions.

As can be seen from the suggested models, it is hard to find practical/empirical examples where more than one aspect has a low relative cost. Often times in real life situations only one of the aspects of the trilemma is even close to satisfactory. Looking at the Swedish example, increasing the individual burden is tantamount to a move towards a totalitarian solution of recycling. Some measure of increase in individual responsibility may be possible along communitarian lines, but leverage available for such a solution has to be studied. Recycling less is not politically acceptable, and may well be environmentally unsound. What remains then is to facilitate recycling through an increase in the relative cost of waste management. In effect this suggests a move towards a Misean

solution as the only feasible alternative for high level recycling societies. In my articles I will explore this and the other options available.

3.4.15 Final remarks on the epistemological basis of this thesis

I have tried to show how two seemingly disparate schools of thought will contribute to the further study of recycling and as a consequence any other study of marginal phenomena in societal governance.

Recycling problems are highly dependent on the context, what technical solutions have been applied, how well do people recycle etc. This differs from society to society, even between communities within a country. What can be done to further increase compliance, optimise technical solutions or individual convenience depends on our visions for the future and our understanding of what is possible to do.

Communitarianism warns us not to go to extremes, to avoid curtailing individual freedom in the pursuit of perfection and not to abandon all shared values out of fear of totalitarianism. Decent recycling levels can be attained by sharing at least some basic understanding of recycling, as in the Swedish case. But if it needs to be, communitarians suggest that higher levels might be attained by promoting moral dialogues. How this is done, what arguments and rationales are called for should be studied and their effects evaluated.

That same context is also essential to a praxeological approach. If we are to optimise recycling, a focus on marginal behaviour is suggested, on how to reduce the perceived cost of recycling etc. This forms the other main avenue for increased recycling rates suggested in my thesis. Contexts are also important in determining the leeway available to policy makers, as demonstrated by the Trilemma of recycling.

Finally, since communitarians suggest that moral voice should be based on existing values and praxeology emphasises what is actually done, this should be the basis of any changes suggested, and it is in this light that I have studied contemporary research on recycling and recycling determinants.

This chapter has shown us how different we may approach a policy problem depending on is we set communities or individuals in focus. The difference between seen communities as a gathering of individuals and individuals forming communities

is not trivial. Combining the two perspectives is also difficult but keeping in mind the consequences of either as we move toward applied theory is necessary.

4 Chasing determinants - Recycling in an international context

This chapter goes through some of the most influential international contemporary research into recycling in a thematic manner. While doing so I establish a first set of determinants and settings/condition under which different levels of recycling are achieved.

With the above mind-set I will now present my take on the contemporary discussions on the determinants of recycling. I do this with a very selective eye, working along the lines of abduction, selecting from the vast amount of research written on recycling, only that which helps to further shed light on the Swedish recycling situation studied and from the theoretical framework presented above. I have also opted to try to focus on such research as centres or sheds light upon the micro-level of recycling behaviour. It is my overall impression and starting point for this analysis that contemporary research into recycling determinants is more often interested in the system level and either focussed on the highest possible policy level or equally concentrated on the technical details of the system level. In articles that investigate the citizen level, the study of what is broadly termed attitudes is the main focus of attention.

With this in mind I initially identified more than 60 determinants in contemporary research. Most papers only concern a few determinants and a minority like for example the notable works of (Guerin et al., 2001; do Valle et al., 2004) explore a greater variety of recycling determinants. My study was done primarily using the keywords provided in the articles themselves and mention of determinants in the resulting models of the articles. Along the lines of my theoretical model I grouped the determinants

thematically. This was necessary to make the work operable. To structure and make this material operable my analysis of recycling determinants takes into account 5 aspects.

1. Context in terms of recycling rates
2. Research on the system level
3. Research on the individual level
4. Physical determinants
5. Intellectual determinants

First the context, or the recycling rate which the system described in the article has produced. This aspect is important since it is measured almost universally in this field of research and it gives an indication of how far encompassing the recycling scheme is. In fact, it is often used as the primary indicator of how progressive a waste management system is. However, such a single factor emphasis may be misleading since it tells us very little of WHY a recycling rate of X or Y has been attained. Thus we need to differentiate between other types of determinants, while keeping recycling rates as the “ruler” by which we initially compare different systems.

Then I divide determinants into determinants on a personal or individual level vs the non-individual or system level. This is in keeping with the dichotomy I have used in comparing Communitarianism and Praxeology. However it should be noted that being the non-individual level, this group includes both determinants at the communitarian (meso-) level and the predominant system (macro-) level. Instead of this potential tripartite division of determinants, I maintain a focus on the individual level as the main focus and the immediate communitarian level and anything above as its counterpart.

Reasoning that this is the division which plays the greatest importance.

Finally I divide determinants into those of the physical world and those of that are of an immaterial character. To the first group belong determinants concerned with often concern practical conditions of recycling, how the recycling room is arranged, how many fractions are to be recycled etc. To the second belong a plethora of determinants often labelled “attitudes”, motivational factors etc. Such determinants that concern how recyclers view the environment, the efficacy of the act of recycling, antipathies towards waste etc.

A caveat concerning the latter intellectual determinants is that it follows a more general tradition of research into the Ajzens-Fishbein theory of planned behaviour (TPB), which in itself is not without its critics (Davies et al., 2002) in the field. The downside of this is that it lends itself to a strong concern for attitudes for the sake of the study of attitudes. What I refer to is a research not easily transferred into policy implications, instead we end up with scattered information of the general attitudes of 21st century man towards nature in general and recycling in particular. Often politically correct and seldom taking into context the how these attitudes actually perform as determinants, under what conditions they work as determinants and last but not least how they can be influenced or put to good use for policy makers.

4.1 Knowledge and education – what individuals know about recycling

4.1.1 Formal education

A much cited set of determinants has to do with differing aspects of education and knowledge. It roughly breaks down into formal education in general and specific recycling related knowledge. The two are generally regarded as related and a formal education may facilitate the adoption of specific recycling knowledge. On the other hand, as Wilson, Velis & Cheeseman showed, in many societies with an informal recycling sector, garbage pickers may have very high recycling knowledge without any formal education (Velis et al., 2009, pp. 1282, 1284).

The role of formal education is stressed more often in studies with lower recycling rates than in studies of systems with high recycling rates. A lack of education is frequently found to be a restraint on recycling whereas high education is no guarantee. Nixon and Saphores found this to be true of electronics recycling in an otherwise high recycling rate level Californian setting. A low level of education was a counter indication of recycling behaviour whereas a higher level of education was no guarantee for the opposite (Saphores et al., 2006, pp. 10-11). This relationship is also supported by the Barr, Gilg & Ford study of 1265 households in Devon. They found that a low level of education, together with a set of other determinants described the non-recyclers, whereas the best recyclers were not characterised by high levels of education (Barr et al., 2005b, pp. 187-188). To me this suggests a cut-off point for when educational levels is a

useful predictor of recycling rates, and as such it was tested for in our empirical studies.

A more conventional view on the role of education is presented by Vencatasawmy-Öhman-Brännström in a study of a uniquely low-recycling area in the north of Sweden. They found that the great dividing line is found at a very low level, namely at the elementary school education level, with those above doing better at recycling (Vencatasawmy et al., 2000, p. 550). Another study set in an equally low recycling setting in Taipei, Taiwan assumes a positive role of education to achieve recycling but presents only a sketchy argument that this is the case (Chen & Chen, 2008, p. 65). Finally an EU-level survey of determinants showed only weak correlations between recycling and formal education (Guerin, 2001, p. 212).²⁰

This leads me to conclude that low educational levels are good predictors of low levels of recycling, but not necessary for medium or high levels of recycling. From a Swedish perspective this stands to reason since we could never achieve the high levels of recycling we record if there was a linear relationship between formal education and recycling rates. This may even be positive as it offers hope and opportunities for other more easily influenced determinants to take effect! Perhaps knowledge of the recycling system and the environment may offer some insights.

4.1.2 Recycling knowledge

Not surprisingly research on the importance of recycling knowledge is less ambivalent. Some measure of understanding of the need to recycle and the how-to of recycling is a precondition of a successful system.

At the very basic level Boolane notes that when designing a recycling system from scratch in Botswana, recycling knowledge needs to be followed with policy measures that ensure there IS a system to know about (Bolaane & Ali, 2004, p. 738). In the newly instituted Taiwanese system described in Chen & Chen the importance of spreading some measure of knowledge is also stressed (Chen & Chen, 2008, p. 65). A British study exemplifies this clearly when they found that many households were unable to fully use the existing recycling system because they didn't know the full extent of what could be recycled (Martin et al., 2006, p. 391). Martin, Williams & Clark

²⁰ NB: With the causation working from education to recycling and not the other way around.

therefore recommended basic education on the system as a means to raise the recycling rate of 6% to the studies systems full potential of about 44% (Martin et al., 2006, pp. 357, 392). Similar results were reported in a Polish study on the means of increasing participation in recycling where knowledge boosting campaigns were seen as useful (Grodzinska-Jurczak et al., 2003, pp. 83-86). This signifies that recycling knowledge is not general in the sense that there is one set of knowledge applicable everywhere all the time, but it needs to be firmly rooted in the context of the local system.

Studies that describe systems with a medium recycling rate (around 50%) have another emphasis. They stress the importance of actual or applied knowledge as opposed to perceived or subjective knowledge, paying lip-service to what should be done. In developing the recycling system in New York City, Clarke & Maantay found that lack of know-how was one of the most important barriers to be removed in order to facilitate recycling (Clarke & Maantay, 2006, p. 145). Barr goes even further when stating that not only is lack thereof a barrier, local waste knowledge is a precondition of successful recycling (Barr, 2004, p. 245). The Barr study is interesting in many other respects as well, and I shall have reason to get back to it, but he makes an important distinction between household rhetoric and actual behaviour concerning recycling. Contrary to the Ajzen/Fishbein school, Barr argues that not only is intention not the same as actual behaviour, rhetoric is also far from reality (Barr, 2004, p. 246). I interpret Barr's research as indicating that knowledge becomes the *primus motor* in a recycling setting where the sheer existence of a well developed recycling system is the driving force of recycling rates. In essence an individual's knowledge and valuation of the action of recycling determines the outcome in this respect.

While Tonglet, Philips & Bates also argue that knowledge is an important determinant of recycling, they do so from the Theory of Planned Behaviour (TPB)-perspective where the opportunity to recycle is reduced to playing second fiddle (Tonglet et al., 2004a, pp. 37-38).

Here is central distinction in how recycling is perceived. Whereas Tonglet et al see recycling as a result of an active deliberation of the mind and intentions, Barr argues that recycling is an act of convenience in such settings as provide physical opportunities to recycle. The effort to do right by the system as the *primus motor*. If you like, the theoretical perspective of Tonglet et al sees recycling as something that needs to be internalised and accepted; whereas Barr's empirical efforts indicate that recycling need not at all be internalised as such. The mere existence of a recycling system serves as

an indication of a norm of recycling which in turn caters to an already existing need. There is a subtle but important difference here. The Tonglet et al approach indicates that for recycling rates to soar, citizens need to be educated on the virtues of recycling and need to internalise the core ideas of recycling. The Barr approach expects recycling rates to increase even if the recycling activity is relegated to a secondary status among citizens. In a sense Barr takes into account variations in effort whereas Tonglets approach seems not to.

The latter position is implicitly supported by a Swedish study of an advanced recycling setting (75%) in which the authors found that discrepancies between what individuals claim to know and what they should do are not too serious. Petersen & Berg adhere to the conclusion that in due time behaviours will be largely self correcting as long as a thought through system prevails (Petersen & Berg, 2004, pp. 916-917).

4.1.3 Attitudes towards recycling – what individuals think of recycling

Much research is devoted towards the study of attitudes towards and motives for recycling. Not surprisingly positive attitudes are seen as contributing to recycling, and Tonglet; Philips & Bates show that attitudes explain about 24% of the variance in recycling in a moderately advanced recycling setting (42%) (Tonglet et al., 2004a, pp. 37-38). This is also supported by the Nixon & Sapphore's study of a new electronics recycling systems in an older, more mature setting, which found changes in attitudes to be statistically significant for recycling (Sapphore et al., 2006, pp. 10-11). Binder & Mosler found similar results in a high recycling rate context (75%) in Cuba, and linked them to the internalisation of the social norm of recycling and social control into the subjective norm (Binder & Mosler, 2007, p. 15). All of these findings point to positive attitudes being necessary for recycling. However, they are one sided in that they stress the positive influence of positive attitudes and operate under special circumstances.

Another set of research deals with attitudes as constraining and hindering. At the most basic level Mongkolnchaiarunya found that in the fledgling (3%) Thai recycling system he studied, participation caused individuals to lose face in the eyes of his neighbours due to recycling being associated with poverty and waste-picking (Mongkolnchaiarunya, 2005, pp. 36-37). Interestingly enough Binder & Mosler report the same mechanisms active in the more mature Cuban case (Binder & Mosler, 2007, p. 16). In both cases, a sense of shame tended to diminish participation in the stigmatised part of

recycling. However, I am inclined to see this primarily as an example of how poverty stricken societies view recycling where the waste itself has a relatively high economic value.²¹ In that case it is more representative to take into account Grodzinskas Polish study of a low-medium recycling rate setting, which found that negative attitudes were one of the foremost restricting forces to further recycling (Grodzinska-Jurczak et al., 2003, pp. 83-85). Adding to this Bruvoll found that as many as 70% of the population find the effort to recycle a burden alongside other chores and that recycling cannot be regarded as void of cost (Bruvoll et al., 2002, pp. 352-353). Perceived difficulties and the burden of recycling was also found to be a significant hindrance to recycling by Sterner & Bartelings (Bartelings & Sterner, 1999, p. 482). That is to say, regardless of any objective efficacy of the system, the perception of the system as difficult was enough to shape a negative attitude which influenced recycling rates. The effort put into it did not correspond to the value attributed to it in the minds of the user.

Barr et al offers important and alternative insights into this aspect of attitudes. His article further refines the line of reasoning found in Grodzinska by pointing out that individuals differentiate between recycling as such and waste minimisation and “green purchasing”. Individuals see these as separate activities and only attitudes towards recycling work as a predictor for recycling. Attitudinal acceptance for increased recycling was also reported as higher than acceptance of waste minimisation (Barr et al., 2005a, p. 187).

Sadly, apart from the Cuban study by Binder & Mosler, no studies in high recycling contexts mention recycling attitudes as predictors of recycling behaviour and I will get back to the reasons I find for this. Furthermore the Binder & Mosler study is hardly representative of the mainstream western recycling situation in that it depicts recycling under totalitarian rule in the people’s republic of Cuba. It should be noted that Binder & Mosler stress that attitudes towards recycling are closely related to the operations of the Revolutionary Defence Committees, which in turn affects the valuation of participation (Binder & Mosler, 2007, p. 15). In addition to the Binder & Mosler study; Lindén & Carlsson-Kanyama do report that attitudes of environmental concern influence recycling in their study of a high recycling context (ca80%) in southern Stockholm (Lindén & Carlsson-Kanyama, 2003, p. 299). However, environmental concern is strictly speaking not the same as recycling attitudes, since the former is a value and the latter is not.

²¹ The Swedish system is a case in point, where PET-flask recycling is high and hardly at all stigmatised, although there are persons who specialise in collecting refundables.

The resulting duality in research on attitudes is noteworthy and distinct. If attitudes are viewed as a determinant with a positive influence on recycling it follows that it should be increasingly important to influence in order to attain higher recycling levels – in the most extreme form through the instigation of Revolutionary Defence Committees. However, if attitudes primarily influence by acting as a complication when negative, much is attained merely by going from negative value assessment to neutral one. This step would seem less resource demanding and less invasive, leaving resources to be spent on other determinants. My point being that it takes much less to change a person's valuation about something from negative or ignorant to neutral or indifferent than to change it to positive.²² Even such elementary influences as time and experience may negate or erase a negative attitude whereas much more effort is needed to convince a person of something which she is not naturally inclined. Changing the value attributed to recycling or the effort of recycling from negative to neutral is an entirely different undertaking than changing it to a positive value.

In the case of recycling, basic information on the recycling system and persistence in the system itself will over time familiarise and induce acceptance towards it. A parallel, albeit extreme, could be the change from driving on the left to driving on the right in Sweden. You did not have to like and endorse the change in system to induce acceptance of it. Familiarity and convenience of adhering to the system was enough. Forcing a positive attitude²³ was not necessary since the decision was a formal one far from the core convictions of the individual. If other determinants can be shown to be of importance to the individual decision to recycle then neutral acceptance may be enough and the most cost-effective level needed to attain high recycling rates. If corroborated by my empirical studies that is a valuable insight on its own.

²² Or as conventional office humour puts it – it may take 43 muscles to frown and only 17 to smile – but it takes no muscles to be indifferent... Setting the joke aside, this illustrates the point I am trying to make – “effortless compliance”!

²³ Although in time that too may have come about.

4.2 Priority & position of recycling in daily life – how individuals assess the necessity of recycling

4.2.1 Sources of concern – or Priority of recycling

Just as education and knowledge influence the value individuals assign to recycling so does the relative value and priority of recycling relative to other activities.

At the onset of a recycling programme it is clear that it has a lot to compete with. Firstly it is competing with the existing waste disposal regimen. Secondly, users are uncertain of how to value the utility of recycling, unfamiliar with its designs and ramifications for everyday life etc. Whereas getting rid of waste is a universal problem, recycling is subject to a much more complex valuation in that it connotes so much more.

Martin, Williams & Clark describe this initial struggle of priorities well, and show that recycling is only one of several everyday chores. In addition it is also one of little importance to the respondent when recycling is set against the daily fight against poverty (Martin et al., 2006, p. 392). What is especially interesting about their article is that it concerns a contemporary UK setting with a well developed recycling scheme, sharing many characteristics with other areas save the very low recycling rate (6%). In conjunction Boolane, in a similarly deprived setting, notes that concern for the environment and awareness of the problem is not the same as a high recycling rate (Bolaane & Ali, 2004, p. 739). High valuations of the environmental utility may be a necessary but certainly not a sufficient criterion. Clearly it is possible, at the initial stages of recycling, to be aware and have access to a recycling scheme without prioritising recycling – just as long-term exposure to a recycling system will attune the recycler to the system.

Thus, once the initial resistance to recycling is worn down it seems that environmental concern or more correctly individual assessment of the value of environmentally friendly behaviour becomes a driving factor. Interestingly enough the articles that stress this determinant as their main finding all operate in a recycling rate context of about 20%-40%. Typical of this is the Magrinho, Didelet & Semiao study on the fledgling Portuguese system where environmental awareness together with the existence of a

collection system and source separation was one of three main venues of influence identified (Magrinho et al., 2006, pp. 1482-1483, 1487-1488). Although it is not the main focus of the article, I interpret the Portuguese effort on increased source separation as highly reliant on awareness. Considering that the other two determinants are more physical in nature, this puts awareness in an important position for the formation of general participation.

Sakata refined this type of argument by investigating more specifically the nature of this awareness. He found that environmental risks in general and the fear of dioxin spills in particular prompted intensified participation in recycling schemes (Sakata, 2007, p. 643). These results at the local level of Kagoshima municipality indicate that proximity to resultant environmental danger is an important factor which is hardly surprising. As a stark contrast Guerin, Crete & Mercier's study of determinants at the aggregated EU-level (44% recycling rate mean) indicates that global environmental concern and national deforestation rates also plays into the decision to recycle (Guerin et al., 2001, p. 212). This would seem to include all types of concern and awareness as important determinants to recycling. However, in high recycling rate contexts data on environmental concern as a major determinant seems to be lacking. It may be that, as recycling rates soar, the individual valuation of her own contribution tapers off along marginal utility lines. Each additional effort put into the system yields less of a relative impact on its overall performance. I look forward to contrary findings, and shall discuss this aspect thoroughly later on. In the mean time it would seem that the role of environmental awareness, global or local, tapers off as recycling rates soar and the system matures.

4.2.2 Gender

Another determinant seemingly typical to the fledgling system is gender, which seems to be of significance only in systems where participation has yet to become general. It stands to reason that gender differences fade out gradually as participation and recycling rates near 100%, how else would such numbers be reached. However, for as long as gender is a significant determinant it is clear that women are at the forefront of recycling. In their study on electronics recycling Darby & Obara found that while men were more likely to visit electronics recycling centres, active female recyclers were as likely to recycle electronics despite fewer visits. In addition in the non-recycling group men were over-represented (Darby & Obara, 2005, p. 29). This indicates that women may play a crucial role during the first stages of recycling, through a higher commitment to the recycling principle

although the exact mechanisms for this are unclear. Barr, Gilg & Ford tried to ascertain more specifically the intra gender differences among recyclers. In their cluster analysis they found a group of older women²⁴, politically active home owners who were especially inclined to take up recycling (Barr et al., 2005a, p. 188). These forerunners are in stark contrast to the young non-recycling, politically apathetic males living in rented apartments also identified in the study (Barr et al., 2005a, pp. 187-188). Again, gender as a determinant tapers off with higher recycling rates, and I have been unable to find any studies where gender is a significant determinant with recycling rates above 20%!²⁵

4.2.3 Politics

In a fashion similar to gender, politics or social norms seems to be a determinant primarily in low recycling contexts. Barr touches upon politics as a determinant but does not differentiate between ideologies, just the degree of activism versus apathy (Barr et al., 2005a, pp. 187-188). Thus involvement in society as such would be more important than what kind of involvement is the case. The traditional right-left scale of ideologies proved of little use in the Guerin study as well (Guerin et al., 2001, p. 206). However, Guerin found that local environmental activism and membership in environmental non-governmental organisations had an influence on recycling participation (Guerin et al., 2001, pp. 212-213). Clearly, both the Barr and the Guerin results support the finding that the traditional political scale does not predict behaviour. Instead a “green” social norm drives recycling at its early stages, later losing importance as more people internalise it after getting involved in recycling, reflecting “green” sentiments in general in the public.

Again, higher recycling rates peter out the relative effect of green political motives, especially if and when recycling becomes a natural de-politicised everyday occurrence. In this respect it may well be that the compulsory Swedish system produces special results – on the one hand it takes away the political tension by making recycling mundane which in turn increases potential recycling rates since recycling is no longer a point of contention and a great divide. On the other hand the compulsory, de-politicised high-

²⁴ Especially those of the so called “war generation”.

²⁵ In the strictest sense aggregate recycling rates would never go much higher than 50% if men did not eventually get involved in recycling. Thus it is feasible that recyclers as a group become more homogenous as recycling rates and participation soars – becoming nearly impossible to separate as recycling nears 100%.

recycling rate might also diminish the potential spin-off effects of an environmentally aware populace.²⁶

4.2.4 Time

Yet another determinant particular to the lower recycling rate segment is time. Grodzinska-Jurczak's study of a typical Polish city (rr=30%) found that perceived lack of time was indeed the main reason for non-participation in recycling (Grodzinska-Jurczak et al., 2003, pp. 78-79). Bruvolls Norwegian study (rr mean ca 50%) goes into great detail as to the workings of household recycling efforts and concludes that time is indeed a limiting factor, one that households take into account and value carefully (Bruvoll et al., 2002, pp. 340-341, 352-353). There is a subtle difference between the two studies though. The first cites time as a reason not to recycle, and the second sees time consumption as burden, in addition to other household chores. This illustrates how differently time can be valued in varying contexts. At the onset of the Polish programme time is seemingly valued very highly and thus turned into a directly limiting factor. In the Norwegian context, recycling is more accepted and time consumption monitored yet accepted, rendering a somewhat lower value. This gives us a hint of the relation between recycling and time consumption and the dynamic value attributed to the act of recycling and its alternative costs.

If recycling at the 50% level adds up to 10% to the total time spent on chores then is that an acceptable level? Bruvoll finds that although households tend to accept this addition, it is by no means unproblematic. Households do value their time, and many would not hesitate to pay to alleviate the burden if they could. In fact those that spend least time on recycling are the ones most likely to pay well for that service (Bruvoll et al., 2002, pp. 350-351). I interpret Bruvolls findings as an important change from the polish 30% rr situation. Time is still valued and better spent on other things but there is a will to do what is right by the system, and contrary to what might be seen as conventional, those who recycle least are still concerned and willing to pay to get the job done right. Whether this is to do with a real shortness of time or an inefficient approach to recycling remains to be seen. However, it is interesting to note that most of what has been written on previous experience with recycling is set in a slightly higher recycling rate context.

²⁶ As the group characterised as "active recyclers" grows, the relative importance of the green political group diminishes gradually & correspondingly.

It also suggests another paradox of recycling. As recycling rates soar and participation becomes more accepted a polarisation is implicitly implied. On the one hand those that recycle increasingly more effectively and for whom recycling has been reduced to an almost automated chore and on the other hand those who retain the original fervour and recycle with a continued zeal even though it takes more time. In is in this light that I see the call for assistance and being able to buy ones way out of recycling. This is also the Misesian way of interpreting this observation. If the chore at hand has become such a small nuisance, why not try to relieve it altogether by purchasing a corresponding service? That would alleviate the discomfort completely. Those that have found efficient ways of recycling can't see that why it shouldn't be possible to simply pay to get rid of yet another chore analogous with many other circumstances in a modern home. Again we see what I interpret as examples of a counter intuitive reaction to increasing recycling rates. Increased recycling suggests to the average citizen that recycling is like any other household chore, something which can be negotiated and made even more convenient. Perhaps a good sign that recycling is regarded as mundane, but also a sign that recycling is not regarded as a special household activity with higher status or access to time. This relates to the communitarian perspective in the immediate community can be expected to be important in defining acceptable and expected amounts of time set aside for these tasks. This implied relation between recycling and time allotment was factor of special concern to us during the empirical phase and we will return to the results in later chapters.

4.2.5 Experience

Experience is conventionally thought of as an unequivocally positive determinant of recycling. It helps individuals to find their own ways of dealing with the extant system in a way which suits them (Sakata, 2007, p. 643). Experience thus works as a means to refine the system at its lowest level, which is important for the long term operation of the system and its development potential. Or perhaps it is more correct to say that experience helps to refine how the system is interpreted by the users at the lowest level of the system. Experience changes the value individuals attribute to recycling, generally by valuing it higher or at least as less costly when compared to other activities.

The effects of experience are visible even in newly established or immature recycling systems. Darby reports more than double the average electronics recycling among individuals who were the most frequent general recyclers in their area (Darby & Obara, 2005, p. 29). Drawing on Sakatas and Darbys

findings it would seem that the habit established from one type of recycling spills over to other forms of recycling as well. Barr goes so far as to state that the act of recycling and the instigation of a recycling system itself is a normative societal action, implicitly communicating the will of the government to the people (Barr et al., 2005a, p. 187). This, according to Barr is enough, all on its own, to reinforce and induce a recycling behaviour. Such a mechanism is largely overlooked in other research, yet it offers a feasible explanation to the observed change in behaviour. Barr puts the availability of recycling, and resulting experience thereof, as more important to recycling rates than the person's rhetoric and intention of recycling (Barr, 2004, pp. 245-247). I put this in relation to Barr's insistence on recycling being an intellectually separate action from waste reduction (Barr et al., 2005a, p. 187), a finding upon which also Tonglet (Tonglet et al., 2004a, p. 187) agrees.

As I interpret Barr and Tonglet, who are otherwise often contrary to each other, households look upon recycling as less controversial and less political than waste minimisation at the source, reuse or green consumption, to which most households react strongly. Clearly very different values are attributed to the two activities since the first is the continuation of an old behavioural pattern with new means and the latter is an altogether new mode of behaviour. Being told what to do with your waste is easily accepted, whereas being told what to buy is an invasion of privacy. Acquisition is not only different from disposal; it is on an entirely different continuum. This conclusion is of course in stark contrast with the way for example the EU sees its Waste hierarchy, where the two are indeed on the same continuum. Buying is a cherished and highly valued activity whereas in comparison waste disposal is not.

This has great ramifications on how to view and value recycling in comparison with other environmental activities. At a theoretical level it indicates that the communitarian perspective is important in defining the role of recycling in the context of the society in which it is to be performed. At the same time from the Misesian perspective we realise that waste disposal, regardless of HOW it is performed alleviates one type of discomfort, whereas the purchase of new things alleviates an entirely different set of discomforts. With that, the act of acquisition in general vs green or waste minimising acquisition addresses entirely different and perhaps even diametrically opposed emotions. The mental disconnect from recycling as such is therefore to be regarded as complete if we are to be able to advance our understanding of recycling. By using experience as leverage the act of recycling is made less of a burden and recycling is increasingly

made to mimic the basic function of disposal which will always have high priority among household chores. This was the working hypothesis concerning the role of experience in this thesis with regard to our empirical studies.

4.3 Individual physical determinants

4.3.1 Type and amount of recycling

This first group of determinants under this heading is a problematic one. This is because it deals with human behaviour which is general in nature, but troubling with regard to recycling. More specifically, individuals recycle less when they rarely need to or have small amounts of the specific waste fraction (Grodzinska-Jurczak et al., 2003, p. 28). It may be that the waste is small in size and easily stored as with batteries, that it is rarely discarded as with electronics, or seldom replaced as with long-life light bulbs.²⁷

- 1) Size: extremes (very small or large) tend to be recycled less often
- 2) Rate of reuse: waste kept just in case it turns out to be useful is rarely recycled
- 3) Rate of replacement: longer life-spans mean less exp with recycling them and lower recycling rates

Table 11 Objects unlikely to be recycled depending on their inherit characteristics

	Small	Large
Long life, reused	Cell phones	Extra fridge, old TV/comp
Long life, not reused	NiMH, CFL	Dishwasher
Short life, reused	na	na
Short life, not reused	na	na

²⁷ I propose that these three determinants are of special interest in this respect: 1) Size: Where small refuse is more easily stored than large or bulky refuse, which requires more urgent disposal. 2) Rate of reuse: Objects that are replaced, but retain some usefulness may be held in reserve as a spare TV, fridge or computer. 3) Rate of replacement: Objects with longer lifespans are less likely to have well established recycling habits than objects with frequent replacement rates. This observation is in part supported by developed from (Darby & Obara, 2005, p. 29).

Conversely large waste items also tend to be recycled less often (Darby & Obara, 2005, p. 28). This observation is reiterated by Butler & Hooper who found that as a rule bulky or heavy waste items were recycled less often than light-weight materials (Butler & Hooper, 2005, pp. 332, 353). Defining the waste fraction is also important in this context as Thomas has showed, as the amount of waste to be recycled depends on separation rules and distinct clarity of recycling groups. In her study Thomas is able to determine that recycling rates can benefit from more recycling fractions, if these are understood by the citizens. Conversely, fewer, unclear fractions may complicate practical recycling (Thomas, 2001, pp. 271-272). All of the above studies are set in 17-35% recycling rate contexts and provide insights into how an incipient system may develop into something more refined. Interestingly enough these issues are not touched upon in higher recycling rate context studies. I would conjecture that the system by then has evolved to the extent that the system is rather well known to the user. However, it is clear that these factors do influence the development of the recycling system and therefore might do well to be taken into account.

On the other hand, even very mature systems as the Swedish and German systems still have problems establishing higher recycling rates for waste that fulfils the criteria tentatively set out above: Small, Reusable and Long-life. This carries us over to the issue of previous experience with recycling. Clearly recyclables exhibiting the three above characteristics are also subject to low levels of exposure among households. Thus here we have a direct link between the physical characteristics of the waste itself to which individuals are exposed and their understanding of the system. As Darby & Obara reiterate, reuse and replacement rates influence how well the object is recycled (Darby & Obara, 2005, pp. 28-29).

Reconnecting to a praxeological perspective the observed trends can easily be explained. Small objects are less likely to be a nuisance at home. Large objects that require a considerable effort to be disposed of are likewise not likely to be high on the proverbial "to-do-list". Potentially reusable objects, which might become useful in the future are also understandably less likely to be a main concern competing for the attention of the individual recycler. If a piece of waste is not a source of discomfort, then their disposal will not be a high priority from a praxeological perspective. The same goes for long-life objects, lack of experience in recycling them coupled with less developed systems for their disposal both at home and centrally will influence their recycling. Of course the lack of developed systems for their care and disposal are an exponent of their long-life nature.

The communitarian aspect is also at work here. Especially in the latter case of long-life products. The rare occurrence of recycling such objects is bound to influence how it is taken care of. A functional and recycling aware community would be likely to have accrued an aggregate experience of sorts in dealing with long-life recyclables. This is evident, as in recycling rooms provided for collectively by the condominium more experienced ones will have special provisions for for example CFL:s.

4.3.2 Space at home

Some of the problems associated with the rare recycling objects above might be mitigated by ample access to storage space. A special container to store compact fluorescent lamps (CFL²⁸) may for example help to retain a large enough number of lamps for efficient recycling intervals. The precondition of all kinds of recycling is of course that space is available. Martin, Williams & Clark discuss what Barr coined the “hierarchy of storage”²⁹, where recyclables are low on the scale of things to store in households that put a premium on storage space (Barr et al., 2003, pp. 415, 418–418; Martin et al., 2006, p. 391). A recycling system that does not address this problem will likely lag behind in performance, especially when concerning bulky or rarely recycled objects. Especially at the start of recycling this seems to apply, as Grodzinska reports that lack of space is the second most commonly invoked reason for non-participation (Grodzinska-Jurczak et al., 2003, p. 78). This observation is seconded by Colon & Fawcett who found that space constraints were a strong obstacle to recycling at the onset of an Indian recycling programme (Colon & Fawcett, 2006, p. 928). The Indian connotation of space shortage as indicative of the low societal standing of recycling, when compared to other activities, is corroborated by the Clarke & Maantay study of New York, which also lists space as an important determinant (Clarke & Maantay, 2006, p. 141). Their study also links this aspect to the physical aspect of keeping streets clean, one of their three main barriers to recycling (Clarke & Maantay, 2006, pp. 144–146).³⁰ Tonglet, finally, finds that space is primarily a deterrent to recycling where it is not available (Tonglet et al., 2004a, p. 45).

²⁸ CFL = lågenergilampor

²⁹ Which in it self is such a praxeologically inclined term that one almost wonders if Barr has had von Mises as an inspiration in his earlier work!

³⁰ Where the authors connect the spatial concerns to the setting in which recycling takes place. A littered city or recycling surrounding is not likely to improve recycling rates.

Since storage space is such a great concern at the individual level, a functional communitarian approach would be for the appropriate level to provide a common storage space. Much like the recycling facilities required to be set up by all multi-family houses. The municipal housing company may, as in the studied example, be crucial to this process – setting standards for how these areas are designed, kept and maintained. However, it is up to those living in the area to make the most of the opportunities set in their hands. Different communities will of course deal with this differently but for the sake of our research we assumed that there would be considerable differences in how this was done in different areas (communities).

The Misesian aspect has already been touched upon in that Barr formulated the “hierarchy of storage”. Limited storage space is the focus of considerable and acute assessment in all households. How to store, what to store and of course form our main interest what to dispose of. The mechanisms at work here are likely to be strictly praxeological, and assuming this is bound to provide our study with perspectives not covered elsewhere. We propose not only that the position of recyclables within the hierarchy of storage is a hint of its relative value in the household, but also that a low attributed value might itself act as an incentive to optimise the handling of waste in the household. If recycling has to be done, but the act itself has a low value and there is little storage space reserved for it, then crafty citizens are bound to eventually find more effective ways of accomplishing the same task within the given parameters.

4.3.3 Tangible value of waste & recycling

The valuation of waste and recycling is a difficult one. At the fundamental level there is the tangible value of waste and recyclables as raw materials. Bolaane describes this well, when he describes how recycling rates suffer when there is no attributable value to the goods recycled. In an incipient recycling system or one where the raw materials are still relatively valuable this is especially true. As the direct value of the recycled materials diminish Bolaane advocates deposit and refund systems to reintroduce a tangible value and rewards system into recycling (Bolaane & Ali, 2004, p. 739). Thus artificially recreating the original value of the materials. Clarke & Maantay, also arguing from an incipient, low recycling rate context, add to this by observing that the entry into the system need not be overly costly if the system is to succeed (Clarke & Maantay, 2006, p. 145). By “overly costly” Nixon & Saphores observed that households found a surcharge of about 1% of the value of electronics was generally acceptable (Saphores et al., 2006, p. 11). Finding the right balance for the tangible cost of recycling

is notably difficult, and Hage warns that in a system with no or low marginal cost of recycling additional waste there is no incentive for minimising for example packaging waste (Hage, 2007, p. 326).

Where recycling is voluntary these numbers are of course especially true, whereas in a system such as the Swedish one this is less of an issue. However, even in a mandatory system there still remains the individual valuation of the act of recycling itself, which in turn is at least partly dependent on the monetary value ascribed to the waste. The other component has to do with the act of recycling. Bruvoll stresses that the individual assessment of the burden associated with recycling is most varied. With about 70% of the individuals in Bruvolls study of a semi advanced recycling system willing to pay for someone else to take care of their recycling, it is certainly seen as somewhat of a burden. Contrary to previous research Bruvoll found that the group that recycle for the greater benefit of society is much smaller than previously thought (Bruvoll et al., 2002, pp. 352-353). This is interesting as it shows that many recycle *in spite, not due to the value* attributed to recycling. At the other end of the spectrum Berglund argues that recycling costs need to take into account “warm glow” effects of recycling in addition to the perception of recycling being imposed from above to be complete. By this, Berglund means that some of the more elusive benefits of recycling need to be taken into account when valuing the recycling activity (Berglund, 2006, p. 568). Adding to the complexity of determining the value of recycling, Barr stresses that where recycling is a highly visible activity it can become costly, socially, not to recycle (Barr, 2004, p. 247). This too needs to be vectored into the value of recycling.

To summarise, the value of recycling moves from tangible (buyback etc) to intangible (warm glow) values as the recycling system gets more refined. Taking intangible values into account is challenging but deeming from recent research there can be no hope of properly assessing the value of recycling unless such an attempt is made.

Praxeologically forgoing a gain by not recycling in a system where the waste has a tangible value causes discomfort and is avoided. In a more advanced system where the intangible values have taken over that mechanism is reduced and recycling risks losing out in competition with other more mundane or pressing activities. A Misesian mechanism which works under the latter circumstances would presuppose that recycling and the “warm glow” does indeed compete with other similarly intangible effects. That in turn means that recycling has to be regarded as a real and highly valued environmental problem. A contrast to this is the reinstatement

of albeit artificial values to recyclables. Refund systems on a wider spectrum of waste would seem to be a viable way forward even from a praxeological perspective, although it should be stressed that refund systems are also wrought with costs and might have to be reserved for waste fractions that are deemed to be of special concern, e.g. haz-mats. Communitarian efforts to the same effect include the local “litter picking days” instituted by the local municipality in our area to boost awareness and in turn increase the intangible value of picking up and properly disposing of waste. This initiative uses communitarian principles of share values and to some extent local pride to come to grips with the intangible but highly visible price of littering.

Some mention of income, as a facilitator of recycling is also needed here. Trends are generally positive towards income as an influential determinant. Chen-Chen point to income as a determinant which works through increases in environmental education and awareness (Chen & Chen, 2008, p. 6). The intermediary or indirect role of income is also indicated by a couple of other studies which point to income being connected to other social circumstances such as home ownership which in turn influence the decision to participate in recycling (Vencatasawmy et al., 2000, pp. 551-553; Guerin et al., 2001, p. 212).

Depending on how you group them, contemporary recycling research deals with a dozen to about twenty variables or groups of variables. Gathering and comparing these variables I perceive common themes and potential determinants which could be “adjusted” or “tweaked” by a recycling company to influence recycling rates. However, it should be noted that with very few exceptions the causalities studied and to which they are directly applicable relate to situations with recycling rates notably lower than in my Swedish case. Therefore we need to take into account the empirical findings before I can collate and try to say something on which are applicable and remain possible to influence in the Swedish case. Equally interesting is to see if there are more general principles that can be extracted from this comparisons, principles that might be applicable in a broader perspective of business and policy areas.

5 Recycling in Sweden

While the previous chapter made the reader acquainted with international recycling, this chapter deals with the Swedish situation. I start off by going to the historic roots of waste management and recycling. I do this through an etymological approach where I go through the words used to describe waste and waste related activities from ancient Norse times up until the present day. I group the words according to common themes and point to development in the field. I then turn to the actual recycling system and how that has developed in more modern times to the highly refined and fine tuned system of today.

5.1 A brief history of origins of recycling in Sweden

Waste management is as old an activity as humanity itself. Cleaning up, disposing of unhygienic waste and recovering useful scraps are all human activities that come naturally. In this chapter I will look at recycling and waste management in a Swedish context from the earliest times to the present state of recycling.

I take as my starting point the etymological origins for the words we still use to denote waste. These words do not only give us a hint of when different types of waste were first acknowledged, but also a hint of how different waste fractions were perceived and what changes have occurred in this respect.

Definitions of an assortment of terms used for recycling and waste management³¹

³¹ This list is based on my study of what is generally regarded as the only extant complete etymological dictionary of the Swedish language by (Hellquist, 1922).

Old Swedish ca 1225-1525 – [All terms are described in the following format: “Swedish term” (modern English equivalent), explanation]

- “Avfall” (Waste), Old Swedish, of Germanic origins, denoting things that literally “fall off”, primarily while butchering as in the English word “Offal”.
- “Avskräde” (Refuse), related to “Skrot”, used to refer to the “cutaway edges” of cloth in sewing.
- “(Av-)stjälpa” (Dumping), Old Swedish for stumbling or felling motion.
- “Bråte” (Rubble), of Old Swedish origin, literally means “broken things”, however it is a term not often used with relation to waste management, other than to indicate a greater than usual disorder.
- “Kvitt(-blivning)” (Disposal), from the Old Swedish for being “safe” and “free” from something.
- “Sopor” (Garbage) literally means “sweepings”, or what it swept up with a broom when cleaning. The word stems from Old Swedish and is in this sense older than “Skröp”.
- “Tross” (has no modern English equivalent, but might be indirectly related to “Trash”), now disused Old Swedish word for “dry or rattling waste”. Modern meaning is “cable” or “thick rope”.

Modern Swedish ca 1525-2009³²

- “Krafs” (n.a.) from “Krafsa” in the Swedish bible of 1541, literally means “creeping” and denotes smaller household waste.
- “Kompost” (Compost), entered into the Swedish language from German in 1807 with the meaning “pile of manure”. Through its French and Latin origins directly related to the word composite.
- “Lump” (Stuff) attributed in the meaning “rag” in 1749, before that meaning “stump” or leftovers from logging (1614). In its earliest form (1405) meaning “pitiful fat woman or animal” with its origins in the English word “Limp”.

³² The term modern Swedish coincides with the first bible translation printed in Swedish in 1525.

- “Skrot” (Scrap) meaning “cuttings” or “residuals” from the Old Swedish word for the leftovers from coin minting. First used to describe canister shot for cannons (1636), but also to describe the actual cut coin (1657) – the expression “Skrot och korn” refers to the net amount of bullion metal in a coin (korn) and the net amount of base metal (skrot).
- “Skröp” (Scrap) is attributed in texts from 1699 and originally referred to dry twigs used to light fires. In form “skrap” it also refers to waste “scraped” up and in that meaning the word is already in use in 1544.
- “Slagg” (Slag) referring to the by-products of ore smelting. Recorded in 1600, but likely of older origin. Stemming from “Slag” (Strike) or that which is stricken from the workpiece in forging.
- “Slask” (Slop) – onomatopoeical expression to mimic the sound of wet waste. In use at least since the beginning of the 16th century. Related to the English word “slag” and “dreg”, used in a sense to denote “a thick soft mass”.
- “Sortering” (Sorting), from the German word (sortieren) for (sometimes random) selection or arrangement – related to “sort” in English. In use from around 1648.
- “Subbert” (n.a.), now disused word for “filth” & “uncleanliness”. In use to denote primarily wet filth from 1848 until the early 20th century.
- “Tipp” (Landfill), first mentioned in 1642, indicative of tipping motion, but also in the sense of the outer “edge” – of the garbage tip.
- “Varp” (n.a.), now disused (1745) word for discarded branches or gravel.
- “Återvinning” (Recycling) although today most often translated as “recycling” it is of unclear origins in the Swedish language. Referring to “recovery”, “-vinning” is Old Swedish for e.g. “gain”, “struggle” and “acquisition”. However the word is not used in the recycling context until the 20th century and not in relation to waste until the 19th century.

So from this listing we can see that there are differences in what constitutes waste between the different eras. In the Old Swedish context, waste is either related to animal offal, sweepings, residuals from handicrafts, outdoor rubble or really vile things one wants to rid oneself of. This of course reflects the times and the waste fractions encountered. It might be helpful to sort the Old Swedish concepts of waste as follows:

Table 12 A suggested taxonomy of Old Swedish (pre 1525) words for waste:

	Indoors	Outdoors
Useful (reusable)	Avskräde	Tross
Unuseful	Sopor	Avfall, Avstjälpa, Bråte, Kvittblivning

We see a fairly uncomplicated set of words relating to waste. With the majority being concerned with outdoor disposal of what might be conceived as especially foul waste. Unuseful indoors waste (“sopor” or sweepings) are of course disposed of outdoors once collected. The only specific reuse related term “Avskräde” refers to textile and clothes manufacture and may be seen as an indication of the importance of reuse of scarce resources in this industry. Interestingly enough no terms related to forging are recorded in this period although forging was already a well established industry. I can only speculate as to the reasons, but it seems likely that most of the words related to forging, formalised in modern Swedish have Norse origins even if they were not written down before 1525.

In modern Swedish waste is a broader concept. From a situation where dirt floors were merely swept (sopor) to be clean, a more extensive use of wooden floors mean that refuse stuck to the floorboards. This gives rise to a need to scrape (skräp) dirt from the floor. Reuse is also extended to more businesses than tailoring, with words specifically to describe large quantities of cloth (lump). Advances in metallurgy also spur the development of words to denote reusable metal (skrot). Urbanisation also makes for the introduction of wet waste (slask & subbert) to describe the sanitary problems facing cities. Sorting through discarded materials (sortering & återvinning) for recycling also makes its entry on a large enough scale to warrant new words, as well as landfills (tipp) for that which is of no use to anyone.

Table 13 A suggested taxonomy of Modern Swedish (post 1525) words for waste:

	Indoors	Outdoors
Useful (reusable)	Lump, Skrot, Slagg, Sortering, Återvinning	Kompost,
Unuseful	Krafs, Skräp, Slask, Subbert	Tipp, Varp

In contrast to the previous period there are more words to denote reusable waste from industry or other human activities. These are added to the already existing words. There is also a diversification in the types of words which denote unuseful waste. Especially in terms of waste related to indoor activities. It is also noteworthy that the only word denoting useful outdoor waste falls out of use and is replaced by one of the buzzwords of contemporary waste management – compost. Yet other words introduced during this era also fall out of use like Subbert and Varp or lose their importance as waste management terms like Lump and Slagg.

Instead new words are brought into an increasingly the more diversified and complex contemporary recycling scheme; which encompasses in excess of 50 distinct terms in the industry dictionary.³³ Out of the 53 concepts listed by the recycling industry, I estimate that 15 are fractions that households would be expected to know and be able to distinguish when recycling; even if not all of them are actually used in day to day recycling.³⁴ In addition, when cross referencing the recycling dictionary with recycling information aimed at citizens 37 out of the 53³⁵ terms are readily used in communication with households concerning the recycling system.³⁶ This is in no way representative of the total number of potential terms related to recycling, but it is still a measure of how the complexity of everyday waste management has grown. Another significant change is the shift from words that denote waste reusable by the household itself or the local community to waste reusable by an anonymous third party actor. So, while the number of words increase, and become more complex and high-strung, their use also indicates a less hands-on relation to the reuse and recycling process. I

³³Based on the industry standard dictionary of recycling terms: (*Avfall Sverige - Ordlista Sv-Eng*)

³⁴ As is noted below, citizens in the Gävle region are expected to distinguish between 12 waste fractions in their home recycling station and an additional 9 at their recycling center – making a total of 21 de facto fractions. The 15 fractions in the dictionary are less specialized than the actual fractions, explaining the discrepancy in numbers.

³⁵ Or 70%.

³⁶ Based on a series of Google searches of the *gastrikeatervinnare.se* domain name.

believe that this change is indicative of a more general trend with regard to our relationship to waste management.

5.2 Recycling in the Gävle region

In 1722 a royal decree stated that citizens were responsible to dispose of latrine and refuse and see to that it was carried out of the cities at least once a week. Before 1722 waste management was not regulated in law. As far as I have been able to determine the old Swedish provincial laws (Västgötalagen, Upplandslagen) do not mention any crimes related to waste or waste management. In 1859 the city of Stockholm enacted bylaws to handle the disposal of latrine, and in 1869 this was upheld as national law (Ljungström, 1996, pp. 4-5). So in this sense the legal status of waste and recycling follows the linguistic development rather well. As industries develop and citizens multiply so do the complexity of waste management and the perceived need to regulate related activities.

Between 1869 and 1888 private contractors and individual citizens in Gävle were responsible for upholding the requirements of the 1869 law. From 1889-1925 the city council of Gävle centralised the disposal of waste through private contractors. In charge of inspecting this arrangement was the department of sanitation and its “Helsopolis”³⁷ or sanitation officers (Ljungström, 1996, p. 6). Between 1925-1998 waste management was taken over by the city council and run as part of their technical department. During that time many new innovations and changes were made to the waste management system. During WWII composting was implemented for the benefit of council run pig farms for example. The post war years and increasing consumption was met by the introduction of garbage chutes in new apartment buildings from the late 1940’s and extensive new landfills being established on the outskirts of the city.

In 1998 waste management was transferred to a new waste management organisation Gästrike Återvinnare (approx. “Recycling in the Gästrike region”). This organisation coordinates the waste management efforts in 5 council areas in the region.

- Gävle with 93000 inhabitants
- Sandviken with 37000 inhabitants
- Hofors with 9900 inhabitants

³⁷ Literally “Healthpolice”.

- Älvkarleby with 9000 inhabitants
- Ockelbo with 6000 inhabitants
- Total 155.000 inhabitants

This new organisation is headed by a CEO, with a politically appointed board of directors (5 persons, 1 from each of the 5 regions) and a likewise politically appointed council (20 persons, 4 from each of the 5 regions). The council counts as the highest office and convenes roughly two times per year. In the intervening time the board convenes around 10 times per year, and outside this the CEO is in charge of day-to-day operations.

From a judicial perspective this type of organisation follows the same laws as a normal city council in Sweden. However, the organisation is not funded through taxation as such, but through tariffs (which on the other hand are impossible to avoid, making the tax-like in an international perspective) and other fees. A typical household pays roughly 1900 SEK (185•)/year for the waste management service.

5.2.1 Recycling fractions (in the 2009 version of the system)

Waste category 1: Normally possible to recycle close to home

- Compost
- Coloured glass containers
- Clear glass containers
- Household waste
- Metal containers
- Newspapers
- Hard plastics
- Soft plastics
- Paper containers
- Compact fluorescent bulbs
- Batteries
- Light bulbs

Waste category 2: Recycled at the major regional recycling centres

- Hazardous materials
- Electrical waste
- Garden waste

- Combustible waste
- Landfill
- White goods
- Wood
- Impregnated wood
- Wellpapp

5.3 Practical day to day recycling in the Gävle region

For all intents and purposes recycling is conducted in two different manners depending on if you live in a house of your own (detached house/villa) or if you live in a condo/flat.

5.3.1 Scenario 1 – detached house

All households in detached house have access to a generic household waste bin. In addition they can choose whether they want to compost kitchen waste in their backyard or if they want a second kerbside bin for compost waste. All other fractions of category 1 have to be stored in the house and brought to the community recycling centre which is normally within a 5-30 min walking radius from the house.

A typical household stores glass jars, plastics etc in an outhouse or garage until the quantity reaches a level which warrants a visit to the local recycling centre. This centre usually consists of a number of open air metal or plastic containers with slots for category 1 fractions. Maintaining order in and around these centres is usually difficult as containers might spill over, waste is just dropped off outside the bins and birds might extract paper etc from the bins.

5.3.2 Scenario 2 – condo/flat

In this scenario the household usually has access to a smaller recycling centre or room³⁸ where most of the fractions listed as Category 1 are to be found. These recycling rooms are usually no more than 5 min walking distance from the flat. In addition, they are usually located along the main arteries in/out of the apartment complex. This is often purported to imply a higher potential recycling frequency of most fractions since it is easier to

³⁸ Often a modified version of the room where the old garbage chute system used to end – but increasingly a newly built house in the backyard to accommodate the increasing number of fractions to be sorted.

combine daily disposal of household waste with other fractions as well. This however does not mean that the recycling rates are necessarily higher.

A typical household has smaller bins under their sink to collect the main waste fractions and these are then emptied along with household waste as needed. Alternatively a larger bag or container is used to store a mixed collection of waste which is then sorted in the recycling room. Many variations to these methods exist of course.

Important to note is that at the time of our empirical studies there existed no official method of recycling, no best practice or canon, just recommendations in paper format and online guides on what and how to recycle. This meant that I could study the actual³⁹ practice of recycling from an open perspective without bias or influence from the recycling company.

5.4 Recycling statistics for Sweden and the Gävle region

Transparency concerning recycling statistics in Sweden is on the one hand great, but on the hand fragmented. Most statistics are available through official channels. However, there are a number of different web portals which provide different aspects on these statistics. The trade organisation Avfall Sverige⁴⁰ and its pop-science web portal⁴¹ provide entries to the other sources of information, like the trade organisations for packaging waste⁴² and WEEE⁴³ as well as others like them.

At the local level, regional data is often presented, at least in part, by the regional recycling company.⁴⁴ However, as can be seen in my examples below, even though there are efforts to synchronise reporting there are differences in how data is collected and presented. The statistics below should therefore be seen more as a general indication of the state of recycling and not as an absolute.

³⁹ Often described by us as in Appendix 17.

⁴⁰ www.avfallsverige.se

⁴¹ www.sopor.nu

⁴² www.ftiab.se

⁴³ www.elkretsen.se

⁴⁴ www.gastrikeatervinnare.se

*Table 14 A summary of 2008 recycling statistics relevant to the study*⁴⁵

2008	Gävle region	Sweden	National	National goal
			recycling rate	
People	93482	9302133		
Combustible waste incl compost (kg/pers)	227,3	243,6		
Compost of the above (kg/pers)	58,4	★ ⁴⁶		
Newspapers (kg/pers)	47,26	50,4	89 %	75 %
Metal containers (kg/pers)	2,8	1,97	67 %	70 %
Glass containers (kg/pers)	19,77	18,4	93,6 %	70 %
Paper containers (kg/pers)	15,6	10,3	74 %	65 %
Plastic containers(kg/pers)	3,76	2,21	60 %	70 %
White goods (kg/pers)	3,986	4,08		
CFL bulbs (kg/pers)	0,067	0,05		
Incandescent light bulbs (kg/pers)	0,066	0,053		
Batteries (kg/pers)	0,6 ⁴⁷	0,2		
Electrical waste WEEE ⁴⁸ (kg/pers)	9,138	8,818		
Hazmats (kg/pers)	★★ ⁴⁹	4,7		

With regard to the above number there are a couple of figures that I would like to point to. In general the regional statistics are close to or somewhat higher than the national averages. Having said that, paper, metal and plastic recycling stand out a bit extra. In general I would expect local recycling levels to be lower than average considering that the Gävle region rates below the national average as regards income indicators.

Lower volumes of WEEE recycling, following the economic recession would indicate that the region as such follows the general trends fairly consistently. This makes the “above average” statistics stand out even more. One possibility is that a kind of Hawthorne effect has been in place as Gästrike Återvinnare visited 23.000 households to inform them of the compost recycling reform. Originally intended only to inform citizens

⁴⁵ Compilation based on gastrikeatervinnare.se, ftiab.se, avfallsverige.se and elkretsen.se all figures concern 2008 unless otherwise stated.

⁴⁶ Since there is no national system for compost there is no national statistics on the total amount of compost. It should also be noted that in 2007 only 91% of flats and 66% of villas were actively engaged in compost recycling. Either completely unable to recycle (flats) or recycling in their own backyard.

⁴⁷ This number includes used car batteries – which are not included in the national statistics – which only include small batteries.

⁴⁸ WEEE = Waste Electric and Electronic Equipment

⁴⁹ No separate figure is available at the regional level.

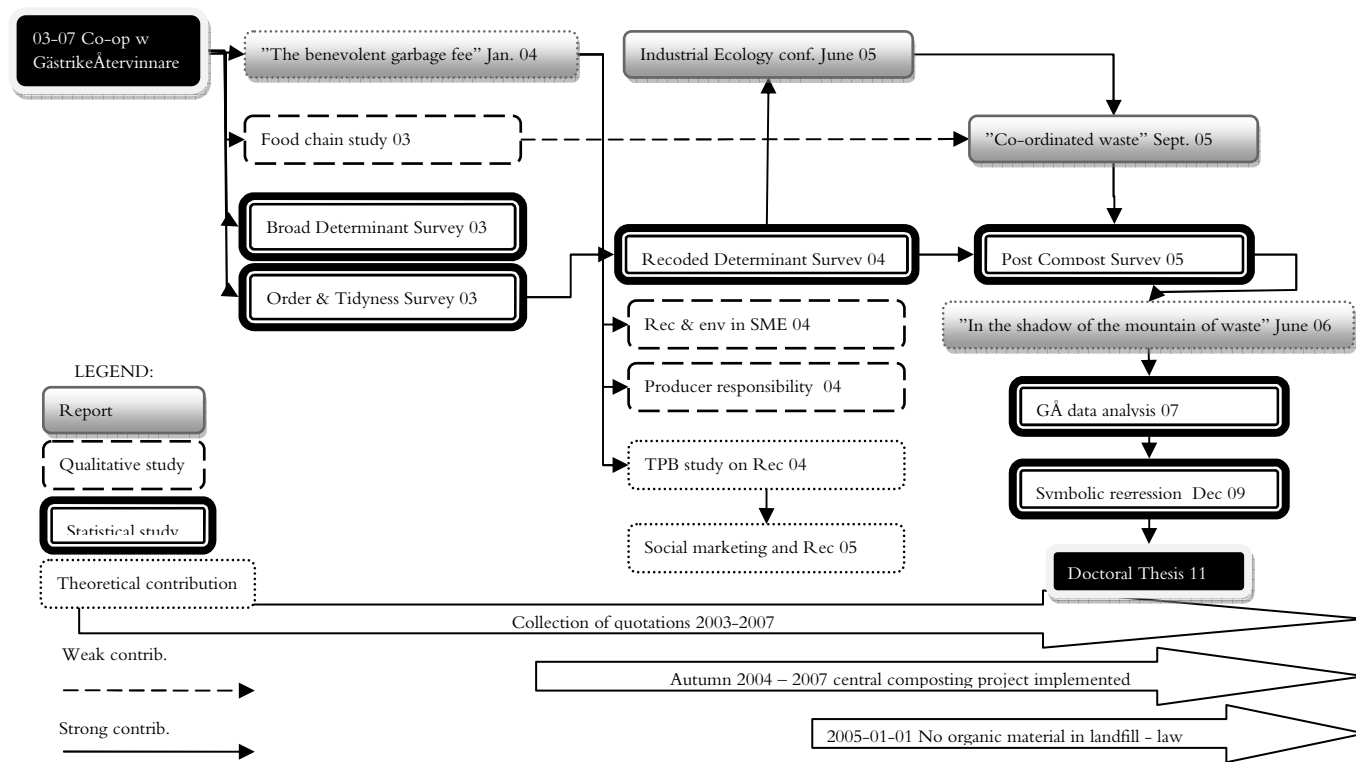
about changes to the recycling system concerning compost, it was soon clear that the effort itself sparked interest in the other areas of recycling as well. This effort is covered by a number of special studies in my work so as not to overlook its contribution, intended and unintended.

6 Results

6.1 Local recycling in the field - a summary of field data 2002-2008

This is perhaps the most daunting chapter to the reader. This is where I present and summarise the field work and research that my team conducted between 2002 and 2008. The longitudinal character of our work is reflected in the incremental nature of each study as it is added to grand total. Due to the nature of this chapter my main ambition has been to try to present the main findings of each study and its contribution as clearly as is possible and to help the reader avoid information overload. The figure is an attempt to disclose in full all of the different studies undertaken as part of the study. Since the sheer number of studies itself is daunting I have in the following tried to emphasis the studies that carried our work forward. This is indicated in the figure.

Graph 7 Schematic of the studies and their internal connections leading up to the thesis



In the following I present the systematic testing of determinants that our research group investigated as a part of my research.

In the following I will detail the different studies that I took part in and lead as a part of our research team during the years up to this point. The first group consists of studies started in 2002 and completed in 2003. They were started parallel with our main task at the time which was to study the effects of a new waste collection tariff system due to be implemented at the time. The intention of this system was that the design of the tariff system would promote the recycling solution desired by the regional recycling company. Our task was to investigate the mechanisms of such a system and its efficacy. However, it soon turned out that the monetary differences between the alternatives were so small that an understanding of the mechanism was hard if not impossible to attain. Instead my research into this public policy problem encountered a number of other themes which we deemed interesting to investigate further. This was the background and the reason why we initiated:

- a) An interview study to determine the reason of observed differences in recycling rates between areas dominated by single family houses, flats and condos.
- b) A broad statistical survey of a wide range of possible determinants of recycling behavior, specific to our region.
- c) Two studies on the role of the producer responsibility system of recycling - which, at the time, we considered to be one of the strongest direct and indirect determinants. One general study of the concept as such and one specific study aimed at the electronics recycling fraction and its connection to the home electronics industry.

As can be seen from the list we were heavily vested in the producer responsibility debate and tied to follow up one other important lead or anomaly by investigating the importance of housing arrangements for recycling. However, in retrospect it would be the general determinant investigation which was to provide the most knowledge and input for further studies.

6.2 The order and living arrangements interview survey 2003

This was one of our first three major investigations of the conditions of recycling in the regions. A series of interviews with key personnel at the regional recycling company and the municipal housing company started the operation. These interviews confirmed that recycling rates and the degree of perceived order in recycling facilities went hand in hand and that there were most tangible differences between the municipal housing areas and flats owned by the residents in Bostadsrättsföreningar, a Swedish version of a condominium system. Students were then dispatched to follow the recycling trucks around on their routes to substantiate this impression and search for suitable areas to conduct further interviews and surveys. This resulted in 6 areas being chosen for the next stage. Three condos and three municipal housing areas were picked, and among these, priority was given to areas which the local experts agreed were of special interest. It should be noted that the choices were made on the impressions of the experts and that the end results and impressions reflected in the latter interviews and survey would not necessarily be reflected in the tenants views.⁵⁰ The final areas were in turn chosen according to the following criteria (Klingberg & Kågström, 2005a, p. 7):

1. Municipal housing – low RR, problem area, high proportion of immigrants, large area
2. Municipal housing – medium - RR, medium problems, mixed tenants
3. Privately owned housing – well kept, medium + RR, few problems, small area
4. Condo – medium– RR, seemingly orderly
5. Condo – medium RR, seemingly orderly
6. Condo – medium+ RR, seemingly orderly

In the survey we tested how the following variables influenced the recycling situation in the neighborhood:

- Gender
- Household income
- Household size
- Age

⁵⁰ The experts and local janitors were subsequently shown to have simplified views of the state of recycling in these areas, and the local residents appreciation of the situation would often be different from what was reported initially.

- Ethnicity – measured in terms of 1st, 2nd etc generation immigrant
- Order of the recycling facility as perceived by the tenant
- Recycling rate – self reported
- Attitude towards a future central compost scheme – this future system change was only at the discussion stage at the time and was thought to reflect a broader attitude towards recycling as such.

As with all of our results, the results from this survey have undergone a series of subsequent tests and re-tests in the years after the completion of the survey.⁵¹

In this case, variables such as Gender, Income, Size and Attitudes towards compost were not statistically significant for use in the factor analysis.⁵² This is in itself interesting as already at this early stage of our investigation several demographic variables could be discounted. We were expecting to see gender differences, but as would be confirmed by our later surveys gender differences decrease as recycling rates go up. This is so simply because the initial pro-recycling tendencies among women are increasingly balanced out as fewer and fewer citizens opt out of the recycling system and the hard-core non- or anti-recyclers are found among both sexes.

We also expected income to be of importance, since generally speaking a higher income would be needed to live in a condo, and we surmised that living in a condo would be tantamount to an improved recycling rate and more orderly behaviour. This turned out to be prejudice on our behalf, as many of the condo owners are in fact pensioners whose income is low, although they have invested their savings in the condo.

Household size was also suspected to contribute to generating more waste and therefore make effective recycling more difficult. Again, our expectations were wrong and a possible explanation for this could be that a household with many children do generate more waste on the one hand, but also have many more potential recyclers to help out with day to day recycling. These two trends would then balance each other out to the extent that the variable is rendered useless as a predictor. The inclusion of

⁵¹ Our own methods, and my ability to run and use more advanced statistical test has advanced and at times the conclusions inferred during those first years of our studies no longer hold up. However, what is presented in this text is only such results as hold up to the same standards as our latest surveys.

⁵² They were discarded during the process of improving the KMO-value of the factor analysis, using the Cronbachers Alpha deletion method.

the simplistic “Attitude towards composting” variable was a mistake. As our later studies would show, the relation of citizens towards compost recycling was to be much more complex than we could expect.

The factor analysis resulting from this survey was not the most definite⁵³, but then again this should be attributed to the exploratory nature of our research into this field at this time. As is seen in the figure below the factor analysis resulted in three distinct groups.

Ownership and order – The first factor

As expected the first and strongest factor explaining the recycling situation in the investigated areas dealt with living in condominiums and the perceived order of the recycling facility.⁵⁴ Clearly these two go hand in hand and contribute to our understanding of how households understand recycling. As to the causality I would argue that the living arrangement and its particulars come first and contribute to the highly orderly state of recycling. We noted that certain recycling rooms had been fitted with surplus rugs and even potted plants at the resident’s initiative in condo areas. This of course in stark contrast to the often dreary recycling facilities put at the disposal of tenants in municipal housing areas, where no private initiatives had been made (or encouraged) to make the recycling experience as positive as possible.

Recycling and age – the second factor

In this particular investigation age turned out to be directly related to recycling rates. However, this finding was soon disproved in our later findings. The correlation here has to do with the deliberate choice to contrast orderly condos (w higher age residents) with less orderly municipal housing (w relatively lower age residents). Thus the factor is clear cut in this run, but it fares in much the same way as gender in later materials simply because as recycling rates increase the differences in demographic aspects vanishes.

Ethnicity – the third factor

Controversial though it may have been, we included this variable and it turned out to be a relatively strong factor, explaining almost 20% of the

⁵³ KMO value = 0.587

⁵⁴ Explaining 41,7% of the variance.

variance. Clearly a defining characteristic, but implying what? 2nd and 3rd generation immigrants were overrepresented in the non-condo areas and also generally of lower age, thus implying it as a factor influencing the state of recycling. At the time, the interviews accompanying the survey led us to believe that it had to do with accommodation to the recycling system, seeing as how longer periods of stay in Sweden led to higher recycling rates. It also led us to interpret this as a sign of the rate of turnaround in the housing system as a factor to be accounted for. The longer someone stays in an area (which is usually the case in condos) the more the household members feel for their area and take care of their common concerns, such as the recycling facility. We drew no further conclusions at the time, but decided to invest in another series of field work specifically dealing with this interesting issue at a later time.

In conclusion this part of our studies made us aware of the importance to know the studied area better and to be more sceptical or at least questioning of standardized demographic variables/determinants that are thrown into surveys more or less out of hand. It also served to make us more aware of the tacit knowledge held by all of the heavily involved citizens that we met during the study. Their knowledge and importance for a successful recycling program was to be a recurring theme in later studies as our respect for what citizens actually know grew. Finally it was also the first and last time we allowed ourselves to be influenced by outside “experts” in picking the areas to be designed. As we shall see all studies after this one were either conducted as broad area wide encompassing surveys or specifically directed in-depth interview studies designed to gather information based on our own previous results. In dealing with such a complex and always changing field of research it pays to be on top of one’s own material.

6.3 The pre-compost determinant survey 2003

6.3.1 The pre-compost setting

This survey was conducted parallel with the previous survey, but in this survey we opted to study one homogenous area more in-depth. A total of 270 out of 366 potential respondents answered the survey, which made it close to a total survey of the three areas in question.⁵⁵ Again living accommodations was checked for, with the addition of self-owned houses added to the previous mix of tenants and condos, and again the

⁵⁵ Response rates: Flats 90/132, Condos 90/124, Villas 90/110 which gives $270/366 = 74\%$ due to sheer determination of behalf of the field workers.

demographic variables had very little effect on the results.⁵⁶ Instead this survey included a set of questions concerning particular to the regional recycling system to test the actual knowledge of the individuals. In addition we expanded the use of self-assessment questions to cover the perceived knowledge of the participants in addition to their self-assessed recycling rate.

In this pre-compost setting, recycling followed the general trends in Sweden as a whole. Recycling rates were on par with the national level and so was the extent of public information campaigns. Nor did the recycling system differ substantially from the national custom. A moderate number of waste fractions were recycled⁵⁷ and the system had undergone only a few minor adjustments⁵⁸ in how recycling was conducted in the years before. To further facilitate recycling the main municipal housing company (Gavlegårdarna) had built recycling centres for most of their customers, and only a minute fraction of private housing companies retained the old garbage chutes. It was thus a settled and fairly advanced recycling system that we set out to study.

“Of course it works with this whole recycling thing – as long as they don’t mess with it [changing the system] – but it sure was a lot easier back when we had them there garbage chutes!” Older lady on the troubles of recycling – city centre 2004-04-20

As stated above the survey showed that we could disregard demographic determinants such as income, household size, ownership vs. tenancy, occupation and age from recycling as such. In fact, recycling was an activity which did not divide the population demographically in any meaningful fashion. This would seem a natural consequence of the high level of participation. When the overwhelming majority takes part in a public policy programme, demographic differences would be expected to peter out.⁵⁹ This lends support to our claim that recycling habits such as they were at this time were indeed settled.

⁵⁶ Age, income and living arrangements covaried with each other in predictable fashion and consistently formed their own factor in factor analysis. The statistical significance of gender was also so low that the variable had to be stricken from the finalized data set.

⁵⁷ The survey identified 11 distinctly different recycling fractions.

⁵⁸ Regarding e.g. how to recycle different qualities of plastics.

⁵⁹ Certain student dorms for example had a bad reputation among waste collectors and certain tenancy areas would stand out from the majority – but these exceptions did not

What was divisive was instead how citizens, as a whole, viewed the different waste fractions in relation to the recycling action itself. The waste fraction division ran along the lines of what we termed the "kitchen waste fraction" (KWF) and a second, larger group, which we call "activity waste". Regardless of demographic background citizens would centre their recycling activities around these two focal points. The two groups from this survey contained the following waste fractions:

The Kitchen Waste Fraction (KWF)

- Soft plastics containers
- Hard plastics containers
- Metal containers
- Food scraps/Compost

Activities waste

- Batteries
- Hazardous materials
- Newspaper
- Glass containers
- Electrical waste
- Paper
- Corrugated fibreboard (Wellpapp)

This division into groups of recyclables seemed robust and only changed when we identified an even stronger determinant. This survey⁶⁰, with its emphasis on different forms of citizen knowledge as a determinant of recycling rates, provided additional information on how citizens regarded different waste fractions. Apart from giving us more insights into how each waste fraction was seen it showed that actual and perceived knowledge did indeed play a pivotal role in citizens recycling efforts. In this run the KWF fraction remained intact apart from compost which was vectored in

stand out in the collected material and the observed problems would change and shift from area to area with time and circumstances outside the demographic sphere. It should also be remembered that even though the order of the recycling room in question might look despondent, the actual recycling rate amidst that chaos might still be relatively high – thus causing only a marginal impact on the overall performance of the system.

⁶⁰ Result of SPSS Factor analysis, KMO: 0,799

separately with actual knowledge on recycling.⁶¹ This pre-compost result is interesting as it points to the special role attributed to compost waste among individuals, even before it had been acknowledged by the authorities. More interesting was that compost recycling was negatively correlated to actual recycling knowledge, putting that activity at odds with a firm knowledge of the system. The benign interpretation is that compost knowledge was something different from recycling knowledge at this time, not necessarily worse, just different and set aside. On the other hand it may have been that the less knowledgeable thought they recycled food scraps when in fact they were just putting them with the residual waste fraction.

“Well it is all put to good use isn’t it?” [Burning food scraps for district heating] middle aged woman on food scraps in regular trash 2003-08-26

My conclusion however, regarding this is that we need to take the figures at face value. Doing this leads me to infer that compost recycling in the pre-compost period was the traditional domain of those that composted for its own intrinsic value. They generally did so as to have compost in the backyard and not as result of any sort of environmentalist conviction on the matter. This has ramifications for how we then regard the results of the post-compost setting. There is cause to return to this interesting observation in later chapters. Furthermore, with actual knowledge loading higher on the compost factor than on the perceived knowledge factor, we had to start thinking in terms of actual and perceived knowledge about recycling as being largely separated. This has ramifications of its own and changed our outlook for later research considerably. In this sense it was far less surprising that perceived knowledge and the environmental value attributed to recycling went hand in hand, although partly disconnected from actual knowledge.

The image of an enlightened recycler as the ideal participant was thus put in question. Instead there would seem to be room for enlightened and effective recyclers with no or little emotional connection to recycling, just as there existed boastful and ineffective recyclers in our material who only paid lipservice to the system.

This was the first manifest encounter with the Value-Action Gap as described and hypothesised by Barr (Barr, 2004, p. 247). That there could be a discrepancy between the reported value and actual action was only to

⁶¹ Loading 0,872 for compost waste and -0,578 for actual knowledge

be expected but to see the magnitude and the potential effects was important to us as it opened up new avenues of research. Primarily, it showed that careful attention needed to be brought to not only the value-action gap but also to other such gaps as for example the gap between reported and actual knowledge with regard to the topic. A lip-service vs shrewdness gap if you will. This realisation prompted us to perform a cluster analysis on the material to see if we could describe these new archetypes of recycling in a fashion meaningful to our research. However before we go into that I will discuss the initial and particular results in more depth.

6.3.2 Pair wise determinant comparison

Looking more in detail into the survey data we find interesting particulars of the recycling mechanism. Taking the previous survey as our starting point this unaggregated actual knowledge data can give us insights into what kinds of knowledge about the recycling system is connected.⁶² It turns out that the recycling of paper containers, newspapers and corrugated fibreboard is unrelated to the knowledge of what happens to the recycled material.⁶³ This is a sign of the mundane and everyday character of this type of recycling and the maturity of this sub-system of the recycling effort. People recycle paper regardless of their knowledge of the system and knowledge of paper related recycling is one and the same type of (unproblematic) recycling in the minds of citizens. This however, is where the mundane character of recycling in this system ends.

Hazmat and batteries recycling form a distinct factor with knowledge about hazmat recycling and household recycling, but are inversely correlated.⁶⁴ Considering the relatively low recycling rates for hazmats, we primarily interpret this as a result of inflated self assessed recycling rates for hazmats among those citizens who have a low actual knowledge of the hazmat recycling system. Those who really understand what hazmats are and how they are recycled also realise how poor their performance in this respect is. Conversely, those who have a dim knowledge of hazmat recycling overrate their efforts in this respect. In addition, it should be noted that low hazmat recycling rates coincide with correspondingly low knowledge of the more

⁶² Result of SPSS Factor analysis, KMO: 0,809 – 5 factor solution

⁶³ Factor loading: Knowledge about fibreboard 0,924, regular paper 0,910 and newspaper 0,776 vs recycling of fibreboard 0,729, regular paper 0,705 and newspaper 0,568.

⁶⁴ Factor loading: Knowledge about hazmat recycling -0,623, household waste -0,484 vs hazmat recycling 0,640 and batteries recycling 0,704.

well know regular household waste recycling scheme. This further strengthens this interpretation of our findings. Household waste recycling levels being, on average, relatively high means that those who fail to grasp this side of the recycling system is a small group.

Equally peculiar, but also indicative of the great potential collective wisdom of citizens, is the relation of the remaining actual knowledge questions. Knowledge on glass, metal and hard plastics recycling go hand in hand and form a factor of their own, whereas knowledge on soft plastics recycling is in a category of its own. While the former factor contains only materials that are re-used in a traditional fashion, the latter contains a material that is separated to be incinerated to produce district heating, just as the household waste fraction. Soft plastics, although distinct from the other types of knowledge, is also separated from the act of recycling said material. My interpretation is that this is indicative of the potential disillusionment of citizens in the system. Those who realise that soft-plastics recycling is not needed from the citizens, or the environments perspective, but only as a convenience to the recycling company risk facing increasing disillusionment and even reduced motivation to recycle.

When the knowledge related questions are aggregated and recoded to be compared with the self assessed knowledge of the citizens a somewhat different image arises.

The most interesting result is that compost recycling and actual knowledge form a factor of their own, with an inverse internal relation.⁶⁵ That is to say, those who did compost recycling in the pre-compost period were among the least knowledgeable about the recycling system. Or put differently, they did more recycling than most even without knowing the system, illustrating that recycling activities need not always be attributed to knowledge about the specific system. Conversely it tells us that those who knew best the pre-compost recycling system did not bother or find it worthwhile to recycle compost. This illustrates the how a strong recycling system may unintentionally make the user passive and unwilling to go above and beyond the system.

As to self-assessed knowledge of the recycling system, that formed a distinct factor with the self-assessed value of recycling.⁶⁶ At first glance this points to

⁶⁵ Result of SPSS Factor analysis, KMO: 0,799, factor loadings: Compost recycling 0,872 & actual knowledge -0,578.

⁶⁶ Result of SPSS Factor analysis, KMO: 0,799, factor loadings: Self-assessed knowledge 0,784, self-assessed value of recycling 0,716 & actual knowledge -0,578.

perceived knowledge and perceived value to go hand in hand and to be mutually reinforcing. However, the first caution against this interpretation came with the discovery of the albeit small crosswise interaction of these two aspects and actual knowledge. The latter more strongly belonging to the category discussed above also had an influence on this factor and this warranted further investigation. Already the relatively weak contribution of actual knowledge to this factor was a sign of caution and an indication that we needed to look into this further. A cluster analysis of the same statistics provided valuable to the interpretation.

6.3.3 The pre-compost cluster analysis

Clusters were prepared to give as good an insight into the behavioural patterns observed as possible. Successive tests with a varied number of clusters and addition or rejection of extreme observations were made. In the end the most illustrative cluster was a 6 cluster analysis retaining all valid cases. This was then repeated in the post-compost material with the same precepts.

The end result is as follows:

1. The second largest cluster (22% of the sample) had a self-reported recycling rate of 94% and distinguished itself by their relatively high age and high degree of home-composting. This is of course a reflexion on the results from the factor analysis above which showed that home-composting need not go hand in hand with actual knowledge about recycling, rather on the contrary. Both actual and perceived knowledge was at the medium level. Members of this cluster were also slightly more affluent than other clusters. This cluster was dubbed the “Sub-urban elite recyclers”. *“I take care of my garbage much as I have always done, and I try to be frugal – I guess that that is a generation thing, us having experienced the war and all.”* Older woman on how she recycles, 040318
2. The second cluster, “The busy average Swede” (16% of the sample), was characterised by a respectable recycling rate of 74%, and average knowledge levels. Knowledge wise they have the same potential for recycling as the previous cluster, they just do not. Most likely because of other life-priorities due to their lower average age. *“Sure we could do more but with the kids and all – and besides I still think that*

recycling is a bit messy” Younger mother of two on the problems of recycling. 040320

3. Much like a mirror reflexion of the first group “The knowledgeable elite” (30% ots) recycles around 93% of their waste, while being distinct in having a very high actual knowledge level. This is also the largest cluster, and like the first cluster, it is somewhat more affluent and older than the average citizen. *“Hey, I know my way around the recycling bins; it’s no big deal once you get the hang of it. I have my own system you see!”* Elderly gentleman’s response when approached on why his visit to the recycling system was so quick. 040318
4. The fourth cluster, “The occasional recyclers” is also the smallest (1% ots) and most peculiar. It is made up of the youngest members of the sample, and also the least knowledgeable in all respects. They recycle no more than 28% of the refuse and see little of no point in recycling. *“I have no time for your questions; I am just here to throw away my trash, ok?”* Young man responding defensively after throwing away a big bag of unsorted trash. 040320
5. The “Urban malcontents” (13% ots) do recycle, but only about half (54%) of their recyclables. They live in apartments and are not all that well off. Their actual knowledge about the recycling system is average but, they have low self-esteem and trust in their own knowledge. A potential for increased RR seems to be embedded here, since in other attributes this group is reminiscent of the second cluster. This cluster also sparked an interest in the effects of differences in where and how persons live, and how the access to recycling facilities affects recycling rates. Drawing on our previous research into the effects of order and tidiness in the recycling room, this was to be a theme in the post-compost research as well. *“Where my boyfriend lives, there are mostly immigrants and I guess they try to do their best, but it’s always messy there [in the recycling room]. Actually he [her boyfriend] prefers to take his trash over to my place to recycle!”*

[Giggles...]" Younger woman at the city centre on the troubles of recycling. 040320

6. The final cluster "The ineffective" (18% ots), is again similar to the second cluster ("The busy average Swedes"), in their 71% recycling rate. However, the persons in this cluster have among the highest actual knowledge rates in the sample, and in that respect remind us of cluster 3 ("The knowledgeable elite"), although younger (middle aged), and less affluent (middle incomes). This suggests a transitional status, in between the split focus of younger age and the experience and efficiency of the older cluster. *"My husband and I bought a recycling kit at IKEA and installed it in our flat, the kids were told in school that it was the best thing to do – we are very environmentally aware you know. But to be honest, it takes sooo much time to get it right. Mats [her husband] says that if it's going to be like this we might as well stop recycling, and that whole compost thing, didn't they say that it was better to just incinerate it all?"* Long rant from a very environmentally concerned, but also critical middle aged woman. 040320

Deeming from the cluster analysis at this time, in the pre-compost era, there were a couple of things that could be influenced to raise recycling rates. First, help to increase actual knowledge among recyclers, not only on the recycling system as such but on over all knowledge of the issue at hand. This seems instrumental as a means of rapidly increasing recycling rates without having to wait for the natural experience that comes with increasing age. This could have pushed recycling rates from the order of the cluster 2 or 6 to cluster 1 or 3, that is from around 70% to 90%. Secondly, lack of trust in one's own knowledge seems to be a major difference between clusters that are otherwise similar except in this and their recycling rates. Boosting this through for example some manner of feedback of what people in cluster 5 do well could help boost confidence and in turn recycling rates, making them similar to those of cluster 2, and help recycling rates go from around 50% to 70%.

Table 15 Distribution of recycling rates depending on knowledge levels

	Low actual knowledge	Medium actual knowledge	High actual knowledge
High perceived knowledge	NA	70-90% RR	90%+ RR
Medium perceived knowledge	25-50%RR	50-70%RR	70-90%RR
Low perceived knowledge	25% RR	50% RR	NA

So in conclusion a combination of educational measures and feedback or similar efforts to reinforce correct beliefs about the recycling system would have been suitable and possible to increase the recycling rates in the pre-compost setting. With reference to the results of the factor analysis the best leverage for such measures would probably have been in the area of recycling fractions that were among the least recycled as for example hazmats etc.

6.4 The producer responsibility interview and policy study 2003-04

A part of the initial investigation into the many different aspects of day to day recycling, we initiated two part studies into area of the so called “Producer Responsibility System”⁶⁷ in Sweden. The first was a study of the effects of the system in the home electronics business, which focused on the tensions between small and large producers and the end retailer. That study encompassed a dozen in-depth interviews with key personnel at regional retailers. Our aim was to determine to what extent this parallel system of recycling interfered with the regular system. The second study on this topic was more theoretical in aim and scope. It dealt with the policy as such, its interpretation and practical application.

I would not go as far as to state that this track was a dead end, although it clearly showed that citizens do not differentiate between this part of the system and the regular recycling system, and that any such division is therefore artificial and must be dealt with as such. Seeing as how our focus had been the individuals perception of recycling from the very start, we

⁶⁷ Producentansvaret – the Swedish system of assigning the producer the ultimate responsibility for recycling its products.

interpreted this as a signal to continue this focus and continue to regard the recycling system as the citizens do. This also influenced our interpretation of this policy and is shown in our reports from that time.

The results of these two studies are deliberated in our 2005 report and I since the most important conclusion was to see the PRS as a part of the regular recycling system I will just go through the conclusions that have a bearing on my analysis in this thesis.

We classified the PRS as an experiment of sort, using a less coercive approach to achieve environmental goals. The PRS is in this regard a successful policy measure if it results in improvements in recycling rates of the specific materials it covers. In addition it should be regarded as means to give impulses to the main actors included in the system to introduce whatever means they see fit to accomplish the goals (Klingberg & Kågström, 2005b, p. 11). The law itself speaks of “appropriate” measures but what is seen as appropriate may vary over time. However, this leeway is also an advantage in that it gives producers the opportunity to test different recycling systems which might or might not suit their business (Klingberg & Kågström, 2005b, pp. 11-12). In the end I surmise that the intention of the law maker is to distill a set of measures that are best suited to the task. It is also possible that the plethora of policy measures created under a lax interpretation of the law may serve as a set of examples if the law maker wants to be more specific.

Returning in more detail to the issue of how citizens regard the PRS, we noted that the average citizen determines how to recycle by what kind of material the waste is made of and NOT by who the producers is. This in turn lead to a situation where, at the time, as much as 30% of for example household packaging waste should have been recycled through PRS channels, which in turn meant that citizens had to pay double for this service. Once as a recycling fee when the product was bought and once again when they recycled it as regular waste (Klingberg & Kågström, 2005b, p. 12).

In conclusion we noted that the main issue facing the PRS was how the main goal of the policy would be realized, so that products cause less waste. However, we determined this issue to more complex than generally described. On the one hand it strives towards waste minimisation through limiting packaging and alleviating recycling through design features, on the other packaging which protects the merchandise and limits damages, storage waste etc can be seen as the real environment savers if a LCA perspective is

put on the packaging debate. From the perspective of this thesis, I wish to reiterate that after these studies we never ventured into this policy area again, although it beckons to be researched in depth. Instead the realization that citizens regard waste depending on the material concerned was further corroborated and continued to be an important determinant for further studies. Equally important was the realisation that

6.5 The collection fees study – 2004

After about a year of studies we summarized our findings in the first public report on our progress. The theme of which was to be on the design and efficacy of collection fees for the environment. In retrospect it is interesting how quickly our focus shifted from the collection fees to the other determinants of recycling behaviour. Instrumental to this shift was the realisation that the relatively small span of alternatives for citizens recycling fees in the region made this determinant null and void (Klingberg & Kågström, 2005a, p. 3). Other determinants had to take precedence. In short we determined that higher fees might result in adverse behaviour and a higher opt-out rate, whereas low fees might signal that the issue is less important.

A balance between the fixed and variable fee also seemed to be of interest. Under the current system we found that the fixed fees do indeed help to pay for fixed costs, but are less well adapted to handle short-term variable costs in recycling business. High variable fees signal the intention of the policy maker more strongly but can become so high that the volume of waste collected is reduced to the point where they no longer cover the costs (Klingberg & Kågström, 2005a, p. 3).

The only possible venue for use of the fee as an environmental policy measure we found to be if the households could expect to reduce their fee through their efforts. A brief (Klingberg & Kågström, 2005a, p. 9) life-cycle analysis experiment among households in the region showed that “good” households with low environmental impact through their recycling efforts find it unfair that households with low recycling rates or high environmental impact pay the same fees. Of course the definition of how each waste fractions environmental impact is important here, and this should also be kept in mind when the recycling company frames how different fractions should be dealt with. The signal from the regional recycling company is easily picked up in this respect. Even if the fee reduction is “imaginary” the feeling conveyed by being offered a discount

on their recycling fee by doing a good job could serve as a means of positive reinforcement (Klingberg & Kågström, 2005a, pp. 9-10).

This line of reasoning also gave rise to the realization that citizens differ in their views on fees that have to do with what they WANT and what they DON'T WANT. Paying for water and electricity is inherently different from paying a fee for something you don't want like waste management. The example is perhaps even more poignant if we contrast the act of actively shopping for something we have dreamt of with disposing of something we no longer desire. Shopping for a new car is not only a major investment but a big emotional investment for most persons, whereas deciding which scrap yard should dispose of it once it is worn out is of little concern. I view this distinction as pivotal to our understanding of what can and cannot be done about recycling. Belonging to an action of the second category has both ups and downs. On the one hand our LCA seemed to show that this line of reasoning made the construction of an environmentally sound fee system more difficult. On the other hand, if we look beyond the obvious negative, it also means that the decision to dispose of waste is, from the very start, a low involvement decision compared to the acquisition of the same object. If used as leverage this latter characteristic may be of value especially as recycling rates increase and ever higher compliance is expected (Klingberg & Kågström, 2005a, pp. 9-10). We hypothesized that at least some citizens would have recognized recycling as such and that this should show in latter field data if we only tweaked our questions to take this facet into consideration. In the post-compost data we would get the answer to this conundrum.

Add to this that the cost for waste management is marginal for most households in comparison to their total budget and you have the bottom line explanation why fees are not as policy inducing as the regional recycling company originally thought. This is the finite argument why we decided to focus on other determinants (Klingberg & Kågström, 2005a, pp. 2-4).

To complicate things further, the above should also be seen in the light of the new environmental law introduced in Sweden in 1999⁶⁸ which represented a return from “negotiated compliance” principle in force between 1969-1999 to a more “compliance oriented” environmental law (Duit, 2002, p. 12). We drew the conclusion that this shift contributed to a gradual undermining of the legitimacy of the existing approach among

⁶⁸ Miljöbalken

ordinary citizens, as the persuasive nature of the new law became more obvious. When preventive measures are turned into control measures the relation between governing and governed shift, and again in such a way as might potentially undermine the policy system. In the worst case scenario the compliance focus may result in a negative spiral of distrust between the controller and the controlled, spinning out of control until neither part has any confidence in the other and contacts are increasingly formalised. Such a spiral is both hard to avoid, break and recover from. This policy design in environmental law is bound to influence how regional waste management is design in turn, and it may well taint the relationship between the citizens and the waste managers even though they are interdependent of one another. The now discontinued use of “Garbage police” or private investigators to hunt down and fine wrongful recycling was a part of this tradition and its results in the form of bad will are still seen when we do interviews. By forcing the waste manager to take judicial action against citizens who do wrong by accident, the new environmental law makes a correspondingly “good spiral” very hard to accomplish. This in turn is aggravated as recycling rates go up. Since all recyclers make mistake, even the most ardent recycler might be prosecuted for what might in the end be a trivial mistake (Klingberg & Kågström, 2005a, pp. 4-6).

In the report we also summarized the most common misconceptions among ordinary recyclers along the lines of the, at the time seminal, study of recycling in Sundsvall (Anderung & Nilsson, 2003, pp. 3, 12). I include an abbreviated list to illustrate such misconceptions which might result in the odd trivial, yet legally reprehensible, mistake.

- Separating clear glass from stained or coloured glass was well known, but the reasons for this was not. Neither was the reasons for not putting window glass in the recycling container. The material as such was the deciding factor.⁶⁹
- Recycling hard and soft plastic separately was also widely known to be correct, but again the reasons for this was not.⁷⁰
- Metal containers were still widely believed to end up as land fill.⁷¹

⁶⁹ The producer responsibility is the main reason, window glass is not a container or packaging material. The second reason quoted at the time was that window glass has other properties than bottle glass and is therefore less suited for recycling together.

⁷⁰ In the system in effect at the time soft plastics was incinerated for the district heating system and hard plastics sold for reuse in PET-bottles etc.

⁷¹ Of course these were carefully recycled for the metal value.

- What to do with letter envelopes was not generally known and at the time even hard to discern from the information supplied by the regional recycling company.⁷²
- A majority thought the waste management fee was much too high, but only a fraction could specify how high it was.
- When asked to assess the amount of waste generated by the population in the region it was overestimated by a factor 100.⁷³

This brief list illustrates three points that are necessary to understand in order to follow the development of our research further.

1. First of all it illustrates the role of knowledge for effective recycling. Knowledge may facilitate recycling, but is not a sine qua non even for high levels of recycling. It is fully possible to do correctly even without knowing why!
2. However, the higher the stakes are that are attributed to a successful outcome of recycling the more important high actual knowledge becomes. If the stakes are less high and less relative importance is attributed to recycling, recycling may be easier transformed into an everyday action which requires less involvement without lowering the expected outcome.
3. Realistic expectations on the system and realistic assessments of the seriousness of the problem may also be beneficial in this respect. A person who overrates the extent of the recycling problem by 100 times is of course more likely to feel frustration at his or her own inadequacies in this respect. On the contrary a person who makes a realistic assessment of the scope of the problem and therefore attributes less value to the action is more likely to just conform without frustration and relegate the act of recycling to an everyday means of waste disposal without any serious moral connotations. We also hypothesized that this latter position would be easier to attain from the societal point of view of the policy maker since

⁷² On a formal level envelopes should be thrown away as general household waste for incineration, BUT off the record managers at the regional recycling company sometimes concede that the paper sorting machinery is well suited to deal with both the glue on envelopes and the possible plastic windows on some envelopes. Stories to this effect also circulate among the population and still contribute to the confusion on the subject matter.

⁷³ This “curio” question was deemed to be so interesting by us that we included it in the post-compost survey two years later as a reference. But more on that in chapter x.x.

fewer values and attitudes need changing to reach this position, than a highly involved recycler.

In conclusion this summary of the first year of research demoted the discussion on fees to a secondary role, increased focus on knowledge and made us realize the special nature of waste management in the eyes of citizens. A much greater attention to how citizens view different types of waste and how they value their own efforts in relation to the overall ambition of the system would be in our focus from here on.

6.6 The food supply chain explorative survey 2004

With this study we wanted to investigate the stages of the food supply chain before the end consumer before the compost project was introduced in the region. We set about doing this through in-depth interviews with two farmers, two wholesalers/retailers and two restaurants operating in the region.

The results of this round of interviews was largely confined to determining the attitude of those that supply the compost material to households.

We found that the farmers had come furthest in their efforts to adapt to recycling and environmental efforts, thereafter retailers and last restaurateurs. The reason for this we determined to be due to a series of rather complex reasons. The farmers found environmental adaptation an inherit part of their business and everyday operations. This was largely to the longer, often multi-generation perspectives on their livelihood. Secondly, and as a part of this, the farmers industry organization (LRF) also promotes a strong green profile and there is a lively debate concerning the conditions of the business (Klingberg & Kågström, 2005b, pp. 6-7).

Retailers reported, as did restaurant owners, that with a system in place which is reasonably easy to follow they will do so. However, daily concerns in their business operations always take precedence so economic pressure sets the level of involvement possible to expect. AS soon as day to day profitability and concerns are settled however even the most stressed restaurant owners had an ambition to do the “right thing” (Klingberg & Kågström, 2005b, pp. 6-7).

The change implied in these results is a slow, albeit inexorable one. The food supply business will go the way society in general is going given time

and opportunity. A business which is going well is more likely to conform or go in the forefront. A personal commitment on behalf of the owner increases the likelihood of proactive measures. Strong central organizations with a greening ambition also helps further the commitment at a local level, but when it comes down to it the level of service available sets the mark for these businesses. Given the opportunity to recycle in an effective way they most likely will make an effort (Klingberg & Kågström, 2005b, p. 6).

From our perspective this foray into the supply side gave further indication that soft measures rather than force and pressure is the most viable way forward. If even the suppliers can be relied upon to do well as long as the means are provided, then this could also apply to the ordinary citizen. Advice and encouragement, except in the most environmentally hazardous activities seemed to offer the greatest potential improvement among the general population.

6.7 The SME and ecological services interview study 2004

A parallel study to the one above was our survey among 70 small and medium enterprises (SME) in our region. The companies targeted were all part of active business clusters seen as proactive and successful in their respective areas and businesses. The first cluster dealt with tourism, the focus of the second was in small scale manufacturing and industry with a high degree of technical specialization especially in forestry and construction. The third and final cluster included computer firms in the B2B sector.

The object here was to complement the in depth study on the food supply chain with a study on the many SMEs that form the basis of the local future economy. We wanted to see to what extent they were going subject to the same pressure and shift in environmental position as the population in general and recycling business in specific.

Apart from data on recycling the survey generated data on attitudes towards environmental work, issues and policy. This proved useful for us in determining the limits and bounds for what can be done within the limits of recycling systems under the current conditions.

What struck us and surprised us the most was perhaps the complete lack of knowledge and disinterest in the environmental policies of the municipality. Not a single company could cite knowledge of this, which was even more

remarkable since the policy implications in question could be construed as rather far reaching for the companies (Klingberg & Kågström, 2005b, p. 7).

This gives an interesting insight into what really drives SMEs to work with environmental issues, and the list of determinants aside from policy measures was thus even more interesting. Not surprisingly customer demands was cited as the most important driving force, however with that said it should be noted that such demands were largely non-existent in the SMEs surveyed. Likewise, similar demands from partners in the supply chain or from their respective industry organizations would be met with a serious response. However, again such demands were not reported. This could be interpreted as a serious problem for environmental attitudes, nonetheless there was a considerable consensus that environmental adaptations would yield societal gains. At the same time this was considered separate from similar advantages for the companies in the survey. Thus we found a duality among these entrepreneurs. If the customer wants it, they will get it – post haste – but as long as there is no REAL demand there are other facets that need attention (Klingberg & Kågström, 2005b, pp. 7-8).

Differences between the industrial clusters were also visible. We expected the tourism industry to report the highest levels of environmental concern, but found that this was not the case. In fact it was the SMEs in the industrial cluster, especially in forestry that showed the highest level of indicators such as environmental certification etc. The computing cluster was only interested in environmental issues to the extent it was sought after by their customers – which was not the case (Klingberg & Kågström, 2005b, p. 8).

Attitudes towards recycling were positive in so much as that all cluster participated to the extent of the average household and to the extent the system permitted. The tourism cluster was deemed to be able to do more in this respect, and manufacturing companies were at the forefront of recycling due to the monetary benefits/resource nature of recycling there (Klingberg & Kågström, 2005b, pp. 7-8).

We interpreted the results as a corroboration of a gradual and incremental development of environmental demands as being the most viable way for policy makers to increase compliance and participation. The reason for this is that such gradual changes allow the SMEs to adapt their business practices in order to comply and see the potential business benefit of change. Radical change was seen as intrusive and seemed to risk the delicate trust between policy maker and SMEs. As in the previous study economic advance and

security seems to come first and then entrepreneurs have time and resources to deal with whatever environmental degradation they cause (Klingberg & Kågström, 2005b, p. 8).

That said, it should be noted that none of the companies in these business clusters are major polluters or companies that disregard the environmental law. What we discuss is efforts above and beyond what is required by law. It is also easy to view these SMEs as separate from the individuals we investigate in our main focus, but I would like to reiterate that these SMEs are run by people who encounter the recycling system at home every day after work, and are by no means impervious to the societal changes brought about by policy change in this respect.

This works both ways and employees as well as owners which have grown accustomed to one recycling system at home question why the same system is not available at their work place. An example of a mental incongruence which may damage the overall system in much the same way as the materials vs producer responsibility conflict detailed above. Just as the environmental information from the recycling company urges the individual to take on a holistic approach to nature and see the broader picture, with increasing knowledge and experience in recycling citizens expect the same holistic point of view to be applied to the recycling system as well. SMEs and citizens are one and the same and just as they accept recycling they expect only having to learn one system to comply with the requirements.

6.8 The miscreant study or the TPB evaluation and usefulness studies

Having studied the different precepts of the recycling system, the peculiarities of the producer responsibility system and how businesses adapt to and influence household recycling we now returned to the individual level. Assured that most citizens do right by the recycling system we wanted to make clear what literature had to say about where to search for the miscreants for the recycling system. Looking at our initial empirical studies we hypothesized that a Pareto relation of sorts would be in effect here. Considering the high recycling rates reported we assumed that 80% would behave near perfectly and that 20% would be responsible for most of the littering and faulty recycling reported. However our assessment of Ajzen Fishbein TPB model lead us to rewrite our hypothesis and claim the opposite, namely that only about 20% of the population reach near

perfection in a system such as the one we study and that most or 80% to paraphrase the Pareto relation sometimes do mistakes in their recycling. The previous assumption may be correct for contexts with lower recycling rates, but in order to make our findings correlate with theory the latter interpretation has to be made (Klingberg & Kågström, 2005b, pp. 10-11).

Our views on the recycling rooms also changed as the metaphor of the tragedy of the commons seemed more than appropriate. These common rooms or small houses are regarded as “commons” where there are problems – for everyone to use and for no one to care for, whereas in areas where there are less problems the recycling facilities are more clearly owned by the inhabitants themselves or cared for in unison by the end users. Solving the problem of messy recycling facilities could therefore be looked for among such patterns (Klingberg & Kågström, 2005b, p. 11).

Looking solely at the TPB model in the context of our research, the reasons for non-compliance with recycling could be found in a combination of factors. Attitudes towards recycling as such and the system citizens are expected to use influence the outcome. So does weak social pressure to do “right” and lacking actual knowledge about the system. Convenience and practical obstacles also imperil higher recycling rates. Moral aspects of ecology seemed to be expected only to have an indirect effect on attitudes (Klingberg & Kågström, 2005b, pp. 10, 12-13).

Seeing that this strand of theoretical research into the determinants of recycling pointed in the way of social marketing we initiated such a follow on study as well. The main precept at this point was that given the above results and our research to this point one could view recycling as the “desired activity” from the policy makers perspective. In this case the main competitor and anti-thesis would be “undesired behaviour”. With this in mind we set about to outline the state of contemporary research into social marketing in our field.

This was done by contrasting how the local recycling company (GÅ) had dealt with social marketing compared to the local municipal water board (Gävle Vatten), the regional health care organization (Landstinget Gävleborg) and the municipal Agenda 21 coordinator (Klingberg & Kågström, 2005b, p. 13).

The report itself concluded with a suggestion on how to perform such social marketing campaigns locally, but this was never implemented or tried, and I shall not go into its particulars here since we have not had the

opportunity to test its efficacy (Klingberg & Kågström, 2005b, p. 13). However, our work on this resulted in a number of general implications and specific conclusions for our further research.

We upgraded the role of knowledge even further. Successful social marketing in our region has been based on educating the end consumer on the basics of what they consume. A determined focus on the individual or possibly small, but well defined groups, would be a more appropriate approach than regarding all recyclers as a homogenous collective. This requires a level of demographic knowledge which is greater than previously identified. Understanding what each demographic group knows and how they understand the policy area helps considerably in designing the educational effort and can save money and good will in the end. The latter is so because tailor made educational efforts need only be offered to those who benefit the most from it and through a non intrusive and non repetitive approach the recycling company need not lose face by reiterating its message unnecessarily (Klingberg & Kågström, 2005b, p. 14).

Not only would it seem that educating the citizens is beneficial, we also found support for our notion of dividing knowledge into actual and perceived knowledge. What people actually know today and how they interpret this through their actions or non-action has also been shown to be of importance in the social marketing campaigns included. Having said this, we also thereby imply a circular approach of continuous improvement and/or evaluation of this factor. Just as it may seem self evident to evaluate the situation before an educational program, there is something to be gained from evaluating the situation afterwards and continuously after that. In addition, knowing that changes to the system will affect the interpretation of actual knowledge among citizens and thus their recycling rates, such actions will also signify an impulse to investigate how this has changed the understanding of the system. These evaluations may act as performance measurements of the recycling system as such. In a fledgling system such checks would seem evident, but as recycling rates near the maximum an ambition to reach this max would also signal the need for careful monitoring of these determinants (Klingberg & Kågström, 2005b, pp. 13-14).

Our focus on “competitors” was also initiated for the first time through this survey. An emphasis on the time consumption of recycling and determining what “efficient recycling” actually constitutes. Undesired behavior was the initial competitor identified in theory, but in our analysis of the comparison we soon found that what defines the competitor is more contextual than

that. All household chores can be said to compete with recycling, so can hobbies or anything else which is done at home (Klingberg & Kågström, 2005b, p. 14). A hypothesis which I formed from this states that a) competing activities do so on a basis of how desirable they are – more desirable activities will always take precedence over non-desirable activities. b) this might lead us to think that the solution is to make recycling more desirable/valuable an activity BUT I instead argue that the greatest potential is for recycling to be framed so that it is regarded as a non-competitor. In effect, regarded as a chore as natural, non-competitive and neutral as possible vs other more desirable activities that the end result is that it is just done.

Table 16A tentative demographic division of the populace with regard to recycling behaviour

	Other priorities = recycling 2nd, 3rd etc	Recycling = main priority
Does the "right" things	Right, but too little... Whose prio is wrong?	The Ideal? A bore or effective?
Does the "wrong" things	A disaster – eco-taliban	Ignorant – but trainable

Source: (Klingberg & Kågström, 2005b, p. 14)

The above matrix symbolizes our standpoint at that time. A rough estimate of the demographics we would expect to find in later empirical studies. We had no idea of the approximate numbers to attach to each quadrant in terms of the local population, but we could surmise that in our region the majority would belong to the two upper boxes, and the majority of the remainder to the lower right box. As the comments to the upper two boxes hint we were cautious as to the potential and interpretation of members of those two groups with regard to their use in increasing recycling rates. Reflecting on the figure three years later, I may have had an intuitive sense that there was more to the upper left group than met the eye, and scepticism at the high horse upon which the members in the upper right hand group put themselves when you met them in the field. As our post-compost survey would show this inkling did indeed have its merits.

6.9 Coordinated waste – on waste management in real life (2005)

This is was our last major summary of our results prior to this thesis. It was presented and published as a “working paper” at the University of Gävle

late 2005. In it we returned to waste and waste management as complex and indeed “wicked problem”. Three main approaches to this were covered in the report. First, the peculiar economic position of contemporary waste management in a regular household. Second, what we saw as a consequence of the first – a willingness and desire to pay to avoid the hassle of recycling where possible. This seen in the context of a kind of loss-aversion. Finally we began our ongoing discussion on how the ambitions of politicians and recycling companies can be matched with the above desires of regular citizens.

If we start by looking at how households regarded the economic burden of recycling, we found that the case of recycling is special because of the relatively marginal impact of the cost of recycling on the household economy.⁷⁴ Even if we tried to include the recycling fees included in the price of packaging material bought by the household the total expenditure for waste management of the household is still marginal. Add to that, that the latter recycling fee on packaging is hard to determine even for us as researcher, and we have a situation where the cost of recycling is even less a matter of monetary expenditure and more a case of non-pecuniary costs (time, discomfort, smell, space etc). In addition we need to consider that the risk of being caught out for not conforming to the recycling system, ie cheating, is very small and the fines usually not even meted out and we have a situation where it is no wonder that certain “mistakes” are made by households in recycling. When the alternative stands between doing what is right and saving time, the latter may well win and indeed the real wonder is that not more waste ends up along forest roads (Klingberg & Kågström, 2005b, p. 17).

The waste management fees communicate, implicitly at least, the environmental utility of the action of recycling, and here we have another potential problem for policy makers. On the one hand they are compelled to keep costs down and not overcharge for a public service monopoly; on the other hand a small surcharge for not recycling does not go very well in

⁷⁴ At the time a household paid between 100 and 169 SEK/month (approx. 10,75-18,20 •/month using the august 2008 exchange rate of 1 • = 9,3 SEK) in waste management fees. Condo and flats usually have this fee included in the rent and don't even see it specified. The difference in fee depended on the compost solution to which the household adhered – with unsorted compost waste as the more expensive alternative and home-composting as only marginally cheaper than the central composting alternative. For a normal villa the economic saving of composting on your own was a mere 26 SEK/month (2,8 •/month). This in contrast to the 60 SEK/month (6,45•/month) extra it would cost not to compost at all.

hand with the alarmist rhetoric often employed in their argumentation to augment recycling. We discussed this and its implication in the light of increased private consumption and increasing purchasing power. We concluded that given the current trends in the field and in society recycling is undergoing a transition from an economic and recovery based perspective to a moral, ethics driven form of recycling, where the act itself has a value. We also hypothesised that there is a strong desire to “buy oneself free”, free from chores, hard physical labour, repetitive actions and actions undertaken by command and not free will. This realization adds to the above in that it opens up new venues to approach recycling. If you can't pay skip recycling or pay to get someone else to recycle for you (as in Germany) then at least the act of recycling should be as easy and consume as little time as possible. This perspective is dealt with in depth in Barr (Barr, 2004; Barr et al., 2005b, a) where his research stresses the importance of a recycling system adapted to the context and conditions under which it is expected to operate. It also adheres to the Praxeological perspectives initially discussed in this text, human action is conducted to the effect that it alleviate sources of discomfort with the most pressing or easiest to alleviate being confronted first. So again we found ourselves recounting the motto “Det ska vara lätt att göra rätt!” (It should be easy to do the right thing!).

Since this report was written on the eve of the new composting system we were eager to construct a null-hypothesis of sorts for the coming period. Looking at the recycling fee system from a “loss-aversion” perspective along the lines of Kahneman and Tversky in (Kahneman & Tversky, 2000, pp. 34, 144) we predicted that the fees for NOT composting would have to be in the 400-550 SEK range to deter households from skipping composting IF the economic/pecuniary determinants alone were the main predictors of how households would behave. On the other hand, if non-pecuniary determinants such as concern for doing what is regarded as morally right were at the forefront we would see, especially villas, joining the composting program – even the central composting program (to make sure everything was done right – and their driveway was dotted with the special brown collection vessel which signals environmental awareness much more so than a private backyard compost). For the municipal housing areas we reasoned that political pressure would ensure their compliance with the recycling program regardless of the costs for rebuilding recycling centres etc. Finally, for private flats we saw that we would have a dual trend, first real estate owners who join to save whatever money there was to save (regardless if their recycling centres were suitable for this or not) and at the other end of the scale real estate owners who upon realizing that the costs incurred from rebuilding and adapting existing waste management facilities calculated that

a status quo would be preferable. 3 years later we can look back at these predictions and say that we were largely right. Private composts are only run by the most enthusiastic home gardeners and all municipal housing areas are part of the system, as is most of the private sector. Few opt to pay the higher fee for NOT composting and as this group becomes smaller it is also easier to increase their fee gradually to enforce compliance. Only one major group in society is outside the system, and that is businesses, public offices and government facilities, although a change is underway there as well. Even though this on its own is not one of our main conclusions, I wish to discuss it here and now to prepare the reader for the analysis which will come. The developments touched upon here lend some credibility to our claim that there is more to recycling than merely the pecuniary. There are other values involved, no less valuable to the individual and perhaps harder to get to grips with.

We concluded this major report by discussing the way forward for policymakers who want to improve on recycling rates further. We posited that general propaganda is subject to diminishing marginal utility as well, and that only a gradual and incremental build up of actual knowledge about the subject matter can form a basis for further improvements on recycling rates at the high rates at which the Swedish system operates. A deep understanding of what to do and why to do it among the citizens bridges the gap between political and market mechanisms. If left to their own devices well educated and cunning citizens will find ways to improve and make efficient the action required WITHIN the existing system, if the system itself allows for this. We have seen examples of this over and over again. Citizens who understand the workings of the producer responsibility system initiate materials recycling (albeit unlawfully – but environmentally sound), they find short-cuts in how to conduct actual practical hands on recycling.⁷⁵ People's behaviour with regard to recycling is dynamic, as with every other daily activity it is dependent on a combination of the structures in place and the day to day deliberations of the individual.

The individual is however not immune to the perspectives of the surrounding community and if this connect is removed from the facts and

⁷⁵ People with small quantities of waste may collect it all in one bag and do the sorting at the recycling center and save both time and space. People with large amounts of waste buy waste fraction based containers to keep at home and empty these sequentially as they fill up or turn smelly, again saving much effort while staying within the limits of the system. The point being that citizens who understand the system will find ways to cope with it which suit THEIR specific individual lifestyle without necessarily going against the nature/intention of the system.

based on conjecture and preconceptions, the decisions of the individual can hardly be expected to be any better. This was the closing remark in the 2005 study. I would like to stress that even though some efforts have been made to promote recycling of haz-mats, the emphasis is still on relatively harmless waste fractions such as paper and even more so on compost. The focus on waste fractions with high relative volumes such as paper, compost and packaging material seemed to distract focus from waste with small volumes, regardless of their respective environmental impact. If we follow Barrs (Barr, 2004) line of reasoning, that the system in operation acts as a normative to the citizens approach to recycling then are the citizens to blame if they do not do “well enough” on haz-mats recycling? The impression that we are drowning under literal mountains of waste are very persuasive and the real volumes are regularly overrated by a factor of 10 for “experts” and a factor 100 for laymen in our studies (Klingberg & Kågström, 2005b, pp. 24-25). We have what is seen and that which is not seen to paraphrase Frederic Bastiat... What we see are the constant increases in consumption and subsequent discarding of voluminous waste, and that which is not seen are the likewise increasing amounts of haz-mats permeating the recycling system and the increasing efforts made by citizens to recycle. Three factors need to be monitored in this respect, with regard to what policy makers wish to optimize and focus on:

1. Recovery of scarce resources from waste
2. Environmental impact of discarded waste
3. Disposal of generated waste in a tidy fashion

From our perspective we note that 1 is often used as an argument even though the price structure and the need to create artificial markets for reused material seem to indicate otherwise – at least in a Swedish setting. Number 2 seems often to be overlooked, firstly in the public debate, secondly in the design of recycling systems since the system focused mostly on non-haz-mat waste. Thirdly, as a consequence of the two previous, unnoticed by the citizens who focus on what the system indicates they should focus on. Although a basic desire, number 3 is a general and most genuine desire of all but very few citizens and policy makers. Looking at the general debate on recycling, it more often than not concerns itself with the order in the recycling facilities and littering in the streets and back yards on tenancies.

The state of recycling in the Gävle region at the onset of the compost recycling project could therefore be summarized in accordance with the three points above. Recycling was not conducted to recover scarce

resources even though that was how the efforts of the recycling company were framed, and this generated an aura of potential hypocrisy among certain parts of the public. To this was added a heralded focus on the least environmentally dangerous of all waste fractions – compost. At the same time recycling rates for haz-mats continued to be the lowest of all in the Swedish system. To round things off public focus was heavily invested in the order of the recycling system, and ways to simplify the day-to-day recycling measures. Not, it would seem, the most beneficial start for a major shift in the recycling scheme and the addition of a new, large, messy and smelly waste fraction. Without forgoing the conclusions, I just wish to add that all concerned were in for a surprise. As researchers we would flounder at the rapid increase in participation rates and quality and the recycling company would be taken aback because of the reasons for the success.

6.10 Recycling and recycling determinants in the pre- and post-compost recycling setting.

The introduction of a central compost scheme in 2004–2006 is a great divider in how households perceive recycling in the region. The massive information effort associated with the compost scheme had an impact on all types of determinants and factors pertaining to recycling. I will therefore use our empirical findings to illustrate and then contrast the situation before and after composting was introduced.

6.10.1 The post-compost determinant factor analysis

As always I approached this material in a two pronged fashion. First employing a factor analysis to investigate which determinants can be grouped to explain recycling behaviour as such and then using a cluster analysis to group respondents in typical behavioural patterns. In my experience this approach makes the most of our broad spectrum investigation into the recycling behaviour. By combining the two we not only make the most of the statistical data gathered, it is also possible to use data gathered through interviews and observations to make sense of our findings.

The factor analysis itself and the technical considerations I made are described elsewhere (appendix x) so that I can describe the results here. The results themselves are divided into three sets, first the non-composting group and their determinants, secondly the composting group and finally the sum total of all respondents when regarded as a group.

6.10.2 Factor analysis of the non-composting citizens

Characteristic of the recycling behaviour in this group is that the new system, although known, is not yet internalised. For example we find that compost information forms a factor all of its own, and not as a part of a greater group. This fragmented trend is what sets this data set apart.

The post-compost, non-composting factor analysis

1. Classic recycling (Metal, Plastics, Glass, Paper) and myths
2. Beliefs and expectations
3. Composting activity
4. Recycling efficiency
5. Compost information
6. Actual knowledge

This is also the case concerning composting as such as well as the views on compost information and the role of the respondents' actual knowledge of recycling. Clearly the non-composting segment of the households is set in old habits. They recycle the major waste fractions and are quite realistic about it. Belief in myths about recycling and actual recycling are inversely related, which means that high-end recyclers have a more realistic expectation of the extent of the waste problem, whereas those who participate less seem to do so under the pretext of a system about to fail soon anyway – a sentiment not uncommon to encounter. Beliefs about the environmental expediency of recycling and expectations as to what the system might be able to achieve also go hand in hand with self-assessed knowledge in factor 2. As stated initially, what is peculiar to this group is how the remaining 4 factors distribute themselves. They are isolated and even though they influence recycling behaviour they seem to do so in an isolated and fragmented fashion.

Taken as a linear regression these factors also indicate the direction and magnitude of their potency.⁷⁶

$$y = 86 + 16x_{\text{ClassicRec}} + 0,8x_{\text{Beliefs\&Expectations}} + 5,7x_{\text{Composters}} - 1,1x_{\text{Efficiency}} + 2,4x_{\text{CompostInfo}} - 0,5x_{\text{ActualKnowl}}$$

⁷⁶ See Appendix 7

Participation in the classic forms of recycling is by far the most influential determinant, followed by those who did compost in this group prior to the compost system. I view this as support of the idea that actually doing recycling is instrumental in facilitating recycling. It goes without saying that this is the case, but it builds upon the arguments of Barr that taking part in the system is instrumental in forming compliance. However the real life situation is far from as straight forward as a linear regression would indicate. Recycling of “classical” fractions being already realised in large, it still retains an influential role of recycling rates in general, BUT it is not likely to change or shift in any large manner, nor is it likely to be possible to actively be influenced by policymakers – apart from the negative shift we have observed after nearly all changes to the recycling system of course.

Interestingly enough efficiency in recycling and being knowledgeable are negative determinants. In the latter case this indicates disillusionment with the system whereas the negative influence of efficiency is harder to explain. However, when the same data set is subjected to a symbolic regression, efficiency is completely re-instated by the most accurate of the suggested solutions.⁷⁷

$$rr = 80 + 0,96 \cdot \text{eff} + 14,9 \cdot \cos(64 \cdot \text{eff}^3 - 68 \cdot \text{eff}^4 - 2,7 \cdot \text{eff}^5)$$

This perhaps somewhat overly complex equation shows nice fitness metrics (R-squared = 0,39 & Corr coef = 0,61) and illustrates how differently symbolic regression interprets the same material. The other variables are only used in solutions with much lower fitness metrics and all the higher order solutions focus on efficiency as a determinant. This is much more in line with our other findings. The citizens involved in this survey were deeply settled in their recycling ways, not having experienced any major changes in a couple of years. It would thus only stand to reason that efficiency played a great role in their ability to recycle. That it would overshadow the other factors like this was a surprise however. The only other factor which symbolic regression takes into account (at a lower level of fitness) is the degree to which these citizens were recycling compost waste of their own accord - then as a positive contributor, often in conjunction with efficiency. These factor analysis results also suggest that composting behaviour as such is a fairly strong positive influence and that harnessing it could yield positive overall results. I view these findings as consistent with the overall observations in that efficiency continues to be an important

⁷⁷ See Appendix 7

factor, and that voluntary composting would pave the way for the new system.

6.10.3 The composting factor analysis

Using the same criteria as in the previous factor analysis the changes that have resulted from the compost scheme become evident. Determinants are now divided into three distinct factors:

The post-compost, composting factor analysis

1. Classic recycling (Metal, Plastics, Glass, Paper) and expectations
2. Actual & perceived knowledge
3. Composting related issues and recycling efficiency

What we see is a shift towards a somewhat more orderly division of the determinants. This is especially evident with regard to the determinants affecting composting directly – which are gathered in the third factor together with our measure of the efficiency of recycling. The latter, not only benefitting from compost recycling, but also becoming closely related to it. The traditional types of recycling still form a foundation upon which all other forms of recycling rest. However in the post-compost setting it is grouped with citizens expectations upon the new system, which to me indicates that this is dependent on previous experiences with recycling. More positive experiences go hand in hand with higher expectations of success on the new system. Interesting to note is that both types of knowledge investigate now go hand-in-hand. Actual measured knowledge about the system and the perceived, self-measured knowledge seems to have started converging in this setting. This indicates an important shift in how waste management is regarded. A measure of self-confidence in the individual citizen's knowledge about recycling is starting to emerge.

If we regard these factors as an indication of the recycling rate in a linear regression, the following pattern appears.

$$y = 82 + 14x_{\text{ClassicRec}} + 6,7x_{\text{Actual\&Perceived knowledge}} + 3,4x_{\text{Composting}}$$

Compared to the non-composting group, this regression offers a promise, not only of higher recycling rates, but also of greater possibilities to influence these rates. This would be so especially if we look at the role of the knowledge factor, which includes two determinants possible to influence. Classic recycling remains the greatest potential contributor, but it

is already at a high level and largely beyond what is possible to change, as was noted above.

Composting and therewith connected determinants form a large and complex factor and I doubt that it would be efficacious to try to influence it further for precisely those reasons. The effects of the compost information campaign were already realised when this survey was done, and now peter out if they change at all. With the passage of time and the acceptance of compost recycling that determinant may well continue to increase towards the rates already attained in with regard to other factors. The environmental utility of compost recycling is not widely recognised among broader groups of citizens, especially not relative to other more “urgent” forms of recycling.

Finally, recycling efficiency is a determinant which is not surprisingly included in this factor at this time, but considering the dynamic nature of recycling, I would doubt if it remains connected to these determinants for long once the compost system sets in place. I would rather predict that it becomes a determinant in its own right, but later results will have to disprove or corroborate this working hypothesis.

6.10.4 “The whole jolly lot” – the post-compost setting as a transitional period.

A final way of studying the material at hand is of course to regard it as a whole. This has the advantage of offering a larger sample from which to do the statistical analysis. It also offers me a way to assuage fears that the state in which we investigated the post-compost setting was still a transitional stage, and therefore not representative of the underlying currents of this dynamic field of enquiry. I concur with these points and will there for present such an analysis.

The post-compost, total factor analysis

1. Recycling (Metal, Plastics, Glass, Paper AND Compost)
2. Beliefs and expectations
3. Information and myths
4. Actual knowledge
5. Recycling efficiency

When regarded as a whole recycling as such becomes one factor explaining recycling behaviour, although with some interesting cross-loading for compost recycling with the Actual knowledge factor. This result strengthens the proposition that the act of recycling is and remains a strong determinant

of recycling behaviour – unconnected to what is otherwise regarded as determinants for recycling behaviour.

Beliefs and expectations “survives” as a factor of its own from the non-composting group and is an indication that perhaps the classification of this situation as transitional is correct, or at least not without merit. Citizens were still unsure as to the outcome of this compost “experiment” and having high hopes and expectations would of course influence the outcome. It should also be noted that when taken as a whole the nascent convergence between actual and perceived knowledge is gone. In this setting the two are again completely separate.

The third factor is really interesting as it combines the determinants concerning the information campaign of the recycling company with the myths of recycling. These two go hand in hand, and one can’t help but wonder to which extent the myths of recycling are not perpetuated by some of the alarmist undertones of the information campaign. This certainly seems to be the case if we look at this data in the light of our interviews with the compost informers themselves.

Lastly we have Actual knowledge and Recycling efficiency. These two stand out as separate determinants as they did in the first factor analysis. Small but strong on their own, I interpret this as a measure of the importance to a) keep up to date with all of the new information during a paradigm shift such as this one and b) being able to maintain an efficient approach to the everyday application of this knowledge. The two are of course NOT connected – that is the nature of the factor analysis, but I would interpret that as a strength. They are separate and allow for two strands of advancement to be followed to improve on recycling rates. Actual knowledge will develop in time, although it is worth to note that it does NOT arrive with the information campaigns. Efficiency will also develop with time as a multitude of ways to do recycling are tried out by all of the participants. The real trick here would be to capitalise on these developments and ensure that actual, proven, applied knowledge about the system and how to recycle is spread to a broader mass of citizens.

$$rr = 85 + 16x_{Rec} + 1,6x_{Beliefs\&Expectations} + 2,8x_{CompostInfor\&Myths} + 0,8x_{ActualKnowl} - 0,2x_{Efficiency}$$

Viewed as the linear regression above, we note a situation much like the previous. Actually performing recycling bears the brunt of the potential for change. Although it has to reiterated that this is a potential for change which is unlikely to be realised. The relative sense of urgency conveyed by

the compost informants and the mythos of recycling also contribute on the whole to what we see in the way of recycling. However, I would warn that those effects are hollow and not sustainable in the long run. Primarily due to the temporary nature of the information campaign, but also due to the potentially damaging effect of having recycling associated with hollow claims and alarmism, which may in turn serve to undermine public confidence in what many Swedes truly believe to be an otherwise worthwhile cause.

Perhaps hardest to explain and put into context is of course the negative influence of the Efficiency factor. On the other hand it is perhaps not so surprising that at this transitional stage being “efficient” might not be associated with the highest recycling rates. Keep in mind that the efficiency measure is blind as to how much recycling is actually done, it only measures how quickly each unit of recycling is done. This is of course the image we get when looking at the numbers as a whole and not the image we get when we break them down into smaller fragments. Already dividing the group into composter vs non-composters alleviates this association. In addition I will state at this time that it is in this measure that we have the greatest potential for improvement, by finding a category of efficient recyclers with exceptional recycling rates.

$$rr = 89,9 + 2,4 \star_{\text{CompostInfor\&Myths}} + 0,4 / (\star_{\text{ActualKnowl}} \cos(-1,1 \star_{\text{Beliefs\&Expectations}} - 0,16) - 0,076)$$

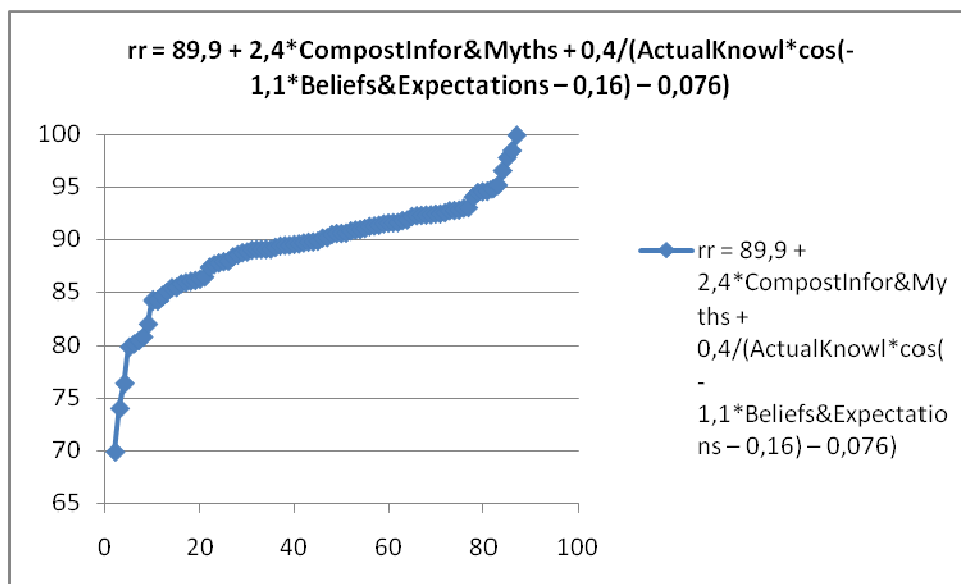
The same factors re-run using symbolic regression⁷⁸ gives another take on the determinants. Again with nice fitness metrics, R-squared = 0,32 and Corr coef = 0,61. Here recycling and efficiency as such are set aside by the regression and is not used in any of the solutions presented. That, on its own is interesting as it implies that other factors were at work in this particular setting. As indicated by the linear regression the “Hawthornesque” effect of the information campaign is the main influence here. That is also emphasised in the less complex solutions:

Reacting well the information campaign would seem to give a boost in recycling. In addition there is complex interplay between on the one hand the actual knowledge levels of the respondents and their beliefs in and expectations on the system. This is a reminder of how capricious human nature can be in terms of behaviour. The aggregate result however is of the

⁷⁸Details see: Appendix 9

same nature as before, exhibiting a horizontal f or s, with sharp changes towards the respective margins of recycling.

Graph 8: Recycling rates (y) plotted against the total post-compost factor analysis set (x) using Symbolic regression.



Looking at other suggested symbolic regression results, the

That hint brings us over to the cluster analysis which was also performed on the same material.

6.10.5 The post-compost non-composter cluster

In the cluster analysis we find nuances to the hard cold facts from the factor analysis. We see patterns emerge that not only coincide with our other qualitative observations, but also render colour and vivacity, a human dimension, to the changes we study.

The object of the cluster analysis was to try to find the patterns in the statistical material which coincided best with a) the findings of the factor analysis and b) the qualitative observations and inputs from our other studies.

As we have seen above, the post compost setting offered new insights into recycling habits. First of all we can compare the composting and non-composting areas in general and secondly we can repeat the cluster analysis to try to discern the more peculiar habits that may explain the trends we see. The results are divided into the newly composting areas and those areas that were still not composting, although aware of the change to come.

This thus represents a state of transition where the composting areas have just gotten accustomed to composting. However, although some teething problems still remained, the familiarity of households with this novelty was already considerable. The non-composting households on the other hand were captured right before the first information campaigns directed at their area had commenced. At the same time, it was immediately clear that indirect familiarity with the compost system as such was growing, through word-of-mouth between friends and co-workers, and general information in the media. It is thus no pristine non-composting state that we investigate, but a state different from the one above in that the actual operation has yet to begin while knowledge through hearsay is accumulating. An interesting state indeed.

It is therefore only proper that we begin by presenting the characteristics of the non-composting community.

6.10.6 General observations among the non-composting households

Table 17 Differences between non-composting tenants and villas

Category	NC-tenants	NC-villas
RR:	53%	70%
Time (min) spent on rec/week:	24,1	33,6
RR/min	2,2	2,1
Satisfaction 0-10	6,3	5,5
Environmental value 0-10	7,4	6,8
Expectations 0-10	4,5	4,6
Technical solution 0-10	6,6	7,2
Magnitude of problem – target=2	152,4	138,2
Perceived knowledge 0-10	3,9	4,1
Actual knowledge 0-15	10,0	10,9

The overall self reported recycling rates among the non-composters were, on average, not that impressive. 53% for tenants and 78% for villa owners putting them both below the national average with differences between the

groups as were expected. The magnitude of difference between the two groups may have been slightly larger than expected but if we take into consideration the standard deviation we will still see typical recycling rates for tenants.

Even though the recycling rate results differed between the two main groups recycling efficiency was very similar. Considering the relative ease with which recycling may be conducted in apartments compared to villas it may be hypothesised that tenants at this stage had failed to realise their full potential at efficient recycling. Those living in villas were also considerably less satisfied with the current state of events, although harbouring greater expectations of the changes announced. More on that as we compare these results to the composting group and cluster analysis. Knowledgewise, both pre-compost groups were almost equally insecure in what they knew about recycling although fairly well read up on the subject.

6.10.7 Non-composting tenant clusters

The first two clusters were discernable among the otherwise rather homogenous tenant group.

1. The first cluster (8% of the valid sample otvs) is one of two clusters typical for the apartment dwellers - "Veteran recycler tenants". This group does a much better job at recycling (86% RR) than the average tenant. These veterans also have the highest actual knowledge (15/15) among non-composting citizens. They are also the most time-efficient in the group, using a mere 11 min/week to recycle.⁷⁹ This means that they do around 60% more recycling in less than half the time of the average recycler. In addition they are optimistic (7,4) of the coming changes and have a fairly high confidence (7,2) in their own recycling knowledge. They also rate the environmental utility of recycling high (9,3).⁸⁰ These persons exemplify people who actually correct other peoples mistakes in the recycling rooms if in that mind-set and practically possible.
2. The counterparts of the first cluster are the "Disinterested free-riders" (8% otvs). These are younger tenants who spend just as little

⁷⁹ 7,8 RR/min

⁸⁰ This may be the reason why the overestimate the "garbage mountain" by a factor of 20.

time (12min) on recycling as the previous group, although without in fact recycling (14%).⁸¹ Their actual knowledge is among the lowest in the sample, although only marginally lower than the average tenant (9,5). In addition, these free-riders have relatively little confidence (2,2) in their knowledge and are highly sceptical of the recycling system (3,0). Their assessment of the extent of the waste management problem is the most correct in the sample⁸² and perhaps this may help to explain their disinterest in recycling as a concept. A genuine disinterest in recycling in combination with a low risk assessment could explain this. “...*I don't see what all the fuzz is about anyway – not that I really care, but wouldn't it be better to just incinerate all of the trash anyway?*” Young man (1) responding defensively after throwing away a big bag of unsorted trash. 040320

These two clusters illustrate the two extremes at opposite ends of the recycler spectrum among tenants. On the one hand those who utilise the potential efficiency of having all kinds of recycling close to the home and set an example for others to follow. On the other hand the clique who uses the relative anonymity of tenancy to escape the chore of recycling. These two groups also contribute to making the span of recycling so wide within this group and this in turn means that good examples may run the risk of literally being drowned in a sea of waste. It is also interesting to note that the delinquents for the second cluster do so badly in spite of their average actual knowledge levels. On the one hand this could be interpreted as support for the TPB-perspective on recycling, in that other determinants need to be in effect before recycling soars (Tonglet et al., 2004a, pp. 37-38). On the other hand it could indicate that there is an untapped potential for improvement, not yet realised – if we maintain that actual knowledge IS a prerequisite to higher levels of recycling (Barr, 2004, pp. 244-245). This leads us to investigate why average knowledge is no guarantee for average recycling, whereas near perfect knowledge seems to be necessary for near perfect recycling. The difference in perceived knowledge is also striking and may contribute to the explanation, but more on this in the analysis.

⁸¹ RR: 14%

⁸² 15 soccer fields as opposed to the actual figure of 10.

6.10.8 Non-composting villa clusters

The diversity of recycling strategies among those who live in their own houses is greater, and with the potential for finding your own solution to the waste problem this should come as no great surprise. However, it should be noted that again the clusters only illustrate the extremes within the greater majority of recyclers. With this in mind, the clusters identified can point to trends in the material that help us to understand the issues at hand.

3. The first cluster is a small and peculiar one, the “The busy beaver recycling family” (4% ofvs). This group has just moved into their first house, the children are young, and energy and environmental commitment is at a peak. They report the highest recycling rates in the entire pre-compost group (93%), are really concerned about the environment (10,0) and think that the waste management problem is a full 100 times greater than it actually is. They think they know everything about the recycling system (10,0), although their actual knowledge is only average (12,0). This discrepancy, and perhaps the relative size of the family, is clearly shown in that they need a full 2 hours/week to reach their recycling rate.⁸³ A cynic would say that as enthusiasm wanes this group will transcend into the 4th cluster, the “Stressed family recyclers”, however it will also be interesting to see how this group fares during the change into the post-compost role. It would be easy to discount the extreme recycling rate of this group as non-sense, were it not for the equally extreme amount of time invested into the act. However, the recycling efficiency is appalling, especially compared to the “Veteran recycling tenants” of the previous group who are 10 times as efficient, while performing on par. Needless to say this is time that such a young family could have done well to spend on other things. In addition the cluster is not a role model upon which to build

4. Next comes two rather similar groups of recyclers, the first of which is the “Stressed family recycler” (28% ofvs). This cluster is formed by somewhat younger and larger households, and in this it is mirror

⁸³ 0,8RR/min

image of the previous cluster, albeit with slightly below average recycling rates (65%). The main distinguishing feature of this group however, is the inefficiency of their recycling.⁸⁴ They spend more than 40 min per week and still perform sub-par. Since their actual knowledge is medium (12,0) it would probably be more a question of getting them to trust in their own knowledge (5,0) to get them recycling at a higher rate. There is nothing wrong with the will of this group to do right, and considering that they overrate the extent of the problem by a factor 100, they probably feel rather badly for it too, further adding to their stress. *“We really want to get it all right and sorted – but it’s just soo hard and time consuming – still we try...”* Young mother on the bothers of recycling. 040320

5. Similar to the previous, although a decade or so has passed and the children have moved out are the “Grey panthers” (16% ofvs). This group is not overly worried or interested in recycling⁸⁵, although they try to do their share⁸⁶ in a fairly efficient way. Experience have taught them that an average amount of recycling is attainable with less effort than their neighbours spend on it. Still, these are persons who have begun appreciating what the recycling system does for the environment again (7,1), although it is certainly not their main concern.
6. The last and largest group (36% ofvs) the “Routine recyclers” being the most representative of the clusters, differing from the average villa recycler in that they are more efficient. They have an average recycling rate (70%), and spend 10 min less than the average villa recycler on sorting their waste.⁸⁷ However, this seems to be a routine action since their actual knowledge (12,4) is average and perceived knowledge (4,5) is well below average. Their perception of the waste problem is comparatively sober and all of

⁸⁴ 1,5RR/min

⁸⁵ Actual knowledge 9,5

⁸⁶ 71% RR and 3,1RR/min

⁸⁷ 3,3 RR/min vs 2,1 RR/min

this put together may explain why they show some reservation towards the upcoming change.

Note that while most recyclers toil with this task as a part of the great majority there are interesting deviations. It would be easy to point to the “Busy beavers” as an ideal for all others to take after, but note what is required for them to do that well. It might also be tempting to become complacent with the results of the last cluster, the “Routine recyclers” as they seem to do an ok job without actually needing all that much in either knowledge or encouragement. However, both of these potential strategies are misleading as we shall see when we compare them to the situation of the post-compost composting group.

6.11 The post-compost composter setting

Among the composting households there were many discernable shifts and changes to the cluster structure. Among the most important things to note were that the actual knowledge was higher and more evenly spread among the composting households.

Table 18 Composting and Non-composting households compared.

	NC-ten	NC-vil	C-ten	C-vil
RR:	53%	70%	78%	82%
Time (min) spent on rec/week:	24,1	33,6	30,1	36,5
RR/min	2,2	2,1	2,6	2,2
Satisfaction 0-10	6,3	5,5	7,7	7,8
Environmental value 0-10	7,4	6,8	8,1	7,4
Expectations 0-10	4,5	4,6	6,5	6,8
Technical solution 0-10	6,6	7,2	8,3	7,6
Magnitude of problem – target=2	152,4	138,2	129,3	136,7
Perceived knowledge 0-10	3,9	4,1	6,3	6,5
Actual knowledge 0-15	10,0	10,9	12,9	13,6

Most notable are the general and substantial increase in recycling rates, on the order of 25%-points for tenants and 12%-points for villas. Likewise, the time spent on recycling increased, but taking the increase in recycling rates into consideration the efficiency increased as well. In spite of low expectations on the upcoming change, expectations actually increased as the compost project was implemented as did the satisfaction with the recycling system. Closely related to this, we also see that the technical solution to recycling meets with high and increasing praise. The estimation of the

severity of the waste problem also decreases, although only significantly so among tenants. Finally knowledge levels increase dramatically during this period, although more so among villa households. The general trend is thus positive. However, we need to break down these results into their component levels in order to be able to shed light on the further implications.

6.11.1 Composting tenants

Table 19 Tenants compared.

	NC-ten	C-ten	+/-
RR:	53%	78%	25,0
Time (min) spent on rec/week:	24,1	30,1	6,0
RR/min	2,2	2,6	0,4
Satisfaction 0-10	6,3	7,7	1,4
Environmental value 0-10	7,4	8,1	0,7
Expectations 0-10	4,5	6,5	2,0
Technical solution 0-10	6,6	8,3	1,7
Magnitude of problem – target=2	152,4	129,3	-23,1
Perceived knowledge 0-10	3,9	6,3	2,4
Actual knowledge 0-15	10	12,9	2,9

Three clusters stand out among the composting tenants. The 6 cluster solution was again picked to illustrate the more advanced and peculiar fringe behavioural patterns observed during our study. However, just as with the non-composting residents, the composting tenants are a much more homogenous group, again this may be due to two main explanations. Either villa residents have greater freedom to recycle as they please or maybe the orderly state of affairs in tenant recycling offers a better and more easily followed solution for recycling. Our analysis will shed light on this later on.

1. The first cluster is the counterpart to the busy beaver family above, although taken even more into the extreme. These “Busy beavers” are older and have larger households than their counterparts. They take recycling to perfection with a recycling rate of close to 99%, however they also spend a total of 135 min/week to reach this level, making them one of the least efficient (0,73 RR/min) recyclers in the survey. Unlike their non-composting counterparts however, they are very knowledgeable about recycling (14,75) while making the most informed estimate of the environmental

problem (11ha). In addition they also display the highest realistic (non-inflated) score for perceived knowledge (7,1). Interestingly enough they are the most sceptical of the potential success (6,5) of the new system and the least, albeit still concerned, convinced of the environmental utility (7,0) of it. All in all this group is most intriguing, it is extremely well informed and it grants the new system the benefit of the doubt, recycling with a vengeance. However for all their sound approaches to recycling they had yet to find an efficient approach to recycling with which to sustain their efforts for the future. Although I would like to promote this cluster as the very zenith of recycling bravado I cannot do so due to their inefficiencies. As a rolemodel for their housing block I have no doubt that they might serve well, but as to the extent of their ability to induce a proper recycling habit I have my doubts. Other cluster will offer other insights into this later on. ‘

2. The second cluster “Average Plus”, is a cluster which stands out by being somewhat better than the average, only just. It would be easy to discount this cluster as uninteresting, but I have opted to allow it to remain because it illustrates the start of a shift. While the average recycler is just that, a faceless average with little or no basis in an actual cluster, this is a viable representation of the average recycler, or what they could become as the system sets. Doing above average in recycling, and with efficiency to, the “Average Plus” sets a standard for other tenants to follow.
3. The “Young free-riders” are interesting in that they exemplify what we identify as the greatest change in a cluster after the introduction of composting. These are in important aspects similar to the “Disinterested free-riders” of the former group, apart from a substantially higher recycling rate (42% as opposed to 14%). This illustrates how the extremes have closed on the middle scenario with the introduction of composting. In this setting “non-recycling” still means a 30-40% recycling rate, and it should also be noted that it is due to non-recycling of plastics and metal that their

score is reduced and not due to non-participation in the new composting scheme (61% RR for composte). Whether this is a sustainable result or a temporary change confined to the immediate aftermath of the composting information campaign remains to be seen. However, it is noteworthy that this group has above average actual knowledge (14,0), although below average perceived knowledge (4,1). Regardless of the reason for this trend, this is a cluster which represents a fairly sound view of the magnitude of the problem although it seems that this perhaps taken as a pretext to not recycle.

6.11.2 Composting villas

Table 20 Villas compared.

	NC-vil	C-vil	+/-
RR:	70%	82%	12
Time (min) spent on rec/week:	33,6	36,5	2,9
RR/min	2,1	2,2	0,1
Satisfaction 0-10	5,5	7,8	2,3
Environmental value 0-10	6,8	7,4	0,6
Expectations 0-10	4,6	6,8	2,2
Technical solution 0-10	7,2	7,6	0,4
Magnitude of problem – target=2	138,2	136,7	-1,5
Perceived knowledge 0-10	4,1	6,5	2,4
Actual knowledge 0-15	10,9	13,6	2,7

The villa group has two large cluster that set this group apart from the majority. This is again a sign of the greater freedom of finding their own solutions that permeate the villa dwellers.

4. The villa area has its counterpart to the “Busy Beaver” cluster of the tenants section, and in the post-composting environment this cluster has efficient recyclers. The “Efficient realists” will serve as the very epitome of the recycling community in this survey. They recycle more than 91% of their waste, and require only 28,5 minutes per week to do so. This renders them quite efficient in comparison to what they and the others recyclers perform. In addition they are well informed (13,8 actual knowledge and 14,6ha for the extent of the problem) as well as fairly confident in their skills (7,0). It is significant to note that it is the plastics fraction upon which this group “cheats” the system, and often times persons fitting this characterisation would comment this by questioning the veracity of separating the soft plastics fraction from the rest of the incinerable waste before it is all turned into district heating. Keep in mind though, that whereas soft plastics is the weak point of this group they still recycle around 85% of that fraction, opting not to

when the plastic wrap is sticky, soiled or otherwise hard to separate in a meaningful fashion.

5. Similar to the “Efficient realist”, the “Inept majority” do rather well with their recycling efforts (RR 85,7%) but are not very efficient (38,5min/week & RR 2,23). What distinguishes them is their mixture of anxiety of the problem (200ha), above average environmental concern (8,0) yet low confidence in the sustainability of the new system and their own knowledge. This group would have a considerable potential for development if feedback or other measures could reinforce in them a similar confidence in themselves and the solutions provided.

6. “Composting dilettantes” constitute the last of the clusters. It’s a small cluster with aged respondents whose main defining characteristic is their devotion to composting and very little else in the recycling system. This cluster has an overall recycling rate of 32%, but are all the more enthusiastic about composting, with a recycling rate of 86%. They are also the most enthusiastic (9,0) of the recent change and the environmental impact (9,3) of composting. They rate their knowledge on recycling highest of all clusters (8,7) but their actual knowledge is somewhat below average (13,0, although this is considerably higher than the average among non-composters). This cluster serves to illustrate that enthusiastic participation in the new scheme does not preclude non-participation in the other recycling schemes. It is also testament to the impact of the information campaign as such and its efficacy in training even the most negative non-participants in the new recycling scheme.

Table 21 Summary of the pre-compost clusters (detached house clusters in bold cursive font)⁸⁸.

	Veteran ten	Disint Free	<i>Busy beaver</i>	<i>Stress Fam</i>	<i>Grey Panth</i>	<i>Routine R</i>
RR	86	14	<i>93</i>	<i>65</i>	<i>71</i>	<i>70</i>
Time/week	11	12	<i>120</i>	<i>43</i>	<i>23</i>	<i>12</i>
Efficiency (rr/t)	7,8	1,2	<i>0,8</i>	<i>1,5</i>	<i>3,1</i>	<i>5,8</i>
Actual K	15	9,5	<i>12</i>	<i>12</i>	<i>9,5</i>	<i>12,4</i>
Perceived K	7,2	2,2	<i>10</i>	<i>5</i>	<i>6,1</i>	<i>4,5</i>
Value of C	9,3	4	<i>10</i>	<i>6,6</i>	<i>7,1</i>	<i>6</i>
How well?	7,4	3	<i>5,4</i>	<i>4,9</i>	<i>5,6</i>	<i>4,6</i>
How big?	200	15	<i>200</i>	<i>200</i>	<i>125</i>	<i>18,3</i>
CompostRR	na	na	<i>na</i>	<i>na</i>	<i>na</i>	<i>na</i>
PlasticRR	9,5	1,5	<i>9,3</i>	<i>7,7</i>	<i>8,4</i>	<i>7,3</i>
Av Age	68	34	<i>23</i>	<i>48</i>	<i>60</i>	<i>51</i>

Table 22 Summary of the post-compost clusters (detached house clusters in bold cursive font)⁸⁹.

	Busy beaver	Average + Young Free	<i>Efficient rea</i>	<i>Inept maj</i>	<i>Dilettantes</i>	
RR	99	81	42	<i>91</i>	<i>86</i>	<i>32</i>
Time/week	135	29	11	<i>29</i>	<i>39</i>	<i>10</i>
Efficiency (rr/t)	0,7	2,8	3,8	<i>3,1</i>	<i>2,2</i>	<i>3,2</i>
Actual K	14,8	13,6	14	<i>13,8</i>	<i>14</i>	<i>13</i>
Perceived K	7,1	7	4,1	<i>7</i>	<i>6,8</i>	<i>8,7</i>
Value of C	7	8,4	8,3	<i>7,8</i>	<i>8</i>	<i>9,3</i>
How well?	6,5	6,7	7,6	<i>6,9</i>	<i>6,6</i>	<i>9</i>
How big?	11	129	20	<i>15</i>	<i>200</i>	<i>1000</i>
CompostRR	99	78	61	<i>90</i>	<i>87</i>	<i>86</i>
PlasticRR	98	69	7	<i>85</i>	<i>77</i>	<i>17</i>
Av Age	43	40	28	<i>58</i>	<i>48</i>	<i>70</i>
Otvs 77	4	1	4	<i>7</i>	<i>31</i>	<i>30</i>

⁸⁸ See Appendix 10

⁸⁹ See Appendix 10

6.11.3 Summarising the post-compost setting

The introduction of composting seems to bring clarity in the eyes of the citizens. Including and separating compost as a fraction of its own is in line with the perception that materials and not their use (packaging) is the guiding principle in recycling. We see this first and foremost in the reduction in determinant factors. Those households who are still on the verge of composting are influenced by no less than six determinant factors, whereas the composting households are influenced by three. Knowledge is roughly twice as important as participation in composting and participation in “classic” recycling is roughly twice as important as knowledge levels. This sets the scene for what and how to further influence citizens recycling rates. As the recycling rates near 100% the influence of “myths”, beliefs and expectations is reduced. This is as would be expected. What remains to be influenced outside of actually recycling as such are the knowledge levels.

On a more basic level it can be noted that recycling rates benefited from the compost project and the attention it brought to the recycling activity. It also brought recycling levels more in step between tenants and house owners with very small recycling rate differences remaining. All other indicators investigated are also up, albeit to a small degree. Overall the time spent on recycling increased somewhat, average increases in the magnitude of 3 to 6 minutes per week or 10 to 25%. So far so good and this is the general image which would be indicative of the impression of the compost project held by the majority of citizens and civil servants in the field.

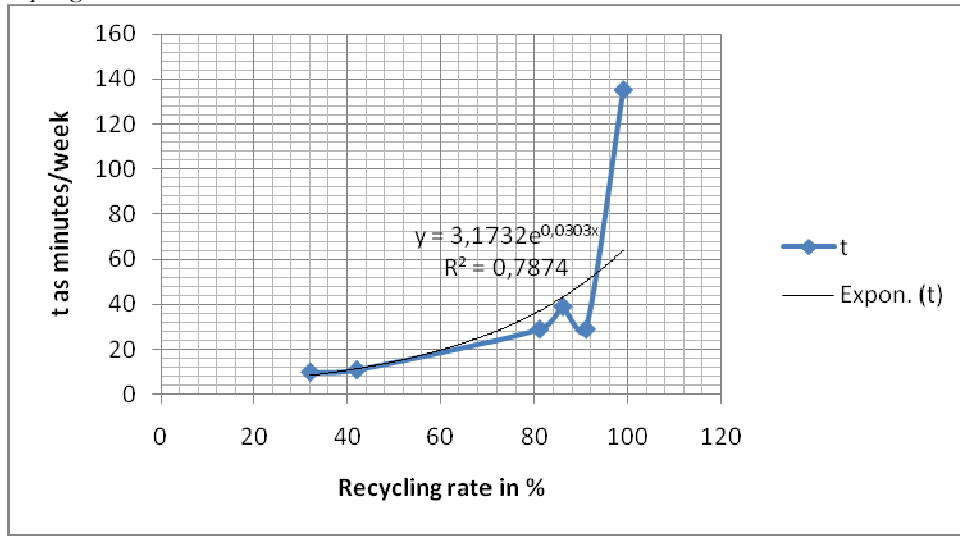
However it is among the detailed clusters that we find the interesting changes in recycling habits.

Most importantly efficiency drops substantially from the top performing groups in the pre-compost setting near 8 units of recycling per minute of recycling put in to the top post-compost cluster at a little over 3. The Busy Beaver cluster remains, although it moves from the detached house to the tenants group with efficiency ratings well below 1. I chose to see the pre-compost ratings as a measure of the maximum potential efficiency which is attainable in any mature setting, and consequently something for the recycling companies to strive for. Put differently, from a theoretical

perspective it is also possible that this is an indication of a high level equilibrium which citizens themselves attain as they acquaint themselves with the prevailing system. Combining Barrs perspective with the praxeological perspective would suggest this.

Viewing the different clusters as an indication of the marginal utility of additional recycling efforts also yield interesting results in this respect.

Graph 9 Post-compost cluster recycling efficiency as a measure of the marginal utility of recycling

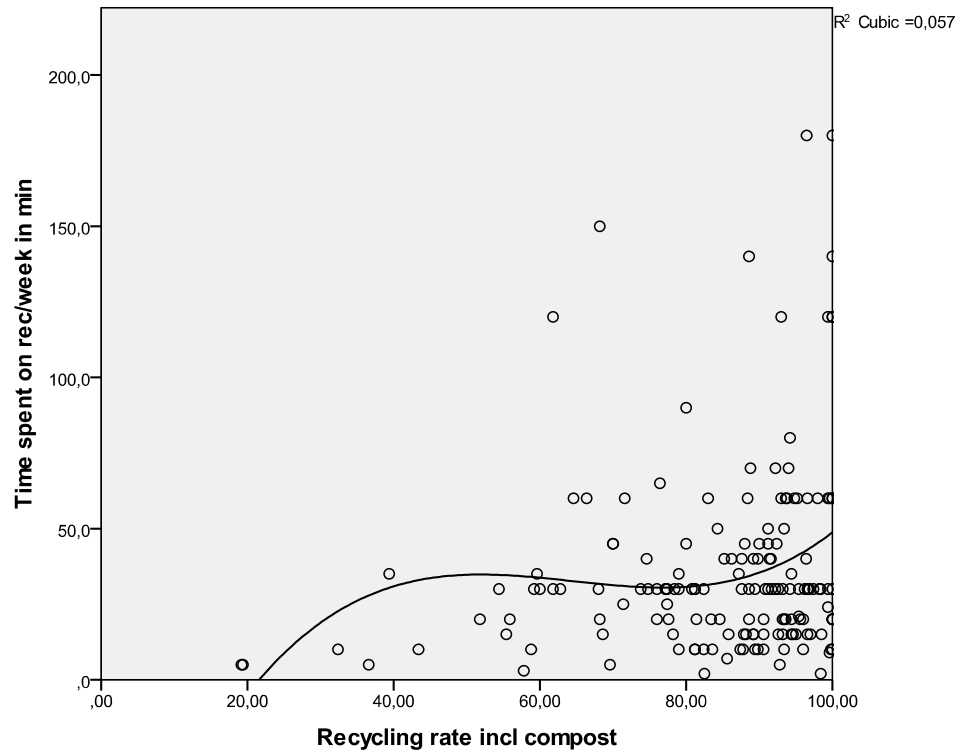


This graph serves well to illustrate to observations which fit nicely to the field observations done at the same time. Firstly we observe the marked hook of the curve as we near 100% recycling. The efficiency displayed by the “BusyBeaver” cluster near 100% of the system’s capacity comes at a high cost in terms of time allotted. Seeing how this cluster has internalised the key elements of recycling and made the fully their own, I dub the “FormalCore” segment. Second, we see the “dip” in time consumption near the 100% hook where what I dub the “CasualCore” segment come into play. This group correspond to the “Efficient Realist” cluster above, and can be said to include all recyclers in and around the sharp bend in the hockey club graph. In effect, this includes those who attain recycling rates around 90% while still spending less than 30min/week on recycling. Looking at the characteristics of this cluster and the extreme changes in

time allotment in the cluster nearing the 100% mark a pattern emerges. Both in terms of actual recycling outcome and values associated with each cluster there is correspondence with what Deci (2000, p. 237) termed the difference between those governed by Integrated Regulation (CasualCore) and Intrinsic Regulation (FormalCore). As I see it the importance of distinction lies with the differences in how ambitious policy makers wish to be in their public marketing. If attainment of near 100% recycling rates for all remain the objective, then SDT would indicate a continued ambition to strengthen the autonomy of citizens with respect to recycling, focussing on making the values of recycling fully internalised while giving up greater than hitherto levels of control of the process (Moller et al., 2006, pp. 108, 110). To the extent that policy maker's ambitions are more focussed with strengthening the overall recycling rates, NEARING but not fully attaining the 100% mark, then mimicking the degree of internalisation of the CasualCore segment would seem sufficient. Such an ambition would build on citizen's actual recycling behaviour and require considerably less in terms of commitment of citizens while still stand as an ambitious environmental alternative (Moller et al., 2006, p. 110). This stands in stark contrast to the previous ambition where attaining the CasualCore segments' level of internalisation is needed but not sufficient for goal achievement.

If we go back to the raw data and use all valid datapoints we get a result which is graphically similar to the eye, although not as clear cut as there are more outliers to take into account.

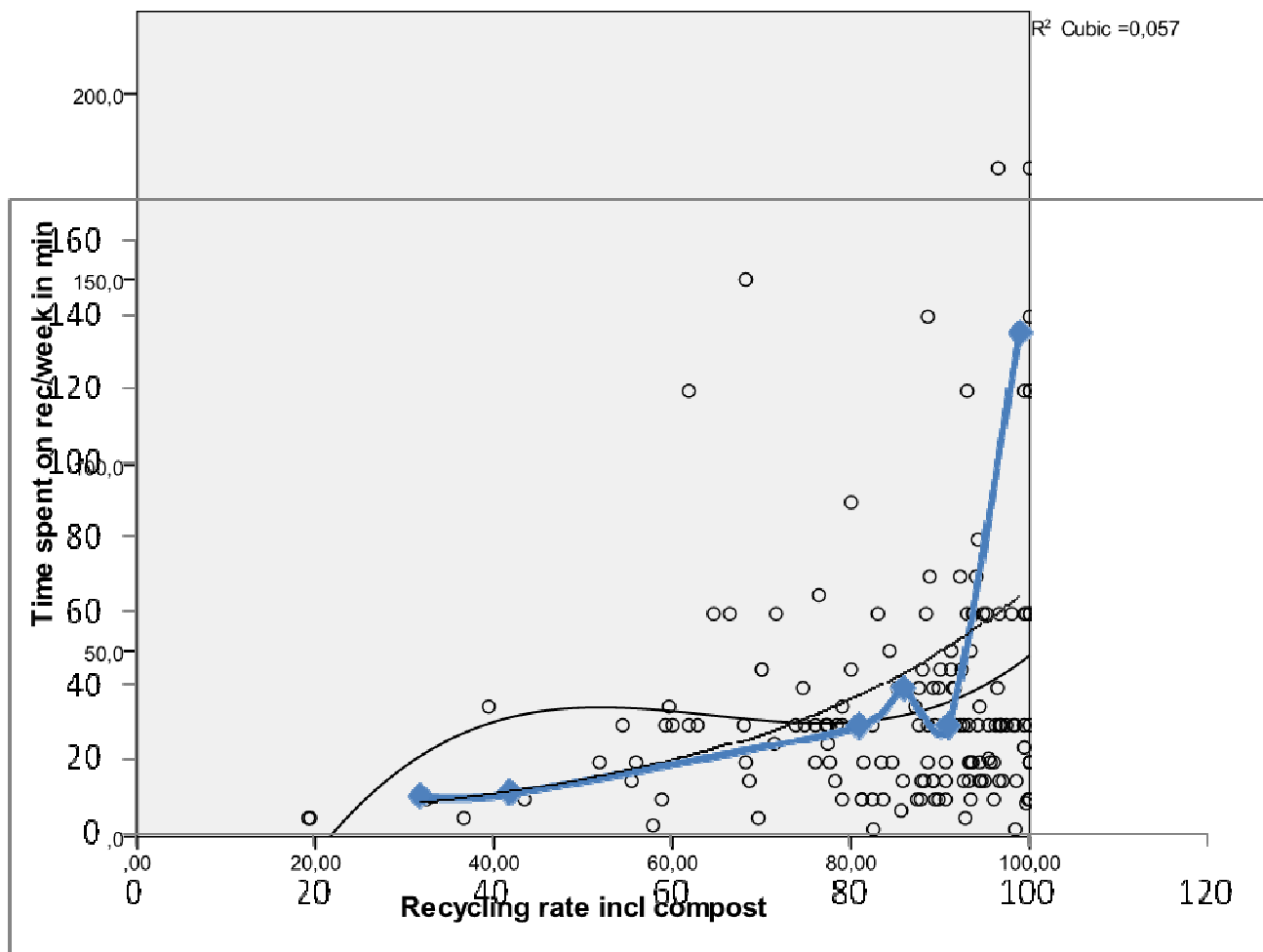
Graph 10 Time spent on recycling compared to recycling rate – traditional measures



Although less clear cut, it illustrates the same point.⁹⁰ An increase in time consumption, as we near 100%, and a slight dip in time consumption among the more experienced recyclers is clearly visible. Effectively this forms a horizontal s-curve when all data is considered and a hockey-club effect when only taking into account the clusters in question. Although not very elegant graphically, superimposing one graph on the other makes this effect more telling.

⁹⁰ The use of cubic curve fit is selected ONLY to guide the eye, and I make no claim in either case that the curve fit as such has validity in a statistical sense. See my chapter on symbolic regression.

Graph 11 Time spent on recycling compared to recycling rate - with "hockey club" superimposed



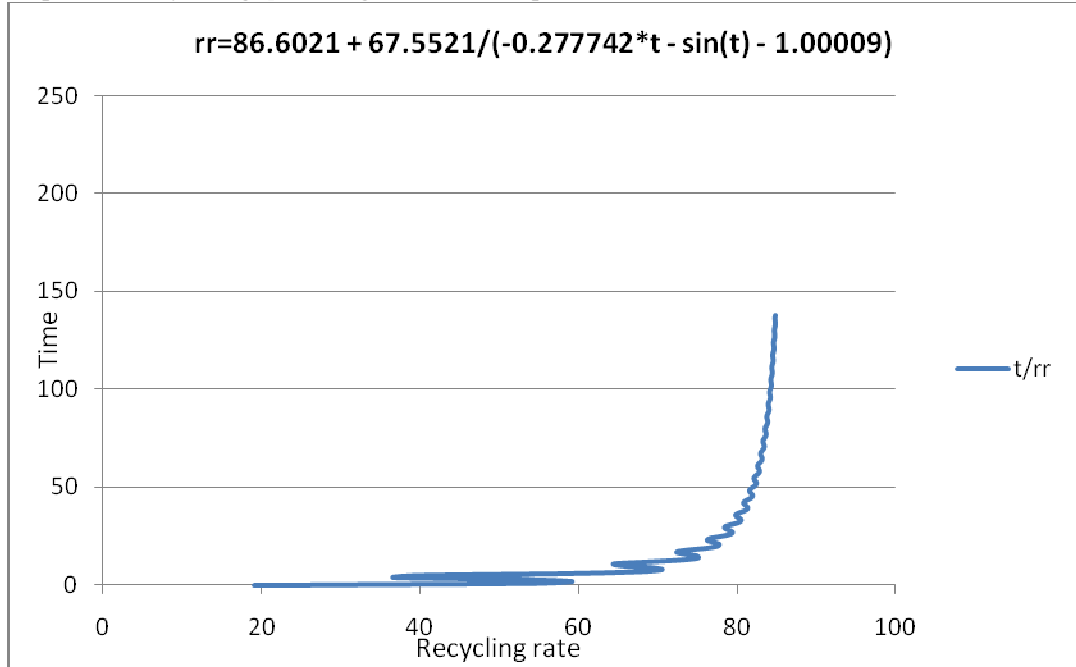
We see that the clusters converge nicely with the projections made. However, both these measures are relatively crude compared to the new possibilities offered through “Symbolic Regression”⁹¹ techniques and the newly (November 2009) released Eureka⁹² software. Through machine

⁹¹ (Genetic programming - Wikipedia, the free encyclopedia)

⁹² (Eureka | Cornell Computational Synthesis Laboratory)

learning techniques this allows us to find and define the underlying mathematical relation of our data. Using the exact same data as in the traditional graphs above this technique finds a sinus oscillation in the material AND the diminishing marginal utility with a better curve fit than all of my previous methods.

Graph 12 Curve fit using symbolic regression and Eureka⁹³



Without interposing it to the previous charts we see a similar pattern to the ones described above. The oscillation of the curve is also clearly visible as is the increasing effort in time needed to approach a recycling rate of 100%. The most important addition however is probably that this model takes into account what we have termed the maturation of a recycling system. It also illustrates how the CasualCore segment marks a shift in the “resilience” of recycling patterns – that is a marked shift towards ever smaller shifts in recycling rates as usage changes. The oscillations would then represent the shaky road by which a recycling citizen gradually learns the finer points of recycling, with new challenges at each new level of recycling. This is the

⁹³ Details found in Chapter 0

first time, to my mind, that a mathematical representation of this kind of process is clearly shown within my discipline.

6.12 Residual findings – dead ends

The Pre-compost determinant survey also split the knowledge centred survey first group into smaller determinants, where paper related recycling (newspaper, corrugated fibreboard and misc paper) was an expected group. So was the haz-mats related group, where glass containers were also included. Thus the division into KWF and non-KWF largely held up.

Returning to ethnicity and gender, in our pre-compost survey we got an indication that ethnic Swedes may have been more inclined to recycle compost waste than 1st and 2nd generation immigrants. However, although the factor analysis itself was sound⁹⁴, the number of immigrants in the survey was limited to such an extent that we only used the result as a basis for further investigation into the issue. In addition the Order and Living arrangements survey which had a more representative complement of immigrants among its numbers made no difference.

Before I continue on this main track of the results I will just briefly discuss those slight demographic issues that we kept in store and mind from those first surveys.

When the above division was taken into account certain small indicative differences could be noted for expected determinants such as gender and ethnicity. This was of course a “hen and egg” situation, what came first – gender induced recycling habits or recycling habits as such. For the sake of simplicity, it should be noted that the possible gender influence was noted only after primary statistical analysis had been conducted on the overall material.

Gender as a determinant was an important point of investigation in all of our early surveys since we expected it to influence recycling habits greatly. This was not to be the case however, and in retrospect we should perhaps have noted that with participation levels so high there could in fact not be any greater discernable differences. To the extent gender made any difference as a determinant in the Pre-compost survey, it had no bearing on

⁹⁴ Result of SPSS Factor analysis, KMO: 0,808

the KWF, and only a limited bearing on the remaining waste fractions.⁹⁵ To the extent it had a bearing though, it indicated that men might be more likely to engage in recycling of Haz-mats, batteries and other technical or bulky forms of waste, although this division was not at all distinct. Consequently recycling of the KWF fraction was non-gender dependant. However, in the Order and Living arrangements survey we found that women were somewhat more inclined to engage in compost specific recycling in the pre-compost setting.⁹⁶

“Of course my husband helps out with the trash – we all eat don’t we?” Middle aged woman on foodscraps in regular trash 030826
“Yeah, maybe I am the one who b r i n g s the haz-mats to the recycling centre most of the time, but we all help out. We all need to collect, sort and dispose of our refuse! Who is to say what part of all that is recycling and what is not?” Middle aged man on the recycling process - 031114

Thus, gender was not the great issue we had expected due to the extent of recycling participation, and gender differences did not necessarily divide along traditional divides, the KWF fraction just as easily being taken care of by men as women.

Age was also a determinant of low influence of recycling rates. To the extent it showed in our material it provided a somewhat conflicted image. Although all age groups participate to a large extent in recycling, two trends were observed. On the one hand the Pre-compost survey clearly showed that the KWF fraction was the centre of attention among younger recyclers.⁹⁷ Kitchen duty as a chore for the youngest survey participants and a relatively lower income – resulting in less “Activities waste” might explain this.

“As a student I have a small income and produce hardly any recyclables [other than kitchen waste]” Student on her recycling habits. 031213

⁹⁵ Result of SPSS Factor analysis, KMO: 0,862, gender factor loading -0,267 with the non-KWF factor.

⁹⁶ Result of SPSS Factor analysis, KMO: 0,483

⁹⁷ Result of SPSS Factor analysis, KMO: 0,863, with a factor loading of -0,662.

The above is an interesting fraction specific exception since the Living arrangements survey indicates that overall recycling rates would increase somewhat with age.⁹⁸ There is good reason to return to this in the post-compost situation and analysis.

6.13 The compost informer interview study 2007

Pivotal to the successful implementation of the compost program was the rapid increase in actual knowledge of the involved citizens and instrumental in this was the “Compost Informers” (CI) set up by the recycling company. These CI were formed as a cadre of mostly university students and persons with an interest in either the compost program as such or just an interest in earning a little extra cash on the side, or both. Our study of this aspect of the compost program consists of 15 in-depth interviews with former CI, conducted by another former CI, one our assistants. We set up and used this series of interviews as a means of testing and double checking results from our statistical surveys, to add to our understanding of the compost program and the mechanisms it contained.

The results are broken down into a series of themes permeating the interviews. These themes dominated the interviews and were recurring patterns in the analysis conducted afterwards.

The themes covered included:

- Co-worker vs extra-worker
- Informer vs controller vs salesman
- Routine vs Ad Hoc
- Professional vs Amateur
- Money vs Idealism
- Biology vs Human ecology
- Villas vs tenants

6.13.1 Informer vs controller vs salesman

This seemingly tripartite division has to do with the role of the CI and how they perceived themselves in relation to the public’s perception of the CI. On the one hand CIs were seen as informers, conveying information in the

⁹⁸ Result of SPSS Factor analysis, KMO: 0,527, age factor loading at a decent 0,69

hope of affecting change through increasing knowledge (Kågström et al., 2009, pp. 138, 145). At the same time they were also the representative of the organisation that had ordered the compost change and controls its implementation, possibly even meeting out punishment to non-compliant household (Kågström et al., 2009, pp. 138-139). In that controller role the CIs ability to actively share knowledge may have been impaired due to the public's reaction to them (Kågström et al., 2009, pp. 139-140). Thirdly the CI occasionally saw themselves as salesmen, in a derogatory sense, and in direct contention with their role as informers – not in contention with a controlling role. When called upon to “just” stand around and passively inform the public at fairs etc, CIs who had become accustomed to actively seeking out the customer and sharing of their knowledge felt left out and out of context (Kågström et al., 2009, pp. 145-146). So essentially this tripartite division revolves around the informant role in juxtaposition with the controller and salesman roles.

Informer vs Controller AND Informer vs Salesman

The controller role is especially interesting since the CIs reported that they themselves perceived that this was a role into which they entered under certain circumstances, for example in certain geographic areas with recycling problems or when confronted with reluctant or negative citizens (Kågström et al., 2009, pp. 139-140). The reason for entering into this role seems to have been two-fold. On the one hand simply their appearance on the doorstep of the citizen, acting as the representative of the recycling company and on the other hand the type of information given (Kågström et al., 2009, p. 140). The latter part is especially interesting if the CIs perceived it so that they had overcome the first reluctance of representing the “counterpart”, only to enter into opposition again when the information is presented. This two-fold controller role could explain why so many respondents were reluctant to acknowledge the CIs as their main venue of their increase in actual knowledge in our statistical surveys.

If the controller role was a detriment to the buildup of knowledge and the salesman's role was a detriment to the enthusiasm of the CI, then the informant role would remain the pivotal role to positive changes in knowledge and attitudes.

As an informer the interviewed CIs reported two types of approaches to the informant role. The first approach was to achieve change through increasing knowledge, and the second achieving change through altered attitudes (Kågström et al., 2009, pp. 139-140). In the first instance CIs tried to

change behavior by sharing knowledge, answering questions and correcting faulty perceptions of recycling. An example of this could be the common misconception that compost and regular unsorted waste is mixed in the collection truck. In fact the truck has two collection spaces operated from the same opening in the rear. By referring to the compost compartment as the “piggy belly”⁹⁹ the CIs could change this misconception in a more informal fashion. [lägg in bild på hur “grisamagen” illustreras på bilen]

This coaching, educational role is what we envisioned when we measured the knowledge variables. However, the second approach of achieving change through altered attitudes as a knowledge factor was not how we envisioned it. Clearly this shows that at the very least the CIs have viewed their mandate as more normative than the first informant role would indicate. Certainly, we were not oblivious to the fact that the recycling company had (and has) one unified version of the environmental issue at hand. At the same time these interviews illustrate how the CI role had a broad agenda even in this respect. Not only did it intend to inform on WHY to recycle, but also on a method of HOW to recycle.

I would summarise this clash of interests and scopes using this simple matrix:

Table 23 Clash of interest vs scope of recycler

	How	Why
Theory	HOW _{theory} (H _t)	WHY _{theory} (W _t)
Practise	HOW _{practical} (H _p)	WHY _{practical} (W _p)

To comment briefly on the matrix, it should be noted that it is imperative to separate these different perspectives from each other. While most citizens are focused on the practical level of both how and why, and the recycling company was focused on the theoretical issues or system level practicalities, the CIs were caught in the middle. This initial impression will be nuanced by the complete study of the CIs in the summary below.

In this light it is interesting to see how the CIs talk about with disdain of the “salesman” role. The same role, whereby they were utilized to act as figureheads for the project in public relations settings, fairs and exhibits (Kågström et al., 2009, p. 145). There is a sliding scale of the CI role here from the matter-a-factual “pure” system information role, via the “attitude change” role to the “salesman” role. It is a scale from very little debate

⁹⁹ Literally “Grismagen” (pigs belly) in Swedish, the diminutive form added in English to properly convey the “cute” or rustic/rural connotation intended by the recycling company.

about the content of the message towards increasing degrees of debateability over the message and its content.

To illustrate, I would say that where to put a glass bottles according to the recycling system is undebateable, the environmental utility of a focus on compost recycling vs haz-mats is disputable and state of the current monopoly of the regional recycling company is a matter for full blown political debate.

Doubtlessly the recycling company and the CIs seem to view the two first as the flip-sides of the same coin, whereas it could be just as warranted to view the two latter as conjoined. Put more harshly, mixing hard facts (about HOW you recycle) with propaganda (reasons WHY you recycle) and marketing messages (for WHOM you recycle) risk sending a mixed message to the citizen.

Doubts about the reasons why we recycle risk interfering with the action of recycling.

Here we have a clear cut reason why the action-value gap (Barr, 2004) risk emerging anew even in a mature context. The extent to which the controller role exacerbates this confusion over the purpose of the CIs visit warrants further attention.

6.13.2 Biology vs Human Ecology

The distinction above is further illustrated by how the CIs were trained by the recycling company. Focus lay on the biological aspects of the recycling system, HOW_{theory} a compost works, how reuse of materials is conducted etc, and not on WHY it is done. This was not remarked upon by the CIs themselves but it was evident in the interviews (Kågström et al., 2009, p. 144). In addition it was also clear that considering the WHY-related nature of the information campaign the addition of a “human ecology” focus to the biological system focus would have been welcomed by the CIs. In the field the CIs reported that they were often quickly drawn from a HOW_{theory} by way of a WHY discussion to a HOW_{practical} discussion with the citizens. This shows that even the CIs were aware of what the main interests of the individual citizens was, namely getting hands on, down to earth information on how to cope with the new system in a daily setting.

So to summarise the CI discussions with citizens normally followed this pattern:

HOW_{theory} -> WHY_{p+t} -> HOW_{practical}

A fictive and abridged example of what the above type of dialogue might have sounded like might look like this:

CI: - Hi! I am a compost informer from Gästrike Återvinnare – your local recycling company! Is it ok if I tell you a little about our new recycling system? Well as you know it is important to recycle to preserve earth's rare resources and to ensure a healthy environment for coming generations! To this effect we are planning a completely new recycling system for household compost! With this new system we will be able to save on earths scarce resources and make the future brighter for the next generation!

Citizen: - Ok, I can relate to that – I often think of my grand-children, but then again I remember how dirty the air was when I was young compared to now. Oh, and by the way are you sure composting is the most important thing we can do for the environment right now? I mean, if I accept your line of reasoning then why isn't the recycling system better geared towards collecting haz-mats for example?

CI: - Well that's a good point, but I think that you will find that we have done a lot in the past year to make it easier to recycle CFL:s for example. Have you noticed that there is a separate collection bin for those kinds of lamps in your recycling room now?

Of course the actual dialogue would have been longer and the line of reasoning not as straight forward. However the point is to illustrate how the intention of the recycling company and the CI was easily sidetracked by the actual interests of the end-consumer. The strictly biological and mostly theoretical line of reasoning was replaced by a focus on human-ecology and practical issues.

6.13.3 Routine vs Ad Hoc

Reading, as in understanding the underlying reasoning of the citizen being subject to a visit seems to have been especially important in this context. The CIs report how they had to constantly adapt to convey the intended message:

“...well it’s an interesting job. You get to use “language” – whether it be in broken French, or attempting to use German. We do have information [concerning HOWp and WHYt] in English, and that’s more familiar – and Swedish of course... But when they [the citizens] don’t speak either language you have to resort to body language.” Excerpt from interview with CI (Kågström et al., 2009, p. 141)

This reliance on the CI to get across with the intended message adds further to the image of a compost information campaign working hard to get across. At the same time, as the quote illustrates, the result is heavily dependent upon the skills of the individual CI if the meeting does not conform to the envisioned plan. The CIs worked in 2,5h stretches and of course the mainstay of the contacts followed a routinised pattern (Kågström et al., 2009, p. 141). Given time, the task of conveying information was bound to become routine. Even in the most absurd and odd situations long-time CIs would become increasingly able to act in a well thought through responsive fashion - establishing a professionalism among the cadre responsible for promoting the compost program.

When informing a large community this would of course be expected to have implications on the effects of the information campaign in the first areas to undergo the campaign. In addition, it would seem prudent to somehow follow up and gather experiences from the field workers to be better able to educate a new generation of CIs.

6.13.4 Professional vs Amateur

The nascent professionalism indicated as part of the increasingly routine information campaign was largely unobserved (Kågström et al., 2009, p. 142) by the CIs themselves though. Instead this cadre sported amateurish ideals that were defined in the interviews as “open, nice, and friendly” (Kågström et al., 2009, p. 142). That is to say, an emphasis more on social

characteristics than on professionalism seems to have been the ideal during the recruitment phase and subsequent work. This is an interesting observation as it would seem that such an emphasis may be in direct contradiction to, at least a part of, the task at hand.

If we suppose that the recycling company wanted to influence recycling levels through some kind of Hawthorn effect, this recruitment strategy might have made sense. However, if we assume that the goal was to accomplish change through knowledge or even propaganda it is harder to see how it was a good decision.

1. Change through knowledge Wt
2. Change through knowledge Ht
3. Change through knowledge Wp
4. Change through knowledge Hp
5. Change through propaganda (scare effect)
6. Change through attention (Hawthorne effect)

Deeming from this observation, it would seem that nr 5 and 6 in the list above might be attainable under these circumstances. 1-4 would seem harder to attain even though the initial contact focused mainly on 1 & 2, ending with discussions on 4. This further adds to observation in the previous chapter that the longitudinal experiences of this program might have done well to be observed and acted upon to maintain a similar effect throughout the programme.

6.13.5 Money vs Idealism

Perhaps in keeping with the previous dichotomy, we also saw that the CIs were leaning towards idealistic motives as to why they took up work as a CI. Seeing the role of the CI as enacting change is important to the CI, although this again may seem at odds with the predominantly amateuristic approach offered by most CIs.

...at the innermost level it's not about getting an income, but about doing something, contributing to something (Kågström et al., 2009, p. 142).

While the extra money is important for the students acting as CIs, it would seem that idealism and an opportunity to do something for the environment weighed more. Even the business model of the recycling company added to this sense of righteousness.

...my main reason [for working as a CI] is my interest in the environment, but of course as a student one needs a little extra [money] to get by... ..I always wanted to with something that is not so profit oriented, you see Gästrike Återvinnare is more about the environment and stuff and their aim is not to make a profit – although its good [for the environment] if they make a profit... (Kågström et al., 2009, p. 143)

The CIs also talk about the cadre of CIs being “likeminded” in this respect, with a passion for the idealistic purpose of their task. Earning money is not the defining characteristic of the CIs, whereas the idealism is. As I see it this further contributed to the amateuristic character of the CI while increasing the problems of the recycling company in formalising and taking stock of the experiences made during the project.

6.13.6 Detached houses vs tenants

The final dichotomy deals with the relation of the CIs to the two principle types of customers. Those living in detached houses versus tenants in apartment buildings. This is a dichotomy which we were aware of since our first empirical work. As has been detailed previously there seemed to be distinct differences in attitudes and behaviour between these two groups. This impression was relayed and tallied with GÅ at an early stage and they confirmed this to be their impression as well. Thus it remained a factor in our studies. To what extent this influenced how the CIs worked with regard to these two types of communities is impossible to determine. However, their reactions to the two groups complement our statistical understanding of the differences.

Prima facie, the CIs reported that citizens in detached houses were more interested and easier to work with/inform, than tenants. House owners would be more interested, more open, more inquisitive and ask more advanced questions (Kågström et al., 2009, pp. 147-149). This went so far as that the CIs preferred working in the detached house areas over the apartment blocks. However, the latter groups was more diversified with regard to their interest in the compost project. Whereas almost no negative citizens were encountered among the detached houses, there would be a wide range of reactions among tenants. Ranging from deeply concerned to outright hostile.

...in the apartment blocks there are great differences [in the degree of interest], sometimes they are very interested, ask questions and find the program very good, on other occasions it felt completely useless. You might get a hold of 5 interested listeners with the rest being all like: “What kind of effing crap is this?. [CIs on contacts with tenants.] (Kågström et al., 2009, p. 148)

One aspect to keep in mind in this context is that apartment blocks include both municipal housing areas and condos. This greater diversity perhaps helps to explain the greater range of reactions, with detached housing areas more homogenous in socio-economic terms. However, it is perhaps the similarities that provide us with the important insights. Upon a more in-depth study of the kinds of questions and issues the CIs encountered in the respective groups I notice the same emphasis on practical issues as reported earlier.

...mostly practical issues like how to position the compost bins, where to get the compost bags, what will happen to wet compost bags and flies, how often the bins are emptied... ..not so much about specific products although there is always someone who asks what to do with light bulbs and flower pots, but more than anything the durability of the paper bag and fruit flies. [CIs on contacts with house owners.] (Kågström et al., 2009, pp. 148-149)

...in the apartment blocks there are more general questions like where to get compost bags and what is ok to put in them and such...[CIs on contacts with tenants.] (Kågström et al., 2009, p. 149)

So the nature of the practical focus may shift in details between the two areas, but it is still a focus on HOWp and WHYp that we see repeated again and again, with the same rapid shift from the WHYt that the CIs wanted to emphasis to the practical issues.

6.13.7 Comparing emphasis and perception

Table 24 Comparing emphasis and perception of the compost recycling program

Dichotomy	Gästrike Återvinnares emphasis	Compost informer emphasis	Citizen perception
Info vs Contr	Informer (Wt)	Informer (Wp)	Controller (Hp)
Info vs Salesm	Salesman (Wt)	Informer (Wp)	Salesman (Ht)
Bio vs Hum eco	Biology (Wt+Ht)	Biology (Wp)	Human ecology (Hp)
Routine vs AdH	Routine	Routine	Ad Hoc
Prof vs Amat	Amateur	Amateur	Professional
Money vs Ideal	Money	Idealism	Idealism
House vs Apartm	Detached houses	Detached houses	Detached Houses

Depending on the perspective put on the compost informers different aspects are emphasized. The most notable discrepancies arguable lie with the citizens. Where the CIs are regarded as informers, citizens always risk seeing them as controllers. While not surprising, it illustrates struggle facing the CIs. The same kind of rift is discernable concerning the dichotomy between routinised behaviour and ad hoc behaviour as well as with regard to amateurism and professionalism. To CIs their customer contacts soon became routine although the citizens they met, having nothing to compare to more often than not saw their meeting as ad hoc and adapted to their specific needs. In that respect the discrepancy may have been beneficial, but in relation to the perceived combined controller/professional role of the CI it may not have been. When the intent was to convey an enthusiastic, informing and idealistic message it was taken in as controlling, salesmanlike with the authority of professionalism added to it.

If we add the WHY/HOW aspects to the matrix we see how the differences between origin, messenger and receiver are accentuated further. Not only is the role of the CI changing but the task changes in the eye of the beholder. I believe that it is easy to draw too large conclusions from this. What it boils down to is to illustrate the importance of a thought through and coherent communications strategy.

6.14 The double “value-action gap” surveys 2001/02

In 2007 we came upon a most interesting find; we were allowed access to hitherto undisclosed basic data from three large surveys conducted by the regional recycling company from 2001 to 2003, with 700+ respondents each. The surveys covered a vast range of factors, mainly concerned with appraising GÅ performance in the eyes of the citizens. They had been conducted by a commercial polling company through telephone interviews but never data-mined or even analysed in-depth, for our intents and purposes the data was thus pristine.

From our perspective, we could extract questions designed and covering the same factors we had investigated from all of the surveys. However, the 2003 survey results did not cover questions which enabled us to calculate the self reported recycling rate of the respondents. Since this is key to our understanding of the situation we decided to leave the 2003 results aside. Instead the results prompted us to create a follow-up survey for the year 2007 to further test the longitudinal aspects of the regional recycling scene and to test the value-action gap we had observed in these surveys and our other reports. Furthermore the 2001 and 2002 surveys covered a period representing a state before our own field-work and this thus extended our timeline without overlapping.

The results of the 01/02 survey factor analysis were strikingly similar to the results of our earliest pre-compost factor analysis. We have the same divisions into groups of collectible materials, and these are in turn distinctly separate from knowledge and attitudes.

The ‘01 factor analysis breaks down the survey into a 4 factor solution including (Kågström et al., 2009, p. 39):

1. Knowledge related determinants
2. Plastics & metal recycling patterns
3. Paper, glass and utility
4. Haz-mats

The ‘02 factor analysis meanwhile also results in a 4 factor solution (Kågström et al., 2009, p. 24):

1. Knowledge related determinants
2. Plastics & metal recycling patterns
3. Paper, glass & haz-mats recycling patterns
4. Perception of utility of recycling

As we can see the results are strikingly similar, and so were the average recycling rate for both years which remained at about 70% (Kågström et al., 2009, p. 18). However, there was an interesting shift in the distribution of knowledge between 2001 and 2002 which may explain the shift in the factor analysis. In 2001 average actual knowledge was indexed₁₀₀ at 51 and in 2002 this had increased to 63. The interesting thing about this change is that it occurs almost solely on the extremes. The individual scoring in the lowest index brackets (index 0-20, 21-40) almost disappear and the greatest single increase is in the highest bracket (index 80-100) (Kågström et al., 2009, pp. 17-18). Higher actual knowledge levels in the pre-compost setting thus imply that practical recycling issues are increasingly considered as a group in their own context. Knowledge related determinants remain in their own category while citizen's perception of the utility of recycling is separated from the act of recycling. This observation is further corroborated by a corresponding increase in the valuation of practical recycling. Again it is the extremes that are shifting, with the lowest bracket almost emptied and the highest increasing.

Running linear regressions on these factor analyses to determine to what extent and what could be influenced we got the following results.

2001(Kågström et al., 2009, p. 40)

$$y = 71 + 3,2x_{\text{Knowledge}} + 19x_{\text{Plastic\&Metal}} + 11x_{\text{Paper+Glass+Utility}} + 5,0x_{\text{Haz-mats}}$$

2002 (Kågström et al., 2009, p. 25)

$$y = 70 + 3,0x_{\text{Knowledge}} + 19x_{\text{Plastic\&Metal}} + 13x_{\text{Paper+Glass+HazMats}} + 6,1x_{\text{Utility}}$$

As we can see the relative role of knowledge has declined nominally as recycling patterns settled. Haz-mats recycling is shifted into the Paper & Glass group and Utility takes its place. This seems to coincide with the same trend reported in our own field data, namely that an existing recycling system will eventually settle on its own accord as citizens learn how to utilise it in an effective way.

6.15 The 2007 follow up

This study aimed at quantifying the value-action gap described in the theoretical part of this thesis. We pitted the two contrasting views on recycling determinants as described by Tonglet and Barr against each other and postulated that (Kågström et al., 2009, p. 47):

1. If Tonglet is correct then the main determinants of recycling rates should be for example environmental concern, satisfaction and utility of recycling.
2. If Barr is correct then the main determinants of recycling rates should be for example, layout and design of recycling facilities, perceived stress recycle correctly, the amount of waste, smell etc.

These two distinctions are based on our comparison of the two perspectives on recycling which can be derived from Tonglet and Barrs respective research. However, it should be noted that this is not so much an absolute dichotomy of perspectives as two complementary perspectives. The two have cross-referenced each other on numerous occasions and it is my view that we may learn from studying these two different perspectives. Even if they are not inherently in opposition, understanding to what effect they operate under the circumstances in our context may reveal much about the mechanisms at work. Summarising the differences that do exist we arrive at the following table:

Table 25 Tonglet vs Barr – perspectives on contemporary recycling

	Tonglet	Barr
	Attitudes/Motivation	Access
Goal	Make rec honourable	Make rec easy
Guiding principle	Theory	Practise
Raison d'être	Why recycle?	How recycle?
System design	Convincing system	Usable system
Motive	Recycle bc its "right"	Recycle bc its "easy"
Type of decision	Conscious decision	Sub-conscious decision
Priority assigned	High priority action	Low/routine priority action

Source: (Kågström et al., 2009, p. 60)

Drawing on our experience in the field we designed a new set of questions to try triangulate this issue. We addressed the 584 final year students at the university with majors in business, engineering and IT and got 110 responses. These are students who have partaken in the university's compulsory environmental management education and who have lived at least 3 years in Gävle. That was the baseline of the group and considering how minute the demographic differences between citizens have been in our other studies we believe that the results can be trusted in as much as they are more typical than atypical of the general demographic.

Looking at the results of this survey I wish to present them a little differently from the previous ones. I will start by presenting the factor analysis, the linear regression and the symbolic regression of the original data. Then I will finish by going into detailed results on a number of questions designed specifically to capture the finer points of the recycling rationale at this late stage of our investigation.

We arrived at a not very surprising 3 factor solution, dividing the questions into three blocks along the lines we wanted to investigate.¹⁰⁰ In this sense this last of our major field studies was the one most driven forward by

¹⁰⁰ In this sense we figured that at this highly advanced stage of recycling the HOWtheoretical is well and duly a thing of the past for our respondents. With recycling rates in the 80%+ range, citizens know the system well enough in this respect.

previous results and theory. It was a relief to see that our predictions in this respect were met.¹⁰¹

1. The “Mises/Barr-factor“: Dealing with how recycling is internalised, understood and conducted under various forms of external stress, ie dirty or messy recycling facility, high amounts or smelly waste.
2. The “Tonglet-factor“: Dealing with the reasons given for recycling and how these are internalised and understood.
3. The “Etzioni-factor“ Dealing with how community pressure to recycle is understood and internalised.

Taken as a multiple regression we get the following equation:¹⁰²

$$y = 69 + 9,7x_{\text{Mises-factor}} + 7,9x_{\text{Tonglet-factor}} + 3,9x_{\text{Etzioni-factor}}$$

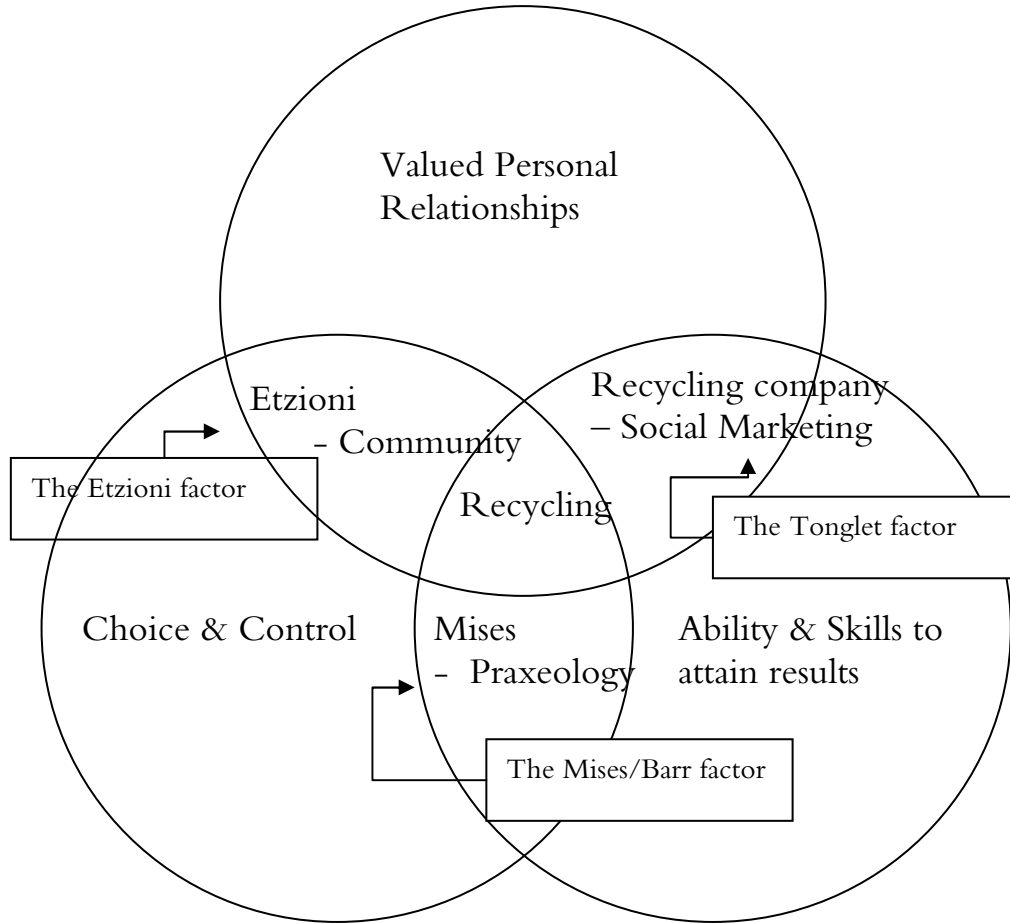
Seen in theoretical terms the first, and most influential factor seems to give credit to Barrs perspective and von Mises praxeological perspective. If the practical sides to recycling are well in tune with how citizens perceive that they wish to deal with recycling, then there is a potential for further improvement which is almost 20% larger than the second most influential factor. This second factor, which we could dub the Tonglet perspective, is also potentially influential, but dependant on continued support for recycling as such and sensitive to information counter to this position. The last position could be dubbed the Communitarian, in the Etzioni tradition. It is also potentially influential and shows that community support and a mutual understanding among citizens on the efficacy and/or utility of recycling still has an impact at this late stage of recycling.

¹⁰¹ With all of the exogenous practical factors co-varying it should be noted that citizens seem to either be affected by all or none of the determinants included in the factor. Thus a citizen who is sensitive to a disorderly situation in the recycling room is also likely to be likewise sensitive to act the same way when their waste amount spike temporarily. We should also note that whereas citizens recycle because it is good for the environment AND deemed valuable to them personally, this factor is completely distinct from community or peer pressure as reasons to recycle. The decision to recycle is taken at three distinct levels and hints at three distinct ways to influence recycling rates.

¹⁰² It should be noted that a somewhat inconclusive symbolic regression of the same data reduced the equation to a function of only two components of the Mises-factor or Barr-factor $y = 104 - 6,4x_{\text{Smell}} - 1,2x_{\text{Mess}}$ – pitting recycling rates against how households react to the threat of inconvenient odours and the order of the recycling room.

These results are also easily understood in terms of Self-Determination Theory. The Mises-factor with its emphasis on the practical sides of recycling corresponds to the Praxeological perspective and the previous finds of Barr (Barr et al.; Barr, 2003, 2004; Gilg et al., 2005; Gilg & Barr, 2006), or the overlapping fields of Autonomy and Competency. The Tonglet-factor, with its focus on the reasons why recycling “should” take place describes the interaction between the recycling company and the development of individual competence in the setting described by TPB-theory and the works of Tonglet (Ajzen, 2003; Tonglet et al., 2004a, b). That is, it describes the Social Marketing aspect of the modified SDT model. Finally, we have the Etzioni-factor, which describes how community pressure and norms interact with individual Autonomy to produce action – this then is also in line with the models described in Communitarian literature previously cited (Etzioni, 1968, 1975, 1988, 2001, 2002).

Graph 13 Empirical results integrated into the SDT model



As I see it, my findings complete SDT theory by describing and explaining the interactions of the principle components of SDT-theory in the form of a trichotomy of sorts. SDT becomes a framework where other theories and empirical results help explaining the mechanisms of the desired action. On a strict research method level this has implications for further research using SDT. The gaps where the components of SDT interact need to be further explored, filled and understood. Perhaps not with the exact theory or factors that I have found, but at the very least my findings indicate that the

interactions are complex and may offer further insights as to what and how the desired action may be influenced. This overlapping interaction between the circles in the graph above become a trichotomy which illustrates where and how influence and change is possible.

However, the recycling specific implications are far reaching from this position. Not only does this result corroborate our previous findings that influencing the practical sides of the recycling system is more cost-efficient and potentially able to yield high results even in a high RR-context. It also illustrates the extent to which other methods can be used to assuage citizens to change their recycling behaviour. We must not lose track of the fact that the Tonglet factor is highly dependent on changes in attitudes which are precarious at best and capricious to boot! Changing attitudes is notoriously difficult and compared to changing the collection system to better suit existing recycling patterns among citizens it seems a folly not to follow through on the Mises/Barr factor first. The Communitarian/Etzioni factor would most likely follow the changes in the two other as recycling becomes and stays the norm in the community.

Looking at the value-action gap the above point is further explored. If we shift our focus from the over-arching statistical analysis and look at individual questions we may be able to take a first step towards quantifying the value-action gap in this Swedish setting. Knowing full well what citizens think is the “expected” answer to questions concerning recycling habits, it has been really difficult to assess the true extent to which people actually do recycle and for what reasons.¹⁰³

When we ask to what extent recycling is good for the environment we get an average of 84%, although the average recycling rate was 69% (Kågström et al., 2009, p. 83). This indicates a value-action gap of considerable proportions, since one could reason that these two figures ought to match were there not value-action gap. This interpretation is further substantiated by the mutual correlation between the two questions which was $-0,295$. This actually means that the cause effect relation between the two was a negative one, albeit a relatively small one. So in fact we do not only have a value-action gap, but a negative one. The more convinced you are that recycling is good for nature, the less you actually recycle and vice versa.

¹⁰³ This would also be a consideration in favour of the Barr/Mises-factor, since there is less reason to suspect that questions regarding the practical sides of recycling are subject to a bias of expectation and political correctness!

This attests to the magnitude of the problem facing a recycling organisation solely trying to use the Tonglet approach to increase recycling.

The same magnitude of negative correlation (-0,235) is also displayed when we compare the value-action gap concerning the perceived personal value of recycling and average recycling rates. An average of 71% is here contrasted with average RR of 69%, so without the correlation value it would be easy to pass over these numbers without noting their implications. Again we see what can only be described as a measure of hypocrisy. Those who are most eager to profess a high personal value of recycling are the ones least likely to actually engage wholeheartedly in recycling! On the other hand, if there is one thing we must learn from the Barr-factor it is that you do not NEED to value the act of recycling highly, nor the environmental utility highly to actually recycle and do so well. I would in fact argue that the opposite is true, a routinised recycling behaviour with no or little personal attachment is both more likely to succeed and to maintain in the long run. Transforming recycling from a high stakes, high value environmental issue into a routine, everyday way of waste disposal (which happens to be environmentally sound because the system is set up that way) is the most likely avenue of further increases in recycling rates in high recycling rate contexts.

6.16 Re-run using symbolic regression

As previously noted Symbolic regression became available at a rather late stage in my research, which would normally discourage against its inclusion. However, as already shown, the results of using this method on existing material is interesting enough to warrant its inclusion.

Barr/von Mises, Tonglet/TPB or Etzioni/Communitarianism?

As seen in 6.15 regular linear regression offers some insights into the influence of each of the studies sets of theoretical determinants.

$$rr = 69 + 9,7x_{\text{Mises-factor}} + 7,9x_{\text{Tonglet-factor}} + 3,9x_{\text{Etzioni-factor}}$$

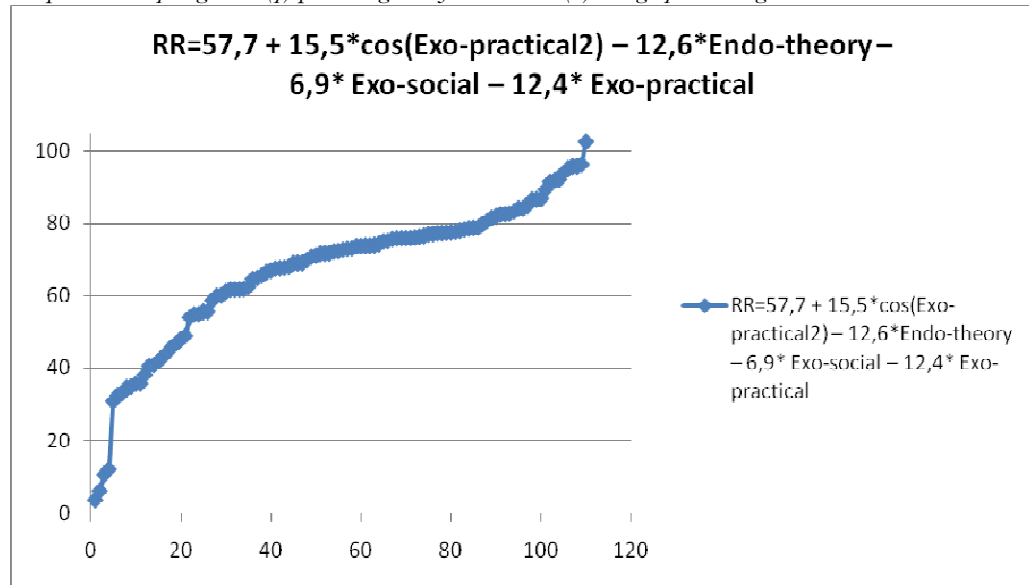
I noted that exogenous-practical issues along the lines of Barr/von Mises lines of reasoning would seem to have the highest influence on recycling rates. The other factors would also complement, though to slightly smaller degrees. The linear regression fails to explain the internal fluctuation in the material and the wavering support noted among many households.

However, when the same factor analysis is re-run using symbolic regression the result is more multifaceted and to my mind more in tune with the actual observed complexity.

$$rr = 57,7 + 15,5 \cdot \cos(\text{Mises-factor}^2) - 12,6 \cdot \text{Tonglet-factor} - 6,9 \cdot \text{Etzioni-factor} - 12,4 \cdot \text{Mises-factor}$$

With a fitness metric which far outperforms that of the linear regression ($R^2 = 0,43$ & Correlation Coef = $0,66$) what we see here is almost a role-reversal. All three factors influence recycling negatively, except for the ease of use related factor, which stands out as the major influence. Varying with the cosine of its squared value the Mises-factor factor become the one major determinant left in the equation, the other factors relegated to hemming in the fluctuations. So what does this mean? Are attitudes and feelings of community redundant? Certainly not, as shown in other context they still play an integral part of our understanding of recycling behaviour, but when posited against each other symbolic regression will point to the practical sides or ease of use as being pivotal. Plotted using the factor values and the resultant equation we get a snapshot of recycling rates which mimics our understanding of the situation well. We get “hockey-sticks” at both ends of the plot – with very few stragglers, many performing around the mean and an avant-garde performing well above average.

Graph 14: Recycling rates (y) plotted against factor values (x) using symbolic regression



This ability to plot and recreate the peculiar, and non-linear, behaviour towards the extremes in a setting such as this is valuable. Rerunning similar data sets to check for the impact of different theoretical subsets would be most interesting. If the non-linear or even cyclical nature of behaviour can be recreated, this will most certainly be a contribution in its own kind and open up new approaches to policy design.

6.17 Analysis of tested determinants & their role in a morphological analysis

6.17.1 Waste fractions

Among our earliest discoveries was the observation that our respondents seemed to group different waste fractions together. In our M survey there was for example two distinct groups of waste that came out of every statistics run. The first group comprised:¹⁰⁴

¹⁰⁴ Result of SPSS Factor analysis, KMO: 0,862

Batteries
Hazardous materials
Newspaper
Glas containers
Electrical waste
Paper
Corrugated fibreboard (Wellpapp)

And the second group comprised:

Soft plastics containers
Hard plastics containers
Metal containers
Food scraps/Compost

Although it is hard to define in any clear cut way these two groups, it is the second that attracts our attention. For lack of a better term I will hereafter refer to it as the "kitchen waste fraction" (KWF). These distinctions and the likeminded way in which persons recycle different waste fractions is a topic which we shall have reason to get back to more in detail later on. The K2 survey¹⁰⁵, with its stronger emphasis on different forms of knowledge as a partial determinant of recycling rates, provided additional information on how citizens regard different waste fractions. In that run the KWF fraction was intact apart from compost which was vectored in separately with actual knowledge on recycling.¹⁰⁶ This pre-compost result is interesting as it points to the special role attributed to compost waste among individuals. More interesting was that compost recycling was negatively correlated to actual recycling knowledge, putting that activity at odds with a firm knowledge of the system. On the other hand it may have been that the less knowledgeable thought they recycled food scraps when in fact they were just putting them with the residual waste fraction.

"Well it is all put to good use isn't it?" middle aged woman on food scraps in regular trash 030826

My conclusion regarding this is that we need to take the figures at face value. Doing this leads me to infer that compost recycling in the pre-compost period was the traditional domain of those that did it for their own value. They did so as to have compost in the backyard and not as result of

¹⁰⁵ Result of SPSS Factor analysis, KMO: 0,799

¹⁰⁶ Loading 0,872 for compost waste and -0,578 for actual knowledge

any sort of environmental conviction on the matter. This has ramifications for how we then regard the results of the post-compost setting.

The K2 survey also split the M surveys first group into smaller determinants, where paper related recycling (newspaper, corrugated fibreboard and misc paper) was an expected group. So was the haz-mats related group, where glass containers were also included.

6.17.2 Demographic determinants

The M survey set aside demographic determinants such as income, household size, ownership of living quarters, occupation and age from recycling as such. However aside from that not much could be statistically determined.¹⁰⁷

6.17.3 Ethnicity

In our pre-compost M survey we got an indication that ethnic Swedes may be more inclined to recycle compost waste than 1st and 2nd generation immigrants. However, although the factor analysis itself was sound¹⁰⁸, the number of immigrants in the survey was limited to such an extent that we only used the result as a basis into further investigation the issue. The W survey which had a slightly more representative complement of immigrants among its numbers made little

6.17.4 Gender

To the extent gender qualified as a determinant in the M survey, it had no bearing on the KWF, and only a limited bearing on the remaining waste fractions.¹⁰⁹ To the extent it had a bearing though, it indicated that men were more likely to engage in recycling of Haz-mats, batteries and other technical or bulky forms of waste. Consequently recycling of the KWF fraction was non-gender dependant. However, in the W survey we found that women were somewhat more inclined to engage in compost recycling in the pre-compost setting.¹¹⁰

6.17.5 Age

Although all age groups participate in recycling, the M survey clearly showed that the KWF fraction was the centre of attention. With a factor

¹⁰⁷ Result of SPSS Factor analysis, KMO: 0,808

¹⁰⁸ Result of SPSS Factor analysis, KMO: 0,808

¹⁰⁹ Result of SPSS Factor analysis, KMO: 0,862, gender factor loading -0,267 with the non-KWF factor.

¹¹⁰ Result of SPSS Factor analysis, KMO: 0,483

loading of -0,662, relative youth was a determinant for recycling the KWF fraction before the central compost system was implemented.¹¹¹ This is an interesting exception since the W survey indicates that overall recycling rates increase with age.¹¹²

6.17.6 Occupation

The M survey was entirely unable to give an indication of how occupation could influence recycling.

6.17.7 Household size

With regard to household size, the M survey indicated that it was a factor influencing recycling in its own right.¹¹³ This was expected since larger households produce more waste and need a bigger apparatus to take care of recycling in the first place.

6.17.8 Income

In the pre-compost setting youth and low income went hand in hand as a determinant for recycling of KWF. The causality, or more in-depth relation is harder to determine though. Age and income covaried to a large extent in the M survey and were largely indistinguishable from one another. Taken on their own, they still were part of the KWF determinants which is interesting. In the contemporary W survey, low income and the propensity to recycle compost was a strong factor, strengthening the observation in the M survey.¹¹⁴ Considering our non-statistical data, I would suggest that youth may influence recycling from an awareness perspective and low income would encourage a more parsimonious attitude towards all kitchen and food related issues.

6.17.9 Home ownership

As has been described before, rented apartments are often well catered for in terms of recycling in the Gävle region. It was therefore no surprise that this form of living quarters was associated with the KWF in the M survey.¹¹⁵ However, the overall recycling propensity was greater among those who owned their own living quarters according to the W survey.¹¹⁶ That

¹¹¹ Result of SPSS Factor analysis, KMO: 0,863

¹¹² Result of SPSS Factor analysis, KMO: 0,527, age factor loading at a decent 0,69

¹¹³ Result of SPSS Factor analysis, KMO: 0,863, household size factor loading 0,924

¹¹⁴ Result of SPSS Factor analysis, KMO: 0,494 income loading at -0,773

¹¹⁵ Result of SPSS Factor analysis, KMO: 0,864

¹¹⁶ Result of SPSS Factor analysis, KMO: 0,545

statistical finding was also corroborated in subsequent interviews, and goes hand in hand with the views of Gästrike Återvinnare and the research team.

6.17.10 Order in the recycling room

The most interesting finding in the W survey concerned the role of perceived order in the local recycling facility or room.¹¹⁷ No other determinant in the W survey could rival perceived order as a determinant for overall recycling. A nice, clean, well kempt recycling facility, preferably governed by the local residents themselves gave rise to a substantial rise in the propensity to recycle.

6.17.11 Knowledge

The K2 survey results distinguished between the Actual and Perceived Recycling Knowledge (ARK and PRK respectively) of those surveyed. As was briefly touched upon in the waste fractions section ARK acted as a recycling rate determinant with compost recycling. PRK on the other hand also influenced recycling rates, but in conjunction with the respondent assessment of how valuable it is for them to recycle. These factors have a roughly equal impact on recycling rate outcomes as was shown in the subsequent regression.

6.18 Analysing the empirical results using an extensive Zwicky box/Morphological analysis

In this chapter I go through and comment the results of a systematic evaluation of all the remaining high end recycling rate alternatives that exist once “impossible” combinations have been excluded using a zwicky-box software of my own design.

6.18.1 Initial observations

Even a very restrictive combination of studied variables and their possible values gives an almost incomprehensible number of potential combinations of individual citizens preferences and outcomes. Looking back at the empirical studies presented in here I have restricted myself to combine only variables that withstood the test of repeated factor analysis and/or cluster analysis as well as the final symbolic regression. This resulted in 9 independent variables in addition to the dependant variable (recycling rate). Even though most variables have been measured using VAS-scales with 100 measured steps I opted to categorise the variables as low/medium/high and recycling rates in increments of 30, 20 and 10 %-units to better reflect the

¹¹⁷ Result of SPSS Factor analysis, KMO: 0,498 loading order at 0,793

diminishing marginal utility of recycling which, in this respect, is the object of the study.

Even with this highly restrictive summary of variables and values the matrix combined results in $5 \cdot (3^9) = 98415$ potential combinations. This is a staggering amount of information, and I notice that it is literally as many potential combinations as there are citizens in studied area. To analyse these combinations in order to find the ones that provide insights into what measures may or may not be taken in order to attain higher degrees of recycling rates is daunting. As I have already discussed in the method chapter, this is the reason why I early on started working with smaller Zwicky-boxes to systematically reduce combinations that do not exist.

Using a novel software¹¹⁸ designed as part of this thesis I have therefore proceeded to minimise the number of actual combinations that may exist according to my empirical results. By matching “impossible” or empirically NOT possible combination the software is able to reduce and single out the remaining potential combinations. For each of the simplest two variable value combinations in the matrix 6561 or 10935 combinations are eliminated. In the current Zwicky box 43 more or less complex limitations¹¹⁹ of impossible variable values resulted in the number of potential results sinking from 98415 to 4138, a reduction of more than 95%. This alone would attest to the usefulness of this method. In addition to this it is also possible to extract groups of potential solutions centred on a specific variable value. The potential solutions where recycling rates are at their highest are of special interest to me. Both the 81-90% and 91-100% bracket are of interest, and with the limitations enforced by my study 105 and 24 solutions remain respectively.

Next comes a more in-depth look at the individual solutions that remain. Which ones are more realistic, which ones are possible to attain, which ones are most cost-effective for a recycling company to strive for etc. I take as my startingpoint the 24 solutions involving high-end recycling on the margins of system perfection.

¹¹⁸ Developed in close co-operation with highly talented high-school student Victor Bäckström who participated in a public out-reach program between the author and the local Polhem technical high-school on “Software programming & academic research”.

¹¹⁹ Encompassing everything from 2 to 7 variable values, for example – there are no recyclers attaining 91-100% recycling while showing low actual and perceived knowledge levels – this would then constitute a limiting combination of variable values.

6.18.2 The 91-100% bracket

Consisting of the highest performing recyclers in our surveys, this bracket is of course of the utmost interest. Being able to narrow it down to a mere 24 combinations also makes it possible to fathom. I will just cast some light on the groups corresponding best to the states discussed above, namely minimum requirements, best practices, CasualCore and FormalCore groups.

Table 26 Zwicky box of viable solutions in the 91%+ recycling rate bracket..

Nr	RR	Actual Knowledge	Perceived Knowledge	Social Pressure (Ez)	Env concern (To)	Ease of use (Ba)	Smelly	Messy	Belief in system	Efficiency
97286	91-100	H	H	M	M	M	L	L	M	M
97289	91-100	H	H	M	M	M	L	L	H	M
97367	91-100	H	H	M	M	H	L	L	M	M
97368	91-100	H	H	M	M	H	L	L	M	H
97370	91-100	H	H	M	M	H	L	L	H	M
97371	91-100	H	H	M	M	H	L	L	H	H
97529	91-100	H	H	M	H	M	L	L	M	M
97532	91-100	H	H	M	H	M	L	L	H	M
97610	91-100	H	H	M	H	H	L	L	M	M
97611	91-100	H	H	M	H	H	L	L	M	H
97613	91-100	H	H	M	H	H	L	L	H	M
97614	91-100	H	H	M	H	H	L	L	H	H
98015	91-100	H	H	H	M	M	L	L	M	M
98018	91-100	H	H	H	M	M	L	L	H	M
98096	91-100	H	H	H	M	H	L	L	M	M
98097	91-100	H	H	H	M	H	L	L	M	H
98099	91-100	H	H	H	M	H	L	L	H	M
98100	91-100	H	H	H	M	H	L	L	H	H
98258	91-100	H	H	H	H	M	L	L	M	M
98261	91-100	H	H	H	H	M	L	L	H	M
98339	91-100	H	H	H	H	H	L	L	M	M
98340	91-100	H	H	H	H	H	L	L	M	H
98342	91-100	H	H	H	H	H	L	L	H	M
98343	91-100	H	H	H	H	H	L	L	H	H

6.18.3 Minimum requirements to reach 91%+ recycling rates

Perhaps the most obvious distinctions in this category are the homogenous characteristics. High levels of actual, perceived knowledge and a low

sensitivity to smelly or messy recycling facilities or the absence thereof.¹²⁰ Thus, these values for these four variables would be predicted as the sine qua non of recycling rates approaching the highest levels allowed by the recycling system.

This means that measures taken to increase knowledge and confidence in the knowledge acquired are important. At the same time it should be noted that actual and perceived knowledge grow with experience and approach the higher levels with the passing of time for many citizens. Increasing the knowledge levels of those who are lagging behind and avoiding changes that undermine perceived knowledge would seem prudent given this.

As for the smelly/messy variables their symbolic regression showed them to have a substantial impact¹²¹ on the recycling rate. Changing respondents sensitivity to disorder and rancid stink might be difficult, but avoiding the build up of rotting waste and residual stench as well as keeping the recycling facility orderly is hardly impossible. In addition, the symbolic regression involving these factors clearly show that dealing with problems concerning smell is more than 5 times as important as efforts dealing with disorder in the recycling room. Even though the exact disposition between the internalised attitudes towards smell/disorder versus the exogenous smell/disorder cannot be established, a rule of thumb would at least suggest that combating stench should take priority over disorder when such a choice is necessary.

6.18.4 Potentially most efficient practises in the 91-100% bracket

Next to establishing the sine qua non of high-end recycling, I would hold that the establishment of a minimum level or potential best practice in all other aspects would hold priority. Simply put, which is the minimum level of effort need to attain a possibility to reaching recycling above 90%?

Looking at the table containing this bracket (nr 97286-97381) it is soon clear that strong social pressure is not needed, nor is a high level of environmental concern. Some measure of social pressure, perhaps a sense that at the very least, most other neighbours recycle is needed. A disdain or blatant disregard for the environment must also be avoided, but a thoroughly “green” attitude is clearly not necessary. What is interesting

¹²⁰ As previously mentioned the smelly/messy variables are factors created in a factor analysis which incorporates valuations of both the respondents sensitivity to and the actual state of order in the recycling facility.

¹²¹ $rr=104-6,4*Smelly-1,2*Messy$ – with $R^2=0,32$ and Pearsons $R = 0,57$

about this is that identification with a green elite is not necessary, which reinforces the observation of the CasualCore cluster covered before. Neither does the same cluster necessarily rely on a strong communitarian sentiment to push them to recycle.

Table 27 Zwicky box of the potentially most efficient practices in the 91%+ recycling rate bracket.

Nr	RR	Actual Knowledge	Perceived Knowledge	Social Pressure (Ez)	Env concern (To)	Ease of use (Ba)	Smelly	Messy	Belief in system	Efficiency
97286	91-100	H	H	M	M	M	L	L	M	M
97368	91-100	H	H	M	M	H	L	L	M	H

Solutions 97286 and 97368 can exemplify this “best practice” by combining the easiest levels of effort to attain. I emphasise solution 97368 where efficiency is set to high, since the effort there lies with learning how to be efficient and not with being efficient. As covered earlier, efficient recyclers reach these levels of recycling in around or less than 10 minutes of recycling/week. 97286 is perhaps a potentially favoured solution for recycling companies which feel unable to increase the end-users ease of use – effectively transferring part of the workload to the individual while still attaining the same level of recycling rates.

If the ambition is to find the easiest combination to attain in a broader context by measures possible to undertake by the recycling company there are a couple of aspects to tweak. Firstly, it is perhaps consoling to see that costly programs to change the attitude towards the environment in general and recycling in particular are strictly speaking not necessary as the medium level of environmental concern is enough. Instead a focus on facilitating ease of use and the study of “best practices” would seem worthwhile. The two go hand in hand of course. More logical and practical recycling systems in the field will facilitate the development of more time-efficient recycling practises. Synergies should be possible with positive system changes reinforcing both trust in the system and in the practical recycling knowledge acquired.

6.18.5 The CasualCore cluster in the 91-100% bracket

Table 28 The 91%+ Casual Core Zwicky box.

Nr	RR	Actual Knowledge	Perceived Knowledge	Social Pressure (Ez)	Env concern (To)	Ease of use (Ba)	Smelly	Messy	Belief in system	Efficiency
97371	91-100	H	H	M	M	H	L	L	H	H
97368	91-100	H	H	M	M	H	L	L	M	H
97611	91-100	H	H	M	H	H	L	L	M	H
97614	91-100	H	H	M	H	H	L	L	H	H
98100	91-100	H	H	H	M	H	L	L	H	H

Apart from high knowledge the CasualCore cluster would be characterised by their efficiency and non-reliance on social pressure, environmental concern and/or belief in the system. This leaves 2 typical (97368 & 97371) and a number of partial (97611, 97614 & 98100) combinations. Though rare in the context of the matrix, these recyclers are hardly unattainable ideals, indeed they exist and their inherit lack of resource demanding attitudinal alignment make them potential role models to study further and mimic.

6.18.6 The FormalCore cluster in the 91-100% bracket

At the other end of the spectrum, the FormalCore cluster is also evident in the matrix. Here we have Zwicky-solutions that combine sub-par efficiency but thorough recycling with environmental determination and strong convictions.

Table 29 The 91%+ Formal Core Zwicky box.

Nr	RR	Actual Knowledge	Perceived Knowledge	Social Pressure (Ez)	Env concern (To)	Ease of use (Ba)	Smelly	Messy	Belief in system	Efficiency
97613	91-100	High	High	Medium	High	High	Low	Low	High	Medium
98018	91-100	High	High	High	Medium	Medium	Low	Low	High	Medium
98099	91-100	High	High	High	Medium	High	Low	Low	High	Medium
98261	91-100	High	High	High	High	Medium	Low	Low	High	Medium
98342	91-100	High	High	High	High	High	Low	Low	High	Medium

Again two solutions (98261 & 98342) spearhead the FormalCore cluster, 98261 persists regardless of the external circumstances in terms of ease of use

and will (like 98342) continue to perform through social pressure and environmental concern. While still belonging to the cluster the remaining combinations waiver in terms of environmental concern, but still manage to reach the highest recycling levels. In fact this could be seen as corroboration of the importance of attitudes. However, in terms of easily attainable improvements to the recycling system it is still likely to be more costly to reach.

6.18.7 The 81-90% bracket

The next lower category of recyclers, with recycling rates between 81-90% is substantially larger with 105 potential combinations. The reason is of course that lower recycling standards allow for a more allowing spectrum of combinations to be valid. I will not present that table as such in the text, instead I will refer the reader to the appendix and just cast some light on the groups corresponding best to the states discussed above, namely minimum requirements, best practices, CasualCore and FormalCore groups.

6.18.8 Minimum requirements to reach 81%+ recycling rates

As with the previous group, the least demanding requirements to attain the 81% bracket are fairly low.

Table 30 The 81-90% Minimum requirements Zwicky box.

Nr	RR	Actual Knowledge	Perceived Knowledge	Social Pressure (Ez)	Env concern (To)	Ease of use (Ba)	Smelly	Messy	Belief in system	Efficiency
70070	81-90	M	High	L	L	M	L	L	M	M
70151	81-90	M	H	L	L	H	L	L	M	M
75173	81-90	H	M	M	L	M	L	L	M	M

Interestingly enough nr 70070 presents us with a type of individual who performs well in spite of showing low environmental concern and without being susceptible to nor the object of social pressure. In addition they operate even under conditions where the ease of use is only medium, and their belief in the system and efficiency likewise medium. This would make for a resilient group, not easily affected by external influences since so much of the basis of their approach to recycling is already set. Notably though the 70070 solution operates on medium actual knowledge, BUT with a high degree of confidence (high perceived knowledge). This is especially interesting since what in this case what they believe in and know they know is what they act upon – AND that suffices to reach the 80%+ level. 75173 operates on the reverse knowledge base (high actual, medium

perceived) but has other peculiarities. It would seem that this combination relies on a greater (medium) level of social pressure. In other respects, there is still a reliance on low levels of sensitivity to smells and disorder and a medium level of belief in the system and recycling efficiency. Both are attainable with a minimum of study and their mannerisms in terms of recycling would be reasonably easy to copy and spread.

6.18.9 Potentially most efficient practises in the 81-90% bracket

Though still reliant on the system to be easy to use, little else is required by the two examples I bring out in this context. 70152 & 75252 need not vest much in the system to perform this well, which also means that they qualify as CasualCore combinations.

Table 31 The 81-90% Casual Core Zwicky box.

Nr	RR	Actual Knowledge	Perceived Knowledge	Social Pressure (Ez)	Env concern (To)	Ease of use (Ba)	Smelly	Messy	Belief in system	Efficiency
70152	81-90	M	H	L	L	H	L	L	M	H
75255	81-90	H	M	M	L	H	L	L	M	H

The two examples above illustrate that in fact little in the way of commitment is needed to perform well under the current system.

6.18.10 The FormalCore cluster in the 81-90% bracket

Although the 91%+ bracket would be the domain of the FormalCore cluster, they do have to develop from somewhere and “proto-formalcore” combinations exist in this bracket. Again these are experts in terms of knowledge and feel warmly for the cause, although their practices hamper their performance in terms of efficiency.

Table 32 The 81-90% Formal Core Zwicky box.

Nr	RR	Actual Knowledge	Perceived Knowledge	Social Pressure (Ez)	Env concern (To)	Ease of use (Ba)	Smelly	Messy	Belief in system	Efficiency
78575	81-90	H	H	H	H	M	L	L	M	M
78578	81-90	H	H	H	H	M	L	L	H	M

6.18.11 Summarising the results of the Zwicky box analysis

As shown, the Zwicky box allows to structure complex results, weed out variable combinations that are no longer of interest and help us find

combinations that might have been missed otherwise. The role of the CasualCore group is strengthened through the dominance of this group in the remaining results. The overlap between that group and the most time-efficient solutions is also striking. Secondly, the fact that combinations with low commitment to the overall cause have survived the Zwicky-analysis is also interesting. It offers policy makers possible new strategies to reach the masses with new approaches and techniques in recycling which might bring up large proportions of recyclers to new and higher recycling levels without infringing upon them. Lastly, the Zwicky box results also show the continued dominance in the field of highest attainable recycling knowledge among the FormalCore cluster. Illustrating how and why their performance continues to be a “lure” for policy makers to focus on. They DO perform very well, but again – as can be seen by the combinations which illustrate the clusters – they perform well under conditions less easily mimicked by the majority.

7 Discussion

7.1 The underlying logic of recycling

To start this chapter off, I would like to summarise what I see as the underlying logic or modus operandi of recycling in the system I studied. I do this as a relatively long bullet point list to quickly cover the mechanisms that I have identified and how they relate.

1. Learning to recycle is a sensitive process subject to set-backs and diminishing marginal utility.
2. Changes to the recycling system and new levels of understanding of the system will serve to set-back the recycling efficiency of individuals.¹²²
3. These set-backs become smaller as the attained recycling level/maturity increases.¹²³
4. Set-backs range from ca 20%-units for new recyclers to 1-2% units depending on the degree of maturity.¹²⁴
5. The time needed to re-attain the previous recycling level seems to be somewhere between 6 months and a year – again depending on the maturity of the recycler.¹²⁵

¹²² This is clearly illustrated in our comparison of pre- and post-compost data – see those respective chapters.

¹²³ This resilience among the more knowledgeable and mature recyclers is evident in both quantitative and qualitative data, especially when comparing pre- and post-compost data.

¹²⁴ The best estimate describing this phenomenon is estimated using symbolic regression on my post-compost data – the resultant formula describing the oscillating quality of the process looks like this: $rr=86.6021 + 67.5521/(-0.277742*t - \sin(t) - 1.00009)$ A graphical representation of this equation is presented in separate diagram below.

6. This implies that the most effective ways to improve over all recycling rates would be to see to that as many individuals as possible attain recycling rates above a “threshold level” of ca 60–80% recycling rate. Below this level every change to the system entails major set-backs and above this level changes only incur minor set-backs. From a combined theoretical/empirical perspective this would seem possible through increased actual knowledge¹²⁶ of the recycling system, increased attitudinal commitment¹²⁷ to the cause of recycling or through increased efficiency¹²⁸ in day-to-day recycling.
7. Recycling is also subject to major diminishing marginal utility effects among the highest ranks of recyclers.¹²⁹
8. The equation derived in nr 4 above indicates that recycling rates above 85% quickly require time allotment in excess of one hour per week and above. Repeated cluster analysis of the similar data identify groups with recycling rates very near 100% but with a time allocation which would be very difficult for a broader public to attain. Due to the attitudinal commitment to recycling in this cluster I have used the term “Zealots” to describe them – but a more stringent taxonomy¹³⁰ of the groups would have me describe this group as “FormalCore” – see the matrix below.
9. In contrast to the “FormalCore” group I identify the “CasualCore” group or cluster as perhaps the most significant finding in my thesis. This group is characterised by very high recycling rates but retaining a relatively low (<30min/w) time allotment for recycling and a low degree of attitudinal commitment to the “cause” of recycling. In the horizontal L-curve in the diagram below this group would be found in and around the angle of the L, just as it starts to curve sharply upwards.

¹²⁵ However this can only be estimated indirectly and qualitatively with the data I currently have.

¹²⁶ As implied by our earliest empirical results.

¹²⁷ As implied by the communitarian perspective of Etzioni or advocated from an empirical perspective by Tonglet.

¹²⁸ As implied by the praxeological perspective of von Mises or advocated from an empirical perspective by Barr.

¹²⁹ As clearly seen under nr 4 above.

¹³⁰ For a matrix describing this taxonomy see the table below.

10. The significance of the “CasualCore” group is that its members have found methods to comply with the extant system without getting bogged down in the details of it. This not only makes it the most efficient cluster, it also makes it a cluster important to study to find efficient methods to propagate among the majority of recyclers, precisely because their methods are time efficient and require the least amount of commitment in relation to their impact on overall societal recycling rates.
11. It would be easier and more tempting to identify the “FormalCore” group since it is more vocal and more loyal to the recycling company. However, the interpretation of the recycling system and methods developed to cope among this group have little lustre among the majority and may well serve to alienate this latter group from the overall idea.

Graph 15 Recycling rate oscillation

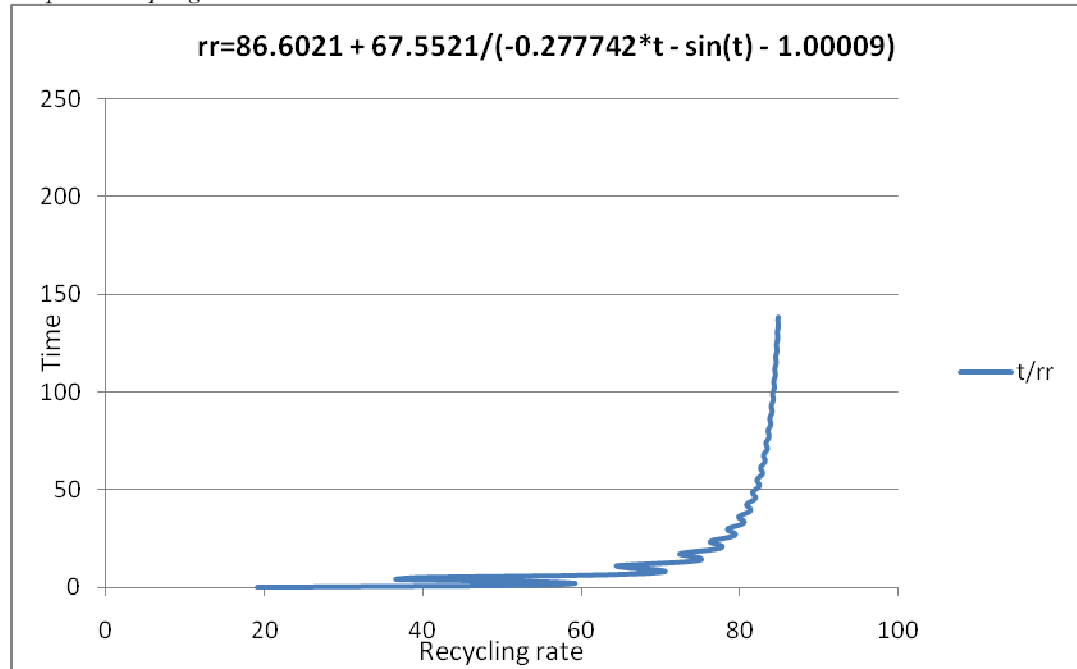


Table 33 A taxonomy of approaches to high level recycling

	Fringe (low performance “tourists” - Laggards)	Core (high performance “veterans” – Avant-garde)
Formal (high stakes)	Formalfringe	FormalCore
Casual (low stakes)	Casualfringe	CasualCore

7.2 Segmenting the population

Generally, determinants change, come and go depending on the setting in which they operate. Carefully segmenting the population is among the most important ways to create possibilities to influence recycling. Recycling habits, recycling knowledge and attitudes towards recycling expressed as the value attributed to recycling are key factors in the analysis aimed at segmenting the populace. More specifically, recycling knowledge and the value attributed to recycling as an action are at the same time the most powerful determinants and the aspects most feasible to use to influence recycling behaviour. This is consistent with earlier research eg (Moller et al., 2006). Although in a low-recycling context, this line of reasoning is also discussed and attested extensively in this context in the work of Stewart Barr (Barr et al.; Barr, 2004). A more traditional view on recycling knowledge can be found in a number of sources primarily dealing with incipient systems (Bratt, 1999b; Davies et al., 2002; Knussen et al., 2004). What is interesting is that all of these studies hint at the continued importance of understanding the role of recycling specific knowledge. However, Barr is strongest in his emphasis of the position of experience as a mediator of accumulated recycling knowledge. That aspect continues to emerge in my material and would seem to warrant further study.

Actual knowledge, about the rights and wrongs of the recycling system and the current debate on recycling issues assist the individual recycler in making an informed decision on how to best participate in recycling. Higher levels of actual knowledge contribute decisively to recycling, but also foster scepticism towards any inconsistencies in the system. Thus high actual knowledge is no absolute guarantee of unquestioning submission to the system, on the contrary. Perhaps we should differentiate between actual and formal recycling rates, where the actual recycling rates (doing what is

perceived as “best”) of the highly informed may be high even as the formal recycling rates (doing exactly as the system says) may be somewhat lower. This principle has been demonstrated elsewhere (Scott, 1999; Tucker et al., 2001; Saphores et al., 2006). Interestingly enough, when combined with a medium or high valuation of the action of recycling, this combination yields the most time (time- and cost-) effective recyclers observed.

How recyclers value their contribution to recycling is important. My contribution is exactly the one above, namely that at the highest recycling rate levels the most efficient modus operandi are those of the less interested rather than, as one might expect, those of the most ardent recyclers. Whereas the general assumption often (Cheung et al., 1999; Ewing, 2001; Williams & Kelly, 2003; Tonglet et al., 2004b) is that the higher the valuation of recycling the higher or better the contribution to recycling would be. Their findings arguably still stand when implementing a new recycling scheme, where the pro-attitude will be a driving factor. Even in my context it still holds true, those who value recycling the most also have the highest recycling rates – hereafter called “hard-core” recyclers. However, this hard-core group is only a small segment of the population studied and their time consuming practices can hardly be copied by the average recycler without installing the same high devotion to recycling in him or her. A lifestyle that puts recycling before all other household chores will certainly raise recycling rates, but is neither readily attainable nor arguably desirable.

7.3 The pivotal CasualCore segment

On the margins of recycling the informed but slightly blasé or disinterested provided a better example for the masses to emulate – the segment I call the “CasualCore” recyclers – if the goal is to increase overall recycling rates. The keen practical understanding of the recycling system of the soft-core recyclers could provide important tips, hints and shortcuts for recycling companies to study if they are only identified as such. As noted earlier (see 6.11.3ff) the CasualCore segment also exemplify how SDT (Deci & Ryan, 2000, pp. 237-238) comes into play, explaining the subtle, but important differences between the CasualCore and FormalCore segments in terms of how deeply embedded and internalised the rationale for recycling is in each segment.

Herein lies an important problem; for why should any company interest itself in soft-core, casual users who are only moderately interested, and in

some cases, outright sceptical of their practices, when it is so much more stimulating to address the hard-core user group? It takes self discipline to avoid this trap. The customer segments into which waste managers normally come into contact are understandably normally those belonging to either of the two most extreme segments. Either those dissatisfied with the entire system and service, or those that are overly enthusiastic. Both segments initiate contact precisely due to their extreme positions. The CasualCore segment, which has a low-stakes perspective on recycling is less likely to initiate contact and is likewise less likely to be contacted by the recycling company as they do not stand out compared to the extremes.

Those who have learnt well to work within the confines of the system and show little interest in it are realistically those least likely to come into contact with the waste management company. The lesson here is that it is up to the recycling company to identify and initiate contact with the soft-core recyclers and learn from their experiences.

This aspect of recycling is, as far as I am able to ascertain, not covered in any contemporary research. I would attribute this to the special settings under which the Swedish system operates, as a phenomenon particular to higher ranks of recycling rates OR as result of my fellow researchers falling into the same lure as the local recycling companies – focussing primarily on the most vocal groups of participants. Both explanations are understandable, and I can only hope that my findings hold and that they are scrutinised in the coming years as this is perhaps the biggest piece of the puzzle that I have been able to contribute with.

7.4 Observed & predicted changes in causality with increased recycling rates

So what changes if the system focus is replaced by an individualist focus? This is where cluster analysis gives good results. Individuals see recycling as one potential solution to their waste problems first and foremost. Systems that cater to this need are readily accepted, whereas more complex systems meet with greater resistance of change. All changes result in initial reductions in recycling rates at an aggregated level. On the individual level though, the changes are more varied. Those less accustomed and knowledgeable on the prevailing system “dip” more than those more well read on it and more accustomed to it. In the most advanced cases the “dip” might even be hard to detect and quickly overcome. Greater understanding of the system will ease the transition.

Environmental concern, understanding and appreciation of environmentally motivated efforts may ease the transition, BUT they are not an absolute condition for attaining the higher recycling rates. Along the same line of reasoning there is a great span in how individual citizens approach recycling. There is at least a factor 10 in the average amount of time spent on recycling, BUT a lot of time spent on recycling is not a precondition of the high recycling rates. Again along this line of thought; environmental concern is also no guarantee for high recycling rates, on the contrary – it is familiarity with the recycling system as such that caters to higher recycling rates at this level of recycling.

One of the most hope inspiring results that I can present is that it is possible to be a time efficient recycler. This opens up for a substantial potential of improvement. Instead of a focus on environmental concern, techniques on how to recycle would do well to be the focus of educational/information efforts. Instead of WHY focus should rest on HOW if the aim is to improve recycling rates. Learning from the efficient instead of the doctrinaire. It cannot be the intention of a modern recycling system that citizens should spend up to 100 minutes/week on recycling, when the same recycling rates can be attained using a mere 10 minutes. I can't help but to reflect how many other efforts for the environment could be done in the 90 minutes it is possible to save each week. If the aim of the recycling system is to reduce the environmental impact through increasing public awareness of recycling, then that road seems less accommodating than my alternative. The traditional way would also seem to be more vulnerable to sloth and disinterest as well as being more demanding in terms of time, space and priority. I would hold that the clusters that would be best served by improving on their recycling performance are also the ones least willing to take to such arguments. On the other hand, these groups might be more inclined to listen to arguments and methods that do reduce their level of guilt, improve their recycling rates without taking up more of their time.

If I allowed to jest a little, then the "environmentally friendly garbage chute" could be the catch phrase. That is to say, it should only take marginally more time and effort to attain the 90% recycling rate mark than it did to simply rid yourself of your waste through the garbage chute in the old days. This is clearly possible as I can see that certain cluster already recycle at this level of efficiency. However, I acknowledge the lure of focusing on the ideologically correct if active in the industry. Environmental commitment is a catch phrase, although I can't help but to reflect that there are plenty of other ways of acting out your environmental

commitment than recycling. Again, I acknowledge that the highly committed are more visible, surely the same that come into contact with the recycling company most frequently while also being a group that the recycling company understands as their lines of reasoning are the most similar. Those that have created their own simple and functional ways of coping with what to their minds is a non-ideological everyday chore risk being met with suspicion.

I have met recycling officials who question if such citizens are the really recycling in a correct way or if they are perhaps cheating on the system. They have doubts about whether such citizens ascribe to the precepts of the recycling company and if they perhaps teach friends and neighbours faulty ways of recycling. I would willingly admit that I myself would risk having such sentiments!

We should keep in mind that the groups I refer to now “cheat” just as much or as little as the other top recyclers. In addition the less outspoken group is no less knowledgeable on the topic even when their valuation of the utility of the task and environmental goals is lower. They simply have other priorities. In fact it is precisely these priorities that constitute the driving force behind finding clever and time-saving solutions to everyday recycling. Without healthy competition from other household chores recycling could take any amount of time.

The typology holds for a number of other examples. If you want to learn the basics of auto repair, you are likely better off learning from your pragmatic neighbourhood backyard mechanic than a Formula 1 pro-mechanic. Or if you want to learn the new office finesses of Windows 7, you are more likely better off learning from your most Windows-savvy colleague than the corporate IT-support/computer wiz. Bottom-line being that it is not always the enthusiast or pro who is best suited to teach how to best accomplish what you see as a chore since the enthusiast sees it as a hobby since hobbies are allowed to take up any amount of time and resources.

Furthermore I would argue that the cluster which has the best aptitude to deal with new recycling fractions or routines remains the CasualCore group. Seeing as how the day only has 24h this group has at its disposal more time than the FormalCore group. At its most extreme a flat 10% increase in time consumption would incur a mere extra minute per week for the CasualCore group, but a whopping 10 minutes for the FormalCore group (provided we see a linear increase in time consumption of course). A

doubling of the complexity and time allotment speaks for itself. A case could thus be made that even the FormalCore group might stand to gain from becoming more time efficient; if for nothing else than to increase their potential for improvement.

How then does one go about finding these cunning solutions; IF the inherit aversion towards the CasualCore cluster is averted? Apart from the indirect methods that I have employed and which could easily be replicated there could be more direct approaches. A competition along the lines of “Give us your best time-saving recycling tip” could work. The recycling company could then sort out system-incompatible tricks from the ones that it could advocate and then spread them in their regular media campaigns. At a meta-level such an approach would also give valuable insights into the differences between a system oriented and individual oriented view on the recycling system.

7.4.1 Implications of my results on public policy instruments

Although outside the direct scope of my empirical results, I find it hard not to deliberate on the potential implications my results have on the policy instrument level. In the following I briefly present my reflexions on the matter as well as some suggestions.

The Swedish EPA list of policy instruments:¹³¹

- Legal policy instruments (laws, rules, regulations and ordinances)
- Economic policy instruments (taxes, fees, subsidies, financial support, emissions trade, green taxes)
- Societal/spatial planning (concerning how to implement sustainable development in building, transport and other infrastructure)
- Information as a policy instrument (op-eds, knowledge transfer, good examples)

7.4.2 Legal policy instruments

Legal policy instruments would have the greatest direct impact on the level of the recycling company. Individual citizens would normally not notice the more intricate aspects of this type of policy instrument; however in

¹³¹ Based on the typology presented in: <http://www.naturvardsverket.se/en/In-English/Menu/Legislation-and-other-policy-instruments/>

terms of SDT they exert direct influence over the Control sphere of the model. Citizens might read about “garbage spies” or bans on certain substances in the press. Aside from that however, this type of instrument would be best suited to direct the general recycling system so that it coincides with the intentions of the legislator. If the system is well designed no end user should risk breaking the law. On the other hand, legal policy instrument may well quell the urge to experiment at the lowest level for risk of sanction. It may also risk hemming the will to compete for best practices among the recycling companies themselves. I expect this aspect to be more important for the long-term development of the recycling system than previously expected. Just as the plethora of citizens trying to perfect their interpretation of the recycling system, so too should a multitude of recycling companies be able to find new roads to improve on the system. The same would also apply to the local level, where bylaws might act to restrain the potential horizon of solutions. Local bylaws are of course also there primarily to set limits on the company, whereas the individual would never have to acquaint themselves with the bylaws as long as they abide by the system; making the local bylaws as distant as national laws in this respect.

7.4.3 Economic policy instruments

It has long been the ambition of the regional recycling company to govern through economic policy instruments. Seeing the full extent of my findings, I cannot but reflect that this has to do with a misunderstanding of how economic policy instruments affect the individual citizens. An incomplete understanding of these economic fundamentals result in legal policy instruments being presented as economic. This is done in the hope that this will result in greater acceptance for the measure. The best example from my empirical material is the example of the differentiated waste management fee which was implemented during the compost process. It was said to lead to environmental governance, but lead the individual citizen to start composting using the centralised compost system more than anything else. Even in rural areas there was a shift from back yard composting to centralised compost. This of course has to do with what individuals perceive as the best way to solve the problem at hand. National taxation is also a measure which only reaches the individual in a roundabout way; through increases in the general waste management fee etc. This leads many citizens to infer correctly (at a factual level) that recycling is becoming more

expensive the more we recycle (although faulty at the causal level). Support at the individual level is also not to be had, and has so far been limited to a plastic scraper to facilitate the removal of compostable material from the sink and coupons for free compost soil. Economic policy instruments are thus far also lacking at the other end of the scale. For example in the form of competition between different recycling companies for the favour of the customers. Not that it would not work or for lack of willing candidates but because recycling companies retain geographic monopolies for their services. In conclusion, the latter may be one of the main inhibitors of further development in this field.

Returning to the individual level, the scarcest resource still remains time rather than money with respect to recycling. Especially with increasing numbers of citizens used to being able to purchase their way out of “inconvenience”. Recent reforms in the systems concerning home cleaning, maintenance and the school system¹³² would exemplify this trend. This means that households are increasingly used to being able to choose the service which best matches their preferences in terms of price and quality. To my mind this is where we have the true economic policy instruments and its hands are tied behind its back. The resulting mental incongruence arising from this discrepancy between the current recycling system and other comparable societal services would risk compounding the risk of the recycling system lagging in terms of development potential and societal intentions. When citizens are unable to purchase or select alternate methods of solving their everyday chores they are left accepting the current circumstances or finding methods of their own to minimise the use of their most scarce resource – time. It is in this mindset I hold that we find the members of the CasualCore cluster, frustrated at the limitations set by a rigid system they give up on its ambitions and perfect their performance within the system. This is seen clearly in the cluster analysis where those who value their time more than recycling give up on recycling as such OR find methods to optimise the execution of the chore. Alternatively, they may rescind on their time ambitions and eventually embrace the system, letting it take what time it may or resign and use plenty of time without accomplishing much.

¹³² ”Pigavdrag”, ”ROT-avdrag” and ”Friskolereform”

Table 34 Recyclers divided along the lines of time and recycling rates

	Low use of time	High use of time
High recycling rate	Efficient recyclers	Environmentally aware rec
Low recycling rate	Disinterested recyclers	Inexperienced recyclers

To recapitulate, it is probably time to study the efficient recycling group more in detail, at least for the sake of recycling itself. In addition, we might do well to tone down the image of the environmentally aware recycler as the role model par preference. That is not where the greatest potential for improvement and as a consequence environmental utility rests.

7.4.4 Spatial planning

Concerning spatial planning, we also largely leave the realm of the individual citizens. Decisions on new incineration plants, closed city dumps and the placement of new recycling stations can of course impact citizens in many ways, but hardly affect the actual recycling rate. At its most extreme I have met suggestions during my research that all blocks should have communal refrigerator houses to which all food is collectively delivered and where all food is stored. This, the spatial planner, told me in confidence would ensure the best possible minimisation of environmental impact. I could do little else than to reflect that it would surely impart a sizable impact on integrity. At the other end of the spectrum I recall US political satirist P.J. O'Rourke who famously claimed that:

”Ecology is the science of everything. Nobody knows everything. Nobody even knows everything about any one thing. And most of us don't know much. Say it's ten-thirty on a Saturday night. Where are your teenage children? I didn't ask where they said they were going. Where are they really? What are they doing? Who are they with? Have you met the other kids' families? And what is tonight's pot smoking, wine-cooler drinking, and sex in the backseats of cars going to mean in a hundred years? Now extend these questions to the entire solar system.”
(O'Rourke, 1995, p. 149)

I strongly believe that we need both perspectives, in fact we need more than that. If there is anything that my research has shown to me it is that it is through the multitude of perspectives and reiterated trials that real and lasting improvement are achieved. We need the utopists who sketch different scenarios for the future, but also the down to earth perspective to challenge these utopias so that we have a sporting chance to reach eutopia¹³³!

7.4.5 Informative instruments

Informative policy instruments are the only ones that have as their direct recipient the individual citizen. In addition it is a policy instrument with a direct and explicit intention to control and direct. As noted above I hold that most citizens are unaware of the judicial policy instrumental, that economic policies work indirectly with purposes that are often hard to deduce and that spatial planning belongs more to the political sphere, perhaps even the sphere of political alienation... Information however, through home-visits, pamphlets, telephone calls or other means of public education are clearly aimed at the individual. On the other hand this information can be dubious in how well thought through it is, the message might be weak or double and the effects unpredictable. Even the very earliest management research showed that the mere fact that an individual was acknowledged was enough to induce the so called Hawthorne effect. Unpredictable though it may be, attention from the policy maker will certainly give rise to some manner of response.

The experiment like, gradual implementation of compost recycling that took place during my research of recycling provided me with a unique opportunity to study the effects of a very far encompassing information campaign. The results were not directly negative, although perhaps not the expected. Without being able to isolate the exact extent to which the information campaign paved the way for the successes of the compost system the new system DID seem to match a latent need among citizens. This match seemed to have to do with the inherit rationality of recycling materials as opposed to containers. Compost was wholly in line with the rationality of materials recycling and coupled with a rational and easy to use practical model and a competitive pricing plan it was bound to rather well. As a bonus the added attention from the recycling company seemed to give a temporary boost to recycling rates although time consumption also soared

¹³³ Eutopia meaning a positive utopia, in that it is perfect but not fictional.

during the time of the Hawthorne effect. How long this effect lasted and if it still lingers is outside the scope of this study to answer. What was clearly seen though was that it was the system as a whole that gained from information campaign. Confidence increased markedly, with perceived knowledge increasing in large groups. This in turn reinforced and contributed to the continued growth of the CasualCore cluster.

The aspect of confidence, that is to say to what extent one actually trusts enough in ones knowledge to act upon it remains an important and modifiable determinant. Actual knowledge seems to be the “sine qua non” of recycling, but it is only when the citizens is certain of her knowledge that she acts upon it. This further illustrates the importance to be sparingly with changes to the system. Seeing that every change causes temporary and oscillating setback to the aggregate recycling rate should be interpreted as a signal that changes undermines actual knowledge and confidence.

The tripartite effects of change

1. Small changes cause the oscillations in recycling rates
2. Big changes cause shifts in the aggregate recycling rate
3. Increased attention/information reduce the time of upheaval due to changes

This tripartite effect of change needs to be understood in relation to the extent of change. Smaller changes to the details of the recycling system are the root causes of the oscillation observed in recycling rates. Greater changes, such as the inclusion of compost recycling cause rightward shifts in the recycling curve to greater levels of aggregate recycling. The Hawthorn effect of the information campaign constitutes the third part of the tripartite effect of the compost program. I would hold that it served to shorten the period of upheaval, reduce the perceived difficulty of the new system and to minimis the degree of uncertainty during the process. This is illustrated by the effect of anticipation in the areas waiting to undergo the compost program. They reported lower recycling rates and knowledge levels than comparable pre-compost program areas did less than a year before. This was evident even among clusters that would have been expected to perform at a higher than average level – like the CasualCore and FormalCore clusters.

In addition to these overarching effects there are other circumstance that could warrant further study. Changes to the principles of paper recycling for example (whether newspaper and paper containers should be separated or recycled together) clearly reduce the levels of perceived knowledge. Weak groups in terms of knowledge also seem susceptible to minute changes in

the layout of the recycling room. Even frequently repeated information from the recycling company becomes a problem. Repeated information seems to strengthen the perception of right and wrong among the confident – regardless of whether they are factually right or wrong. In addition, repeated information seems to undermine what little confidence the already insecure have unless extremely clear as to its message. The mechanism here – which requires more study – seems to be that repeated information is eventually interpreted as a new change of the system, triggering the oscillation in recycling rates as insecurity sets in. This is precisely because the citizens starts to question if what they previously thought was correct is in fact correct or not. Thus the repeated information is interpreted as new information with temporarily lowered recycling rates as a result.

Along the same lines the feedback system using “Smiley faces” on special information boards in communal recycling rooms will reinforce already prevalent opinions about the system. A happy smiley face =) telling the tenants that the compost has a good/pure quality and that the amount of recycled compost is as expected is a clear indication that citizens can be confident in how they recycle. However, this system needs to be very well kept not to lose its effect and credibility. Especially so at the extremely high recycling levels expected in the studied area. It only takes that a citizen knowingly misplaces a couple of objects¹³⁴ in the compost bin and still receives a happy face in return for doubt to sow its seeds...

With regard to information policy instruments, actual knowledge seems to be a fruitful focus. A large proportion of citizens are increasingly knowledgeable on recycling. If for nothing else this becomes so through sheer experience with the system. Knowledge on the environmental aspects underlying the recycling system are also increasingly well known. Although average knowledge increases, the maximum span between highest and lowest actual knowledge would surprisingly seem to increase somewhat during the studied time period. Although the absolute level is of less importance the shift as such is interesting. Especially as so much of the high-end recycling seems to circle around the level of actual knowledge of the system. Users who have high levels of actual knowledge are the ones who are most likely to find their own ways to handle built in problems and discrepancies in the system in an environmentally ok fashion. On occasion this means breaking the system rules to improve on aggregate recycling levels and environmental utility (as with the recycling of metal nails as metal

¹³⁴ All biodegradable materials are generally accepted as compost, but the list is very long and has exception and potential for citizens to err.

containers). How these groups “cheat” on the system therefore also differs. The confidently knowledgeable (CasualCore or FormalCore) most likely skips sorting the occasional messy paper object while the insecure, non-knowledgeable is more likely to cheat on haz-mats recycling where knowledge is still sometimes sorely lacking – while maintaining decent recycling levels on fractions such as paper where they have the most experience.

In fact, I would say that what this all boils down to is precisely that – Experience. Since all of the above policy instruments are either likely to influence policy areas above the level of the individual citizens or affect them indirectly or even capriciously – it is experience, hands on experience with recycling that remains. Citizens need to learn how to recycle, and they need to get the best possible tips on the practical aspects of recycling without the system changing too frequently. A well devised recycling system which correctly identifies and caters to the basic needs of the household will given time approach the maximum recycling level for which it was designed. Any ambition above that limit is either an illusion or based on an undue effort on account of the citizens.

8 Conclusions

Here I summarise and deliberate on the main findings of my empirical research in contrast with applicable theory.

8.1 Determinants no longer valid

An important contribution in its own right is for any researcher to try to reduce the complexity of the field studied. As I noted initially, international research lists more than 60 potential determinants of recycling. These can of course be grouped into categories as a first reduction of complexity; as I have continuously done in our field work. Each consecutive study also did away with determinants with limited explanatory power. What now remains is a rather concise and somewhat conditional list. Simply put, there exists a strong case for further study of what individuals know about the system, how they go about complying and how individuals view the topic. I will go into these determinants in the chapter below.

Among the many determinants that have failed to provide an explanation of our observations I would first and foremost include such whose power peter out as compliance nears 100%. Gender, age, formal education and most demographic determinants belong to this group – when nearly everyone performs a certain action, demographic difference become statistically insignificant.

The gender differences found in previous research; primarily in terms of how frequently recycling centres were visited (Darby & Obara, 2005) or the more active female portion of the “war generation”, with a correspondingly less active male youth group (Barr et al., 2003) could not be reproduced. It should be reiterated however that these gender differences seem to peter out already after attaining the 20% recycling rate mark. That said, I would

not find it impossible that further study should be able to find inter-gender differences in the details of how recycling is done, but that would require a study focussed on that specific topic.

As opposed to recycling specific knowledge, formal education was another set of determinants where previous studies left a knowledge gap in the higher recycling brackets. However (Barr et al., 2003) found in their study that the “best” recycler was not characterised by higher levels of formal education – only that low performance could be related to lower levels of education. This seems to hold true in our setting with the addition that there are a) very few low level recyclers in our material and b) that the latter group cannot be characterised in terms of educational levels. Education may be a *sine qua non* of early recycling system implementation or under low performance or incipient system conditions as in (Vencatasawmy et al., 2000), but other determinants take over as the system and individual compliance develops.

Statistically significant contributions from these have been tested for throughout without significant or consistent results. Notable, although small exceptions to this rule of thumb regarding demographics include living arrangements (villa vs tenants) and newcomers to the community (immigrants and (exchange-) students). In the first case, living arrangements impact on the possibilities to fully utilise the recycling system. Villa/home-owners often have the opportunity to, and therefore experience of, composting whereas tenants often have a higher degree of access to more obscure recycling fractions in their recycling rooms.

Looking at international studies we also expected to find that size and frequency of use (Saphores et al., 2006) would play into the decision to recycle or not. However, instead familiarity with the recycling fraction in question and how long that particular part of the recycling system had been in operation was more important, if not pivotal. This also touches upon the much discussed practical sides of recycling such as having space at home (Bacot et al., 2002; Corralverdugo, 2003; Bor et al., 2004; do Valle et al., 2004) and the tangible value of recycling. Again the citizens we studied seemed to prioritise a more general ease of recycling or access to recycling over the other spatial aspects covered in international studies. This leads me again to attribute this difference to the overall maturity of the Swedish system and the high recycling rates already attained.

This is related to the attitudes towards the environment in general and recycling in particular. General attitudes towards the environment play a

substantial role in international surveys, whereas in my research the high degree of participation and compliance again acts as an equaliser making individual attitudes increasingly less important as a determinant of recycling.

Determinants found no longer valid

- Gender
- Formal education
- Size and frequency of use
- General attitudes towards the environment

Looking at the above shortlist from a Self-Determination Theory perspective, it is clear that the above no longer function as leverage to policy makers trying to use their position to enhance the abilities of citizens, nor how citizens make their recycling choices. If long-term change is to come about other venues need to be established. With gender differences indistinguishable, that kind of segmenting becomes null and void. Similarly, the recycling companies are hardly able to ride the wave of general concern for the environment either. In SDT-terms this means that such arguments are either too deeply entrenched to come to the fore in the individuals or they are no longer a part of the rationale behind recycling. When trying to increase recycling through empowerment or strengthened autonomy these arguments are also void. Keeping track of such trends among the customers would seem pivotal for further success.

8.2 Critical determinants

8.2.1 Actual Knowledge

Moving towards critical determinants we find a number of more complex relations that need to be summarised. First I note that the distinction between actual and perceived knowledge about the recycling system was a meaningful determinant. Actual or accurate as opposed to perceived or self-inflated knowledge of the system is critical. This line of thought is reiterated in numerous research reports related to recycling (Schultz et al., 1995, p. 106; Morris, 1997, pp. 7, 36; Gatersleben et al., 2002, p. 354; Barr et al., 2003, p. 414; Timlett & Williams, 2008, pp. 630–631), it is also a critical element of SDT (Deci & Ryan, 2000, p. 237; Stone et al., 2009, pp. 14,23). Consistently, in these reports the knowledge factor is able to explain behaviour and it is viable as a determinant possible for policy makers to influence.

Its efficacy is thus corroborated even under the higher recycling levels in this case. This is especially so among those who have both a high degree of actual and perceived knowledge. These are the recyclers that might positively influence both the knowledge and autonomy of other recyclers. These people are self-confident and know what they are doing and the limits of what is possible within the system boundaries. This group is in stark contrast to those with little or no actual knowledge and a high opinion of their knowledge. This latter group seems to diminish as the system matures as it was substantially reduced between the pre- and post-compost surveys. However, to the extent that they exist they are instrumental in perpetuating the “myths” of recycling; in SDT-terms they reduce both the knowledge and autonomy of others.

Table 35 Recyclers divided along the lines of actual and perceived knowledge

Actual/Perceived knowledge	Low	High
High	Potential top recyclers	Pro-active recyclers
Low	New recyclers	Myth spreaders

The Low/Low group is also notably small in our surveys. The children in the region are educated in “proper” recycling practises from an early age and for intra-Swedish newcomers, the system is similar enough not to present a real challenge. The bulk of citizens belong to a category of unrealised potential, where actual knowledge is medium or high but this is not realised by the citizens themselves. This is also a group which is especially vulnerable to changes in the recycling system. Notably, this group is completely absent in the studied literature even though their percentage would arguably be even larger in less mature recycling systems. A policy maker hoping to improve on recycling rates would however most likely do well to try to find methods to make this group realise its potential through measures which increase their Choice and Control capabilities (see 3.1). As I have shown a combination of disinterest in the overall issue and low priority may explain their low level of perceived knowledge.

8.2.2 Simplicity/Efficiency

Related to the above matrix is the issue of the role of the simplicity of the system and efficiency of citizens in utilising it. Consider how raw data, cluster analysis, factor analysis and symbolic regression coincide in pointing out efficiency as a key factor. As a determinant, efficiency is normally only pointed to at the system level (Folz, 1999; Louis, 2004; Hobson, 2004) and less often at the individual level (Owens et al., 2000). However, previous results (Owens et al., 2000, pp. 648-649) at the individual level support an

emphasis on “laggards” as having the greatest potential for improving recycling rates, even though time efficiency is disregarded. Efficiency in recycling is related to the combination of high actual knowledge and low perceived knowledge combination. In short these are the citizens how just “Do It” to paraphrase the sports phrase. Less efficient recyclers normally have less actual knowledge of the recycling system and spend too little time on recycling to develop efficiency. The alternative consists of those that lose efficiency due to spending too much time on recycling. This group belong to the High/High group above and are perhaps too conscious about their recycling habits. Too concerned with getting things right etc. This brings us to the issue of committance and attitudes.

8.2.3 Degree of commitment

Bring the above determinants together we arrive at a matrix positing performance and the attitudinal stakes attributed to the action. The CasualCore segment has been touch upon already, as it was identified above – but by completing the categories I arrive at a functional taxonomy.

Table 36 A taxonomy of approaches to high level recycling (recycling rates should be seen as typical expected values only)

	Fringe (low performance “tourists” - Laggards)	Core (high performance “veterans” – Avant-garde)
Formal (high attitudinal stakes)	FormalFringe (rr 0-60%)	FormalCore (rr ca 90-100%)
Casual (low attitudinal stakes)	CasualFringe (rr <50%)	CasualCore (rr ca 80-95%)

Again there is a returning pattern to be noted here. As previously noted (Hornik et al., 1995; Hobson, 2004) citizens “perception” of these issues matter. High levels of attitudinal commitment to the recycling issue is primarily seen among those who report a high degree of perceived knowledge, regardless of whether this is high or low in terms of actual knowledge (Formalfringe OR FormalCore). This means that the same group of highly committed recyclers¹³⁵ may in fact spread radically different and true (FormalCore)/untrue (Formalfringe) knowledge of the recycling system. This has far reaching implications in terms of SDT. Depending upon which segment constitutes a citizens Valued Personal Relationship, the outcome will be diametrically opposed. Outcomes that are in line with the policy makers intentions need to be inline not only with the segments

¹³⁵ “Eldsjälar” in Swedish or “driving spirits”.

to which citizens look for guidance but also with the “self” of the citizen (Deci & Ryan, 2000, pp. 233,236).

This is a problem in interacting within the community since it is only the level of commitment which shows in a more superficial contact. It is also a detriment in relation to the recycling company (and us as researchers), again since it takes a much more solid contact (in-depth interviews or surveys) to establish the exact extent of actual knowledge. Both groups are however typically outspoken and vocal in their convictions on the matter and risk biasing policymakers decisions through their presence in the public discourse. Although largely overlook this perspective has been touched upon (Kinnaman, 2000) although from an entrepreneurial perspective, the conclusion was however similar in that vocal firms or individuals might influence public discourse.

In stark contrast to this the efficient CasualCore recyclers report low levels of attitudinal commitment and are much less outspoken on the highs and lows of recycling. Again, it is something that they casually “do”, to facilitate regular everyday life at home. This everyday perspective has been deliberated on (Autio & Heinonen, 2004; Barr et al., 2005b), but more as a result of than a reason to the changes underway. Just as it is difficult to assess the relative quality of the outspoken recyclers, it is difficult even to find and or much less assess the efficient ones. As I see this, this is to the detriment of the recycling companies and policy makers since their habits and interpretations of the current system offers valuable insights into a real potential for improvement. It also offers insights into the SDT model as such, since we here have a segment where the internalisation of what most would consider the crucial value, “Recycling”, is not pivotal to a beneficial outcome.

The causality here is crucial. SDT studies have found that intrinsically motivated recycling has had positive effects on other pro-environmental activities (Moller et al., 2006, p. 111), however they did not cite the reverse. So, while the above may be true and the FormalCore group might be considerably better at promoting other activities, some other form of intrinsic motivation must be active in the CasualCore segment. I see it as clear that there IS a form of intrinsic motivation at work here, but I will admit that my research does not permit me to triangulate exactly what that consists of – though I would suggest that basic psychological needs as suggested by Praxeology are at work here.

8.3 Finding the “right” role-model

The benefits of identifying the CasualCore/efficient group as a sort of role-model for both less efficient recyclers and innovative policy makers could be seen as self evident. Practitioners in the field will see an even wider array of potential use for studies of this group. Let me just point out some advantages in relation to using the outspoken, highly committed FormalCore recycler as a reference.

Those who adhere to the formal aspects of recycling and are outspoken as well conscious are easiest to identify and their recycling habits are without doubt the most meticulous. They also identify with the concepts and goals of the policy maker and make for an easy and adaptable group to study. However, the dependence of the FormalCore group on a high level of attitudinal and temporal commitment is not easily understood or mimicked by other groups – their standards are simply highly put. Making recycling a household chore with the highest priority and increasing the time allotted to it by perhaps as much as 5 times is not an easy path for others to follow.

Pursuing such a direction puts great demands on the policy maker to devise a system which forces compliance to this high level and puts an even greater social strain on the individual citizens who are forced to comply. It could be done, but would put the degree of coercion at a very high level, which would perhaps not be desirable from a political and certainly not from an individual perspective.

My suggestion is therefore to use “carrot” instead of “stick” to attain recycling levels which are even higher than today, and which (although not 100%) still fall within the margins of error. By an even more careful study of how the CasualCore understands and uses the system we can find methods to facilitate recycling which are better suited for promulgation among the masses. Facilitating intrinsically motivated behaviours is at the very core of autonomy-supportive policy (Moller et al., 2006, pp. 111-112)

The CasualCore perspective means:

- A reasonable amount of time spent on recycling compared to other groups – marginally higher than the laggards in the CasualFringe group yet substantially lower than the FormalCore group.

- Very high levels of recycling in relation to the extant recycling system
 - optimising use, while not compensating for design flaws which the FormalCore group does and which explains in part the higher time allotment of the latter group.
- Methods of practical recycling, which through their multitude can serve as inspirational examples to both policy makers and citizens. Recycling companies can spread knowledge of these methods and adapt their system to beneficial ideas or practices to facilitate even higher levels of recycling.

8.4 High versus low stakes approaches

It may seem counterintuitive that a high-stakes attitudinal approach might be less of a role-model than a low-stakes approach. However, while the high-stakes groups tend to spend more time on recycling and attain the highest recycling rates, the low stakes CasualCore group attains nearly as high results with significantly less time spent. If we assume that we identify a FormalCore and CasualCore household which share the same level of overall environmental concern the CasualCore household would be in a better position to make additional efforts for the environment – having freed up as much as an hour per week. Certainly you could argue that if the extra hour is spent on recycling haz-mats (which remain critical to the performance of the Swedish system (Holmgren & Henning, 2004)) then that time is more than well spent by the FormalCore household and if the CasualCore group “squanders” the time it saves by watching TV or driving to the mall – then this time saved is hardly well spent.

Considering the high levels of actual knowledge in the CasualCore group one can only hope that the time saved is “well spent”. Moller et al. (2006, pp. 110-111) cite research to the contrary. Then again from a strictly neutral point of view who are we to judge how individuals use their time? Still, if we continue on the normative track briefly and look at the potential repercussions for the “fringe” groups or the citizens that are not yet performing at the average level of recycling we see a different potential. As it is, I can see that the time they spend on recycling is not well spent at all. Employing the recycling methods of the CasualCore group, the CasualFringe group recycling levels in the studied region as whole could rise substantially without diverting either time or effort on the part of the

citizens and with only a minimum of effort¹³⁶ and NO change¹³⁷ in the recycling system on the part of the recycling company. Put in terms of catch phrases:

“How to” persists over “Why to”.

This emphasis as such is nothing new (Davies et al., 2002; Domina & Koch, 2002; Corralverdugo, 2003; Tonglet et al., 2004a; Staats et al., 2004; Darby & Obara, 2005; Barr et al., 2005b) but that it should extend into the high recycling rate context of my research is for nothing else interesting and only indicated as a possibility in a few articles (Tonglet et al., 2004a; Darby & Obara, 2005). Facilitating action through autonomy-supportive measures has been found to enable citizens (Deci & Ryan, 2000, p. 240; Moller et al., 2006, pp. 111-112; White & Thompson, 2009, p. 578). In this context, I see it as support for the results pointing in the direction of the CasualCore segment being pivotal. The type of autonomy and the intrinsic drivers they display combine desired outcomes with a relatively low effort on the part of the policy maker.

8.5 Making sense of recycling

After spending so much time, and such a long time on the issue of recycling I cannot help seeing certain recurring patterns evolve in our material and in my thoughts on the matter. Recycling may seem mundane, yet it is frequently attributed with life changing qualities – as a matter of life and death of the planet. The latter being an aspect which the ordinary citizen, even in a system as mature as the one I studied, sees. Recycling is indeed mundane, but mundane in the sense that it is a method – indeed ONE method of many through which our society in this context has chosen to solve the problem of ridding ourselves of that which is no longer wanted. Although often portrayed otherwise, a heightened rhetoric (Barr, 2004) on the topic of recycling may indeed be counterproductive in that it causes it to be a high-stakes operation to some for whom it obscures other potential environmental problems and a source of great discomfort to others who feel the moral pressure of the community to act but lack the skills or knowledge to do so effectively. In fact “mortality salience” or being reminded of one’s mortality can lead to even more destructive/materialistic behaviour (Arndt

¹³⁶ Spent identifying the current “Best practice” on recycling and disseminating it to the less efficient groups.

¹³⁷ Change is not needed since the CasualCore group performs so well already under the current circumstances.

et al., 2004, pp. 204-206). Thus, the rhetoric used by recycling companies might indeed influence recycling behaviour, but without a more complete knowledge of the customer, the result might be counter-productive.

I may have started this journey thinking that recycling was deadly serious – and to some extent I still see it as thoroughly sound, why waste when society puts such eminent tools of reuse and recycling in our hands? However, as I have emphasised I see that recycling cannot be seen as an isolated environmental issue. It is a system which has its inherent flaws and even quirks and the more we as citizens know of this the greater the risk of being disillusioned with the system. Better then to see recycling in its current form as a rational and indeed convenient method of ridding ourselves of rubbish and indeed what better method of doing so than to do it efficiently so that I may put my scarce 24 hours per day to better use.

8.5.1 From recycling to waste minimization? A brief note on current trends.

Another aspect to be taken into account when making sense of recycling is of course the “input” side of recycling – that is consumption and with that “waste minimisation”. In my researchers community there was increasing “buzz” about waste minimisation being the new paradigm in the last year before my publication – now that recycling had been “fixed” (at least in Sweden). Since research is nowhere near as immune to trends as researcher normally want to think, this provoked my interest. I have state before that I see both recycling and waste minimisation as related to the issue at hand, but as different and indeed separate aspects of the problem.

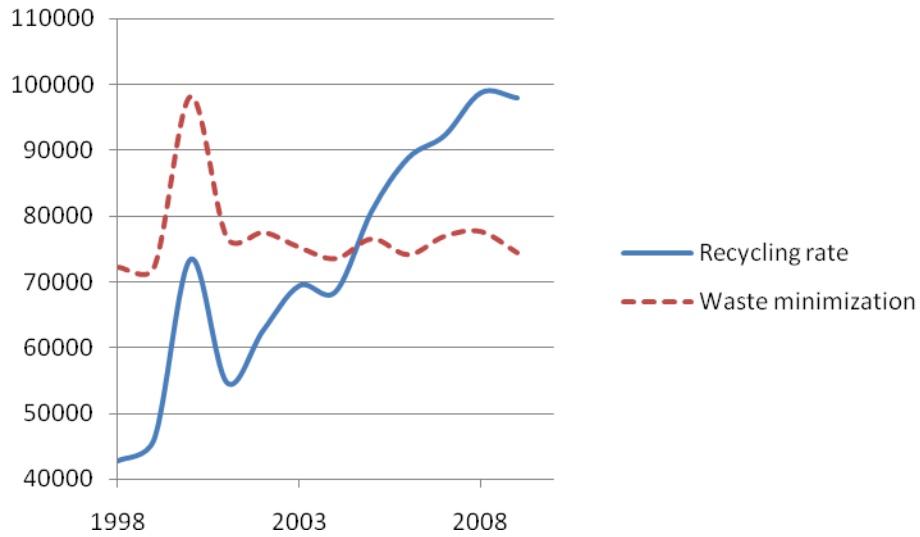
Indeed I am forced to reflect that waste minimisation is an entirely different “species” than the two forms of recycling seen in this thesis. It is no mere question of apples and pears, to my mind it is a question of comparing a crocodile to a lion – a reptile to a mammal. If I am allowed to continue the analogy, both belong to the same “phylum” (Chordata) but are part of different classes (Reptilia vs Mammalia) – or to put it differently recycling and waste minimisation may belong to what seems to be either end of the same problem. However, as we have seen there is a mental disconnect between the two; they cater to different needs. Consumption may give rise to waste, but the need to consume does not necessarily give rise to the need to recycle or even rid oneself of waste.

However, one would easily be lead to believe that waste minimisation is a competing paradigm to the two (for that matter “competing”) aspects of attitudinal change and convenient recycling that I cover in this thesis. In a

sense this is true, since the choice of emphasis will lead to different outcomes, findings and recommendations.

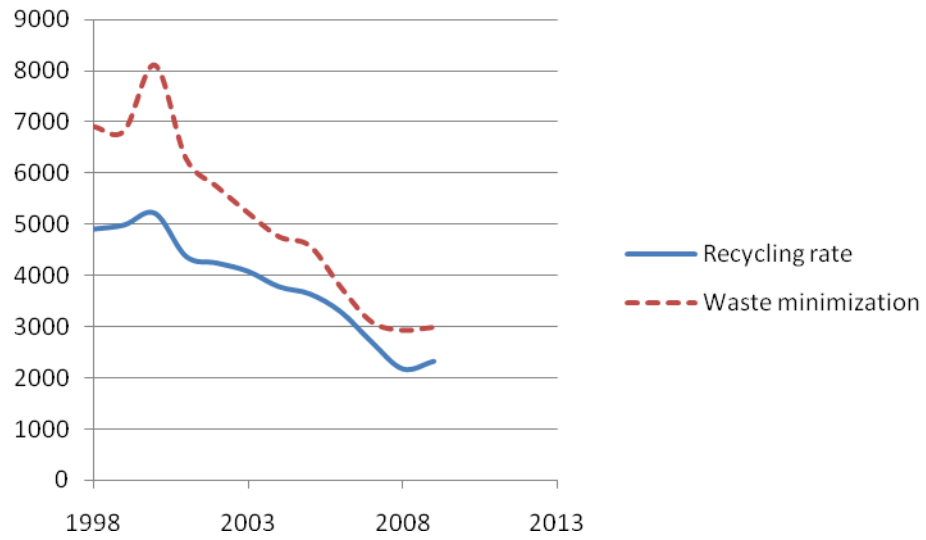
Putting “Recycling rates” and “Waste minimisation” against one another I got the following trends:

Graph 16 Google hits per year for the respective terms



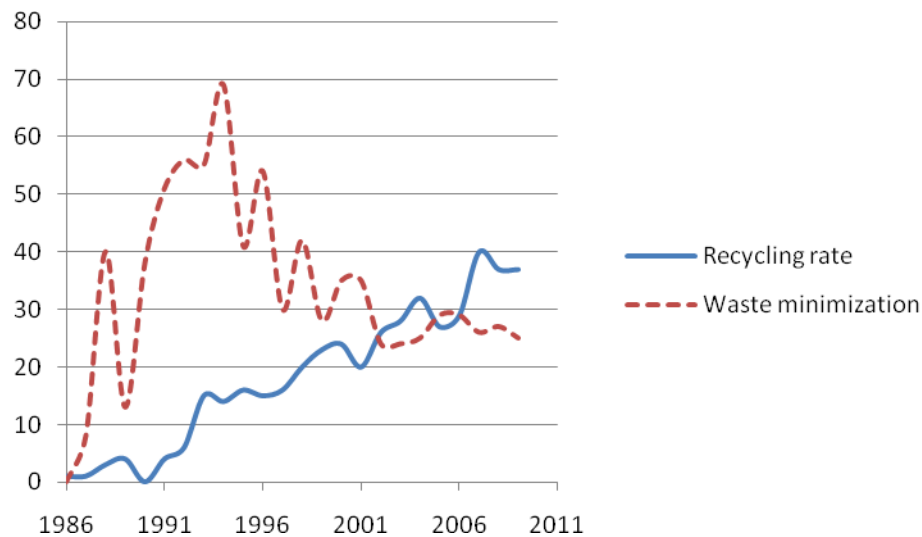
Regular Google hits do not reflect academic interest in the topics, but do indicate trends in terms of general interest in the respective fields. Apart from a peak for both topics around the millennium the trends are fairly clear.

Graph 17 Google scholar hits per year for the respective terms



Google scholar provides us with a more comprehensive look at both peer reviewed articles and books mentioning the terms. Contrary to the general trends, the academic trends discernable here seem to be petering off for both topics, again with a slight peak around the millennium.

Graph 18 ISI Web of knowledge hits for peer reviewed articles per year



The ISI website¹³⁸ offers the most comprehensive database of peer-reviewed articles available and is perhaps the most accurate indicator of actual scholarly interest in the two topics. Providing the longest time series, this is perhaps also the most telling of the three graphs. If anything, interest in recycling rates is on the increase and even though there is considerable lag in terms of publications, interest in Waste minimisation seems to have peaked in the mid 90's.

To summarise, public and general interest in recycling seems to be growing, as is the output of peer-reviewed articles on the outcome of recycling. Interest and output in the field of waste minimisation seems to be somewhat stable or petering out in all three spheres however. Perhaps the latter reflects the less opportune and harder to swallow social implications of waste-, and consequently consumption-minimisation – whereas effective recycling is more palatable in that it is indifferent to or gives an implied *carte blanche* to consume?

¹³⁸ www.isiknowledge.com

With the above said I would like to say that I am hopeful concerning this transitional trend in much of the research that is publicised at the time of my dissertation being complete. However, I would like to reiterate my position that the two are not only very much unlike each other and not part of the same continuum. They furthermore do not even cater to the same need. Recycling is ONE method of many with many variations to dispose of one's waste, whereas waste minimization is directly related to consumption. The first takes care of the residuals of the second in this sense.

Using the same methods to design policy in the latter field as in the first is bound to lead to unpredictable results and potential backlash. It is clear that there is a mental disconnect among citizens between with a higher propensity to accept systems that cater to the need to dispose of waste than systems which direct the impulse to consume.¹³⁹ That is not to say that it cannot be done if policy makers so desire, I would just like to caution against using the same mechanisms without a detailed prior study of the deeper mechanisms behind consumption patterns.

Where the action of recycling is a straight forward combination of a desire to rid oneself of unwanted objects and a desire to facilitate other peoples use of their refuse, waste minimisation has to take into consideration a much wider plethora of concerns. First of all we do not consume primarily with the intention to discard the object in question. From a praxeological point of view we can address the issue in terms of what immediate and pressing needs are satisfied by the act of consumption, adding to it the communitarian concern of how this consumption is perceived by our peers in the communitarian context where we see ourselves.¹⁴⁰

8.6 Recycling as a metaphor

To me it is impossible to work in this field for so long and not think of its implications for other fields. Extending my work into other policy areas is closest at hand of course. We can easily see how a study of the CasualCore group and its dealings with a policy like recommended use of bicycle helmets, healthy eating recommendations or energy savings could benefit. A detailed study of how CasualCore households (in the field of energy savings) go about their energy use could be most enlightening and give insights into to how other less efficient households could save as well.

¹³⁹ See 4.2.5 Experience

¹⁴⁰ See chapter 3 for a discussion on this.

However, it is in the private sector that I image the potential is greatest. Small or large, all companies of course want their product or service to be used to as great an extent as is possible by as many customers as possible. It is only reasonable that the identification of the CasualCore group for a specific product/service provide information on how to improve the product to make it even more appealing to an even broader spectrum of potential customers. The rationale here is the same as in recycling. The FormalCore group is most vocal and likely to be the one to which the company adheres most and finds it easiest to communicate with. However the experience of the FormalCore group is hard to translate into an attractive package for the broader customer groups.

Imagine that “Average Joe” has problems with his computer, he can either ask the casual expert Ann or the formal expert David for advice. It is tempting to ask David since he is probably most outspoken about his expertise in the field and most likely to divert time to help – seeing as how David lives for his computers. Ann on the other hand is the kind of person who’s computers are just always up and running. Nothing fancy, but also few or serious problems. Asking David for help means getting very serious “help”, ending up with a superbly running computer but a computer which is harder to run and in need of more maintenance. Getting Ann to help on the other hand may not give Joe top notch performance, but on the other hand the hands on tips and tricks provided by Ann means that Joe needs to spend less time on maintenance and can spend more time doing what he really wants to do on the computer.

The above example may be a bit too much down to earth, but I expect that many have these experiences. However, we need only look at the development of the Short-Message- Service (SMS) to see a feature which arguably took off only when spread to a larger market through streamlining at the hands of a CasualCore segment. As long as SMS was the domain of what I would see as the “FormalCore” engineers to send technical information and voicemail alerts it was a platform for exchange of technical data and uninteresting to the large masses. As soon the technology became available to a larger set of customers it was inevitable that a cluster of CasualCore users would arise to refine efficient and mass-appealing use of the SMS technology. I can only speculate as to what extent an early corporate study of CasualCore use of SMS and subsequent tweaking of the service would have done to improve market penetration, but my prediction is that the phenomenal growth we have seen in the past 10 years could have been shifted to come substantially earlier. Analysing and isolating this effect

would certainly interest me as a research field for the future. Any emergent (or stagnant) field would be suitable for such a programme.

The unobtrusive manner of this method is also one of the things that I hold as its advantages. By drawing upon the experiences of the many and on the experiences of quite ordinary citizens we reduce the risk of suggested measures being perceived as “expert” or forcing. Instead a plethora of potential suggestions on how to improve individual performance without imposing on the citizens should be possible to devise. This should facilitate a greater compliance with new policies or higher market penetration of products and services. In fact, if made the experiences drawn from the CasualCore group are turned into tweaks in the policy system or product/service the end customer need hardly even notice the change as such.

8.7 My contribution – final words

The work on my thesis has been a long and many times remarkable journey. As I conclude this part of my work on recycling it is time to summarise the main findings and my potential contribution. The longitudinal aspect of my work has allowed me to cover and explore many more aspects than a normal doctoral thesis would. At the same time stringency might have suffered at times as I allowed my curiosity and the joy of working on this project to follow spurious paths that opened up as a part of my field work, or as opportunities arose. Nonetheless, to my mind the consistent use of Zwicky boxes to limit and rein in on what was really important served to keep my research on the straight and narrow. I realise however that the extent of what I have covered in my work encompasses a lot, and when asked what my contribution was and what I was most proud of in my research I came up with the list below. I realise that my research contribution and what I feel most proud of may be two different things, but here goes...

8.7.1 Contribution to recycling research

I start off by discussing the contribution that I have made more specifically to recycling related research.

1. Contributed to the understanding of the mechanisms governing recycling near the 100% mark.
2. Identifying recycling rates as crucial moving targets where determinants change depending upon the context.

3. Identifying the pivotal CasualCore segment as opposed to the FormalCore segment as key to increasing policy compliance OR service/product use.
4. Building a case AGAINST the use of different forms of coercion or scare tactics to increase compliance.
5. Building a case FOR the use of facilitation and efficiency seeking methods to reach the highest levels of compliance or use.
6. Finding a path of recycling which not only allows “Average Joe” to be a top recycler, it also frees up time for other activities, which in turn might contribute to overall environmental utility.
7. Contribution to Self-Determination Theory by using von Mises & Etzioni to explain how SDT-factors interact in the form of a dynamic trichotomy.
8. Putting Swedish recycling into context through a historical and etymological taxonomy of pre-modern words concerned with recycling and waste management.

8.7.2 Recycling near the 100% mark

Although our understanding of individual behaviour as compliance or use nears 100% is far from complete, I like to think that my work has shown its validity and utility. The mechanisms at work here on the “margins of perfection” serve to give insights into what might change and be influenced at an earlier compliance rate to facilitate its increase in the most cost and time efficient manner.

8.7.3 Recycling rates as moving targets

The importance of this finding was a working hypothesis right from the start and showing that sensitivity to the context under which recycling is studied serves a purpose is important to me. Working the practitioners in the field, our ability to remain sensitive to the realities of recycling and adapting our suggestions to the conditions under which individual recyclers and companies operate is important. Different measure have different efficacy in fledgling and mature systems. Understanding and turning this into an advantage will add to the environmental utility.

8.7.4 The CasualCore vs FormalCore segments

In my analysis I have devoted much time to the distinctions between these two segments. On a personal level this finding was perhaps the one that

shook me the most as I too would have been inclined to devote most attention to the FormalCore segment. Seeing how efficiently the CasualCore segment dealt with the task was an eye-opener and to the extent that my future research allows me to continue studying customer segmentation I will most certainly devote even more time to further study of this group and how companies and authorities may relate to them.

8.7.5 A case against coercion

Closely related to the above is the case against coercion. While built almost exclusively on arguments of efficiency itself, coercion as it stands under the current democratic and inclusive societal norms would seem entirely self-defeating. Its lure is there of course, just as it is alluring to listen primarily to the FormalCore segment, but balancing its advantages to its costs there are far more economic ways to attain the same recycling rates. This is clearly shown in the Zwicky box of possible combinations where high levels societal pressure are clearly not needed to attain the same rates.

8.7.6 A case for facilitation and efficiency

In the same, but diametrically opposed vein as the above, facilitation and efficiency boosting measures have an even greater role to play. The old maxim that it should be “Lätt att göra rätt” (or “Easy to do the right thing”) seems to have a renaissance. Ease of use and consistency in system design allow for citizens to do even more recycling in less time with less committance than we initially thought possible. Even if this result implicitly puts more financial strain on the recycling company to attain recycling goals, pro-active measures are not the only possible options. Avoiding or refraining from unnecessary changes to the recycling system could at least be evaluated as policy options as long as the system has reached some base-line level of utility.

8.7.7 New insights on how to counsel “Average Joe”

Combining knowledge on the CasualCore segment, the usefulness of coercion vs ease of use etc in relation to the other parameters studied offers up new venues to improve on the performance of “Average Joe”. Especially interesting from my point of view are the least intrusive means by which this could be done. Essentially avoiding tampering with preferences and instead catering to basic needs. Or put differently - less information on “Why” and more information on “How”. This would be especially beneficial if the recommendation on how to recycle incorporate and emphasise on the time-efficient recycling styles found among the CasualCore segment. The CasualCore segment itself contains a plethora of

recycling styles but even a small detailed study of these should be able to refine upon a taxonomy of styles from which to refine both the tips for individuals and how the recycling company designs recycling centers etc.

Table 37 A basic taxonomy of individual recycling styles¹⁴¹

	Sort at home	Sort in the recycling room
Multi-box/bag system	2	1
Uni-box/bag system	3	4

8.7.8 Contribution to SDT - Mises over Etzioni and Barr over Tonglet?

Apart from the practical sides of recycling, there is also the theoretical discourse to which I have related. Self-Determination Theory helps to put my research into perspective. It has an inherent emphasis on individuals as subjects and the actions and reasons for decisions which goes hand in hand with the topic. To my mind, my choice of contrasting perspectives has paid off. Given my other contribution in the recycling field it would seem that at the high recycling rate level studied meeting basic needs of individual recyclers is more likely to yield desired results than moves to use the community to push in the desired direction. This would imply that, while Etzioni's communitarian perspective is indeed essential at lower recycling levels and/or in incipient recycling systems, the effect of communitarian pressure peters off and the ability of the recycling system to cater to the individual needs as described by von Mises take precedence as recycling rates soar towards system perfection. In SDT-terms it also shows that the communitarian and individual perspective interact with social marketing and the individual through different channels and mechanisms. This understanding helped me to label and sort the different results contained herein.

Likewise, it would seem that facilitating and making systems easy to use takes precedence over a more cumbersome focus on changing attitudes.

¹⁴¹ On a very personal note I early on adopted a scheme that I noticed in the field which corresponds to quadrant nr 4 in the matrix above. In my interpretation nr 4 means that I use one plastic coated canvas bag to collect all waste and then sort it into the respective fractions in the recycling room of my building. Sorting the waste only once and managing only one bag allows me to spend no more than an average of 8min/week on recycling and attaining recycling rates very close to the system optimum. Other individuals may have other preferences and options but for me this is indeed the very epitome of CasualCore indeed!

This of course depends on available resources and political preferences but I maintain that it is at least invasive to optimise the collection system compared to orchestrating campaigns to change citizens attitudes and valuations of recycling. This is not to say that information campaigns aimed at increasing citizen's knowledge about AND confidence in the recycling system are not useful. On the contrary. knowledge, real and attested remains a cornerstone of efficient recycling at the micro level, and if one understands knowledge as having a "half-life" (Machlup, 1972, pp. 396-400)¹⁴² then reiteration and re-affirmation is occasionally needed. However, there seems to be a disconnect – or at least no need for a connect – between knowledge and attitudes towards the environment in general or recycling in particular.

Again there would seem to be a difference between the incipient recycling system and the mature recycling system. The impulse to start a typical modern western style recycling system is of course bourn from strong environmental concerns and not primarily from some potential economic gain. And thus during the initial moments and during the continual struggle to expand and optimise the recycling system this concern would hold the positive attributes that Tonglet describe. However, if this is true for the system administrators and the vanguard among the recyclers (ie the FormalCore segment) this is NEITHER necessary nor present in the CasualCore segment where efficiency and the ability of the system to cater to their Miseen needs are central. This also highlights how important it is that the intrinsic drivers motivating citizens are carefully understood. While I argue that both the CasualCore and the FormalCore segments are intrinsically motivated, there are degrees of difference in what exact values are the primary drivers for each segment. I have used the terms high-/low-stakes to describe the difference, but I see this as an urgent field for further research if we are to understand and be able to differentiate between different forms of motivators. The resulting trichotomy however is a poignant reminder of the dynamic and ever changing nature of a system like this one.

So, in conclusion both the FormalCore and the CasualCore, as well as both the Etzionian/Miseen & Tonglet/Barr perspectives are needed and present in the studied setting. It is just that as long as our aim is to further optimise the recycling system by involving the masses, it is the

¹⁴² In the sense Fritz Machlup (1902-1983) described it in his seminal work most scientific knowledge is subject to decay and has a half-life. I would hold that this applies to what most citizens believe they know as well.

CasualCore/Misean/Barr combination that seems to have the highest potential per unit of cost or effort.

8.7.9 A brief historical etymology of waste

Perhaps not so much a genuine research contribution in the field of business or even recycling, but nonetheless the first all encompassing miniature dictionary of recycling words in the Swedish language. While not all that helpful in the greater context of my work it did illustrate how societal changes have altered and introduced words used to describe waste management. Interesting in this context was that recycling related activities made their mark in the Swedish language from the very earliest of times.

8.7.10 Contribution to business and economics science in general

1. Contributed to the understanding of the mechanisms governing compliance near the 100% mark.
2. Using Zwicky boxes to improve on systematic study of complex or “wicked” research phenomena.
3. Developing software to facilitate the use of Zwicky boxes in social science/economics.
4. Use of “Symbolic regression” in social science – a first attempt to distil the “laws” possibly governing the phenomenon studied.

8.7.11 Compliance near the 100% mark

I find it reasonable that my findings concerning compliance and use near the 100 % mark might well hold in other fields as well. The parallel to SMS or texting as a technology has been drawn earlier and other such more or less implicit “industry standards” would conceivably function along the same lines. As a case in point googles dominance in the field of online services would rather have to do with “ease of use” and efficiently solving everyday problems than coercing the customers into accepting their solutions. In any case further study on this would be highly interesting. I also foresee a possible use of my result in applied settings in different industries or policy making processes. Societal use of my findings to promote social marketing of everything from bicycle helmets to diets should be conceivable.

8.7.12 Use of Zwicky boxes to study complex or “wicked” problems

In this undertaking I understand that my preference for an orderly and systematic study of a problem might be the inevitable result of an inquisitive nature. In order to structure the many things that an inquisitive mind finds a method using eg Zwicky boxes is useful. Obviously so because it allows us to eliminate from our search combinations that cannot conceivably exist, it is also as a method to find the potential combination that were looking for. Hopefully such an approach also yields results that are as surprising as they are useful. The development of a software to aid the researcher in this was inevitable as the number of studied variables increased. Just to illustrate we can imagine the insurmountable task at hand if I had allowed the final Zwicky box to include all of the 60 variables mentioned in the literature study. Assigning no more than 3 (low, medium, high) values to them would have resulted in $(60^3=)$ 216.000 potential combinations – if a Visual Analogue Scale with 100 increments is used then the potential number of combinations reach an incomprehensible $(60^{100}=)$ $6,5 \times 10^{177}$! How can we ever hope to conduct exhaustive research if we do not seek to maximise the possible aid from such handy tools?

8.7.13 Developing software for the use of Zwicky boxes in research

Originally a spin-off of one of my many¹⁴³ ideas for software to aid in my research, the final Zwicky box software that I designed with a local high-school student is a contribution in its own right. The ability to track and lock down variable combinations that are not “possible” or “desired” based on any number of techniques is simple and elegant. If a variable combination is found to be “impossible” through results derived from in-depth interviews or statistical factor analysis this can be used to reduce the number of potential candidate solutions. Although I have primarily relied upon statistical data to reduce the number of potential results, I see no reason why an enterprising researcher in this field could not use the Zwicky box to combine methods to arrive at a more manageable number of results. Depending on the scientific tradition under which one operates, I would say that “soft” methods, perhaps even anecdotal reports could prove valuable in this. No matter the basis, this method would ideally allow the researcher to end with a very small and manageable number of solutions to

¹⁴³ I will mention the software called “Pearwise” developed to conduct large scale pair-wise surveys which was inspired by the work done in Behavioural Economics by Jack Knetsch among others. Originally devised to be used extensively in this thesis, it has so far mainly been used in the environmental certification (ISO 14000) work conducted at the University of Gävle.

study further. In addition, if used and results reiterated from the start then the partial results can be used to improve the design of the next round of interviews or surveys.

8.7.14 Using “Symbolic regression” in social science

My work is a possible “first use” of symbolic regression, using AI, in social sciences/economics to formulate the inherent “laws” in empirical data. While much work remains to be done in this field, the stunning find that recycling rates oscillate, and oscillate increasingly less as rates increase should be enough to warrant further study into this method in a variety of fields. The work done at Cornell University by Schmidt & Lipson will, I am sure, redefine how we utilise statistics in social science. Regardless of the intricacies underlying the methods used, the mere fact that we move from a linear regression and even regular non-linear regression to a curve adaptation to available data that transcends these traditional techniques and is able to capture even more complex phenomena is interesting and should trigger the curiosity to use and develop on this technique. Although so far largely and understandably used primarily in the natural sciences I have taken part in the discussions in the fora of the symbolic regression team at Cornell and have so far encountered very few objections to this application from their perspective. Objections towards the method as a whole exist however, and no doubt the mere fact that symbolic regression software is free (as opposed to eg SPSS) will draw attention and criticism to the project. Time, and further use of symbolic regression outside the intended field will tell how far its use can be extended.

8.7.15 Final words

As I conclude my thesis work, I look with great anticipation to the future. I am more eager than ever to continue my work and expand my finds to new territories and to see my findings tried and tested by both myself and others. Recycling is far more interesting than one might initially think, and it has given me insights into how citizens react to and cope with policies at the lowest individual level. It has also given me reason to consider and reconsider how I view policy design, and the extents to which policy makers can tweak, change or even force a certain behaviour upon citizens. If the basic need to which the policy, product or service in question caters is identified; then I would say that much has been won already! Fail to do this, and reaching high compliance/usage rates will become a burden for all involved. If nothing else is to be learnt from my work then that is it.

Intense, long, certain, speedy, fruitful, pure —
Such marks in pleasures and in pains endure.
Such pleasures seek if private be thy end:
If it be public, wide let them extend.
Such pains avoid, whichever be thy view:
If pains must come, let them extend to few.
(Bentham, 1823, p. 49)

Jeremy Bentham's verse to memorise his views on the value of
pleasure and pain 1789

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Appendices

Appendix 1 The semantic atlas – the basis of chapter 3.3.4

This table presents the synonyms identified by the Semantic Atlas website and the clusters I produced using the computer model.

dico.isc.cnrs.fr	Cluster 1	Cluster 2	Cluster 3
Cajole	Entice, tempt, persuade, cajole, inveigle, coax	Wheedle, blarney, palaver, flatter, sweet-talk	Induce, jockey, talk round, win over, win round
Educate	Drill, indoctrinate, tutor, instruct, teach, discipline, train, prepare, school, educate, form, civilize, develop	Breed, cultivate, rear	Enlighten, inform, edify, improve
Persuade	Actuate, impel, instigate, incite, urge, prompt, push, carry, induce, influence, get, lead, persuade, bend, sway	Assure, satisfy, argue, convince,	Allure, entice, inveigle, cajole, talk round, disarm, win over, coax, jockey, win round
Censure	Denounce, proscribe, deplore, accuse, attack, condemn, abuse, censure, taunt, imputation, blame, invective, inculcate, pan, tax, carp, criminate, discredit, criticise, decry	Warn, give a good dressing-down, belabor, belabour, admonish, lecture, caution, reprove, upbraid, admonition, reprehension, chide, scold, rebuke, berate, reprimand, castigate, reproach, reproof	Castigation, condemnation, criticism, denunciation, deprecation, disapprobation, disapproval, stricture, vituperation
Coercion	Force, enforcement,	Repression	Intimidation

	compulsion, duress, constraint, coercion, pressure		
Compliance	acquiescence, compliance, resignation, submission, yielding, submissiveness, docility, meekness, tractability, willingness, conformability, obedience	Agreement, assent, consent, fulfilment, observance, abidance, conformation, conformity keeping	Complaisance, compliance, deference, obligingness

Appendix 2 The structure of my statistical approach

In my work with survey data, I have followed the same procedure throughout the analysis. In short it has consisted of the following steps.

1. Normalisation of the data set
2. Factor analysis of the data set
3. Cluster analysis of the data set (where possible or meaningful)
4. Symbolic regression of the factor analysis results (where possible or meaningful) and some of the raw data (where possible or meaningful)

My work on factor- and cluster analysis is heavily indebted to the skills taught by James Sallis at Uppsala University who brought these techniques to my attention some years ago. In the case of symbolic regression, I am – as previously stated – largely self-taught; the technique being first available to the broader research community in December of 2009. Through careful monitoring of the Eureka online forums, I believe that I have been able to keep up to date on the latest development and considerations concerning this technique. Factor- and cluster analysis has been conducted using varying versions of SPSS (starting with v10 and ending with v18).

A brief run-down of my typical statistical work process:

1. Data tested for normality using the Shapiro-Wilkes test against a cut-off at the 0,05 level of significance. If skewedness and kurtosis deviate from the expected and I still opt to go forward with that data, it is carefully noted in that run.

2. Bi-variate correlation tested between all variables, irrespective of the nature of the variables. This is where most discarded questions are weeded out due to irrelevance.
3. Checked for multi-collinearity. Cases above the 0,9 correlations level are weeded out.
4. Made sure that the number of observations still outnumber the variables by at least 5 to 1.
5. Started the factor analysis in SPSS
6. Checked the KMO-measure of sampling adequacy so that it was above the 0,5 level.
7. Controlled anti-image values so that they were also above 0,5.
8. Next, communalities are studied in detail to test for undue shared variance among variables.
9. Studied the number of factors arrived at by SPSS. Double checked the distance between the eigenvalues of the last chosen factor and the next, non-chosen factor, to determine whether it should be included or not. This requires great insights into the raw data and when in doubt I always re-run the factor analysis with an additional factor to ascertain what the difference is.
10. Studied the rotated component matrix with a factor loading cut according to tabular data (though normally practically set at 0,3 to facilitate interpretation of the data).
11. Made sure that all resulting factors actually made SENSE – this cannot be emphasised enough! Here again, a thorough knowledge of the raw data is crucial to be able to determine IF the result is useful. If not, the factor analysis might as well stop right here, since SPSS will always find a way to fix your data even though they no longer make sense...
12. Next Cronbach's alpha was consulted to ensure that the solution arrived at was reliable AND to see if reliability could be improved further by dropping additional variables. A cut-off at 0,7 is the norm here, but dropping variables should be weighed against the value of keeping them in for the sake of the investigation.
13. With these steps completed a more qualitative step can commence, where the interpretation of the respective factors and their relations is in focus. Again knowledge in the field studied is crucial to put the results into their local and research context.
14. If the data is deemed good enough the next step would normally be to use the factor data to perform a regression. Not being satisfied with the results of SPSS's inherit regression modelling, I opted to proceed with Symbolic regression. While the method itself has been covered in the methods chapter, I will deliberate on the

practical steps and considerations of running symbolic regression using the Eureqa engine.

15. The first step is to enter the data itself. This is a simple matter of copy and paste, but some care should be taken in naming the factors as this will help in the coming operations.

Appendix 3 Statistical data for Chapter 2.8

Best Solutions:

Eureqa Report

Generated at: 2009-Dec-04 10:13:40

Search for a formula $f()$ that satisfies: $r = f(t)$

Building blocks: operations(8): constants, variables, +, -, *, /, sin, cos

Data:

variables(2): t, r

training samples: 283

validation samples: 170

Best Solutions:

Based on Training Data

Complexity(Size)	Accuracy(Fitness)	Formula
21	0.697119	$f(t) = (81.3811 + 3.30269/(-1.14689*\sin(-2.47967*t) - 0.0539489) + \sin(-2.47967*t))* (0.914288 + 0.0784506)$
13	0.697346	$f(t) = 81.2098 - -2.63397/(-0.0430431 - \sin(-2.47959*t))$
11	0.710794	$f(t) = (t + \sin(t))/(0.0122269*(1.11448 + t))$
9	0.715091	$f(t) = 80.1878 - -67.4939/(-1.12171 - t)$
7	0.715092	$f(t) = -67.5499/(1.12291 + t) - -80.1844$
5	0.72982	$f(t) = t/7.88252 - -73.3925$

Based on Training Data

Complexity(Size)	Accuracy(Fitness)	Formula
1	0.740757	$f(t) = 77.1974$

Based on Validation Data

Complexity(Size)	Accuracy(Fitness)	Solution Formula
13	0.680535	$f(t) = 86.6021 + 67.5521/(-0.277742*t - \sin(t) - 1.00009)$
11	0.689536	$f(t) = (t + \sin(t))/(0.0121161*(1.13169 + t))$
5	0.714311	$f(t) = 73.2122 - t*-0.148954$
1	0.74629	$f(t) = (8.04823 + (t - t)*t)/0.103302$

Search Statistics:

Search Time: 31m 0s

Core Hours: 1.03355

Total Function Evaluations: 3.14071e+010

Mean Solution Generations: 1.15529e+006

Mean Predictor Generations: 1.15529e+006

Mean Trainer Generations: 9026

Search Population Size: 128

Appendix 4 Statistical data for Chapter 6.1

Factor Analysis

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,587
Bartlett's Test of Sphericity	Approx. Chi-Square	93,875
	df	10
	Sig.	,000

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,084	41,671	41,671	2,084	41,671	41,671	1,631	32,629	32,629
2	1,006	20,122	61,793	1,006	20,122	61,793	1,394	27,883	60,512
3	,960	19,191	80,984	,960	19,191	80,984	1,024	20,472	80,984
4	,634	12,688	93,672						
5	,316	6,328	100,000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix

	Component		
	1	2	3
Ordningen i soprummet?	,922		
Hyses eller bostadsrätt?	,858		
Sopsorterar du?		,825	
Ålder		,794	
Etnisk bakgrund			,981

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 4 iterations.

Swedish	English
Ordningen i soprummet	Order in the recycling room
Hyses eller bostadsrätt	Rented apartment or Condo
Sopsorterar du	Do you recycle
Ålder	Age
Etnisk bakgrund	Ethnic background

Appendix 5 Statistical data for Chapter 6.3

Factor Analysis

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,799
Bartlett's Test of Sphericity	Approx. Chi-Square	1075,048
	df	120
	Sig.	,000

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5,069	31,683	31,683	5,069	31,683	31,683	2,486	15,538	15,538
2	1,812	11,325	43,008	1,812	11,325	43,008	2,162	13,510	29,048
3	1,322	8,266	51,273	1,322	8,266	51,273	2,097	13,106	42,154
4	1,206	7,536	58,810	1,206	7,536	58,810	1,705	10,653	52,807
5	,995	6,219	65,028	,995	6,219	65,028	1,676	10,477	63,284
6	,947	5,920	70,948	,947	5,920	70,948	1,226	7,665	70,948
7	,733	4,579	75,527						
8	,659	4,121	79,648						
9	,587	3,668	83,316						
10	,543	3,391	86,708						
11	,510	3,185	89,892						
12	,467	2,916	92,809						
13	,353	2,208	95,016						
14	,338	2,113	97,129						
15	,318	1,990	99,119						
16	,141	,881	100,000						

Extraction Method: Principal Component Analysis.

Swedish	English
Sorterar hårda plastförpackningar	Recycles hard plastics
Sorterar mjuka plastförp.	Recycles soft plastics

Sorterar metallförp	Recycles metal containers
Sorterar tidningar	Recycles newspapers
Sorterar papper	Recycles paper
Sorterar wellpapp	Recycles corrugated fiberboard
Sorterar batterier	Recycles batteries
Sorterar farligt avfall	Recycles haz-mats
Sorterar elavfall	Recycles electrical waste
Sorterar glasförp	Recycles glass containers
Hur är din kunskap om källsortering	What is your knowledge of recycling (perceived knowledge)
Hur värdefullt är det att källsortera	How valuable is to to recycle
Boende	Type of living arrangement
Inkomst f skatt	Income before taxes
Sorterar matrester	Recycles food-scrap/compost
Antal rätt svar	Number of correct answers (actual knowledge)

Rotated Component Matrix^a

	Component					
	1	2	3	4	5	6
Sorterar hårda plastförp?	,854					
Sorterar mjuka plastförp?	,801	,352				
Sorterar metallförp?	,745					
Sorterar tidningar?		,802				
Sorterar papper?		,797				
Sorterar wellpapp?	,410	,646				
Sorterar batterier?			,800			
Sorterar farligt avfall?		,351	,713			
Sorterar elavfall?			,635			
Sorterar glasförp?	,375		,512			
Hur är din kunskap om källsortering?				,784		
Hur värdefullt är det att källsortera?				,716		
Boende					,869	
Inkomst f skatt					,864	
Sorterar matrester?						,872
Antal rätt svar				,476		-,578

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

K-means cluster analysis

Final Cluster Centers

	Cluster					
	1	2	3	4	5	6
Boendeområde	4	3	3	3	3	4
Ålder	68	48	23	51	60	34
Antalpershushåll	2	3	3	2	2	2
1. Hur mycket tid i veckan lägger ni ner på sophantering? (min)	11,0	42,9	120,0	21,0	22,5	12,0
2 a. Vilka av följande alternativ sorterar ni ut i hemmet? Metall	9,5	5,0	10,0	8,1	7,9	1,3
2 b. Vilka av följande alternativ sorterar ni ut i hemmet? Papper	9,5	9,0	10,0	9,7	8,8	2,2
2 c. Vilka av följande alternativ sorterar ni ut i hemmet? Plast	9,5	7,7	9,3	7,3	8,4	1,5
2 d. Vilka av följande alternativ sorterar ni ut i hemmet?Glas	9,4	9,6	10,0	9,1	9,0	2,3
11. Hur värdefull anser ni att kompostering är för miljön?	9,3	6,6	10,0	6,0	7,1	4,0
12. Hur bra tror ni att komposteringsinsamligen kommer att fungera?	7,4	4,9	5,4	4,6	5,6	3,0
14. Hur bra är era kunskaper om kompostering?	7,2	5,0	10,0	4,5	6,1	2,2
15. Hur många fotbollsplaner tror ni att Gävles sopor täcker (på ett år)?	200,0	200,0	200,0	18,3	125,0	15,0
21. Har eran kunskap om kompostering ökat p.g.a. den info ni fått från GÅ?	7,8	4,6	6,8	3,1	6,3	2,7
totala kunskaper F 17-justerad	15,00	12,00	12,00	12,44	9,50	9,50
Återvinningsgrad	85,50	65,37	93,00	70,44	70,95	14,30

Distances between Final Cluster Centers

Cluster	1	2	3	4	5	6
1		43,314	118,265	183,562	77,945	202,118
2	43,314		86,122	183,101	78,983	195,405
3	118,265	86,122		210,099	130,555	229,304
4	183,562	183,101	210,099		107,238	61,161
5	77,945	78,983	130,555	107,238		127,915
6	202,118	195,405	229,304	61,161	127,915	

Appendix 7 Statistical data for Chapter 6.10.2

Factor Analysis

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,704
Bartlett's Test of Sphericity	Approx. Chi-Square	257,357
	df	66
	Sig.	,000

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3,300	27,500	27,500	3,300	27,500	27,500	3,011	25,094	25,094
2	1,790	14,916	42,416	1,790	14,916	42,416	1,653	13,777	38,870
3	1,353	11,278	53,694	1,353	11,278	53,694	1,264	10,530	49,401
4	1,020	8,501	62,195	1,020	8,501	62,195	1,186	9,883	59,284
5	,922	7,684	69,879	,922	7,684	69,879	1,161	9,673	68,957
6	,914	7,614	77,494	,914	7,614	77,494	1,024	8,537	77,494
7	,743	6,195	83,689						
8	,567	4,726	88,414						
9	,523	4,355	92,769						
10	,407	3,392	96,161						
11	,243	2,027	98,188						
12	,217	1,812	100,000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix

	Component					
	1	2	3	4	5	6
2 a. Vilka av följande alternativ sorterar ni ut i hemmet? Metall	,842					
2 c. Vilka av följande alternativ sorterar ni ut i hemmet? Plast	,802					
2 d. Vilka av följande alternativ sorterar ni ut i hemmet?Glas	,802					
2 b. Vilka av följande alternativ sorterar ni ut i hemmet? Papper	,770		,363			
15. Hur många fotbollsplaner tror ni att Gävles sopor täcker (på ett år)?	-,552			-,361	,351	
11. Hur värdefull anser ni att kompostering är för miljön?		,862				
12. Hur bra tror ni att komposteringsinsamlingen kommer att fungera?		,749				
14. Hur bra är era kunskaper om kompostering?		,502	,444	-,358		
4. Hur mycket av er komposterbara avfall sorterar ni?Kompost RR/min			,884	,884		
21. Har eran kunskap om kompostering ökat p.g.a. den info ni fått från GÅ?					,922	
totala kunskaper F 17-justerad						,875

Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

6.9

Appendix 8 Statistical data for Chapter 6.10.3

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,504
Bartlett's Test of Sphericity	Approx. Chi-Square	107,610
	df	55
	Sig.	,000

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,789	43,537	43,537	4,789	43,537	43,537	3,294	29,948	29,948
2	2,178	19,795	63,333	2,178	19,795	63,333	2,504	22,763	52,711
3	1,246	11,330	74,663	1,246	11,330	74,663	2,415	21,952	74,663
4	,868	7,894	82,557						
5	,706	6,422	88,979						
6	,551	5,008	93,988						
7	,298	2,709	96,696						
8	,221	2,010	98,707						
9	,086	,786	99,493						
10	,053	,485	99,978						
11	,002	,022	100,000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix^a

	Component		
	1	2	3
2 c. Vilka av följande alternativ sorterar ni ut i hemmet? Plast	,935		
2 a. Vilka av följande alternativ sorterar ni ut i hemmet? Metall	,818		
2 b. Vilka av följande alternativ sorterar ni ut i hemmet? Papper	,791	,579	
2 d. Vilka av följande alternativ sorterar ni ut i hemmet?Glas	,735	,617	
12. Hur bra tror ni att komposteringsinsamligen kommer att fungera?	,518	,388	,498
totala kunskaper F17-justerad		,863	
14. Hur bra är era kunskaper om kompostering?		,631	
21. Har eran kunskap om kompostering ökat p.g.a. den info ni fått från GÅ?			,867
RR/min		,447	,713
4. Hur mycket av er komposterbara avfall sorterar ni?Kompost		,413	,617
11. Hur värdefull anser ni att kompostering är för miljön?	,385		,611

Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

Appendix 9 Statistical data for Chapter 6.10.4

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,710
Bartlett's Test of Sphericity	Approx. Chi-Square	278,772
	df	66
	Sig.	,000

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3,301	27,508	27,508	3,301	27,508	27,508	3,199	26,661	26,661
2	1,794	14,948	42,455	1,794	14,948	42,455	1,617	13,472	40,133
3	1,265	10,541	52,996	1,265	10,541	52,996	1,251	10,428	50,561
4	1,040	8,668	61,664	1,040	8,668	61,664	1,246	10,382	60,943
5	,998	8,315	69,980	,998	8,315	69,980	1,084	9,037	69,980
6	,866	7,217	77,197						
7	,723	6,022	83,219						
8	,580	4,835	88,054						
9	,540	4,496	92,550						
10	,432	3,602	96,152						
11	,241	2,011	98,163						
12	,220	1,837	100,000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix^a

	Component				
	1	2	3	4	5
2 b. Vilka av följande alternativ sorterar ni ut i hemmet? Papper	,832				
2 d. Vilka av följande alternativ sorterar ni ut i hemmet?Glas	,822				
2 a. Vilka av följande alternativ sorterar ni ut i hemmet? Metall	,818				
2 c. Vilka av följande alternativ sorterar ni ut i hemmet? Plast	,800				
4. Hur mycket av er komposterbara avfall sorterar ni?Kompost	,442			,393	
11. Hur värdefull anser ni att kompostering är för miljön?		,755			
14. Hur bra är era kunskaper om kompostering?		,712			
12. Hur bra tror ni att komposteringsinsamligen kommer att fungera?		,600		,485	
21. Har eran kunskap om kompostering ökat p.g.a. den info ni fått från GÅ?			,870		
15. Hur många fotbollsplaner tror ni att Gävles sopor täcker (på ett år)?	-,456	,317	,510		
totala kunskaper F				,829	
17-justerad RR/min					,914

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 8 iterations.

Appendix 10 Statistical data for Chapter 6.10.5 & 6.11

Pre-compost clusters Andersberg area

Final Cluster Centers

	Cluster					
	1	2	3	4	5	6
Alder	68	48	23	51	60	34
Antalpershushåll	2	3	3	2	2	2
1. Hur mycket tid i veckan lägger ni ner på sophantering? (min)	11,0	42,9	120,0	21,0	22,5	12,0
2 a. Metall: Vilka av följande alternativ sorterar ni ut i hemmet?	9,5	5,0	10,0	8,1	7,9	1,3
2 b. Allpapp: Vilka av följande alternativ sorterar ni ut i hemmet?	9,5	9,0	10,0	9,7	8,8	2,2
2 c. Plast: Vilka av följande alternativ sorterar ni ut i hemmet?	9,5	7,7	9,3	7,3	8,4	1,5
2 d. Glas: Vilka av följande alternativ sorterar ni ut i hemmet?	9,4	9,6	10,0	9,1	9,0	2,3
11. Hur värdefull anser ni att kompostering är för miljön?	9,3	6,6	10,0	6,0	7,1	4,0
12. Hur bra tror ni att komposteringsinsamlingen kommer att fungera?	7,4	4,9	5,4	4,6	5,6	3,0
14. Hur bra är era kunskaper om kompostering?	7,2	5,0	10,0	4,5	6,1	2,2
15. Hur många fotbollsplaner tror ni att Gävles sopor täcker (på ett år)?	200,0	200,0	200,0	18,3	125,0	15,0
21. Har eran kunskap om kompostering ökat p.g.a. den info ni fått från GÄ?	7,8	4,6	6,8	3,1	6,3	2,7
totala kunskaper F 17-justerad	15,00	12,00	12,00	12,44	9,50	9,50
Återvinningsgrad-total med kompostering	85,50	65,37	93,00	70,44	70,95	14,30
Boendeyrde	4	3	3	3	3	4

Post-compost cluster Sätra area

Final Cluster Centers

	Cluster					
	1	2	3	4	5	6
Boendeyråde	2	1	2	2	1	1
Ålder	43	70	28	40	58	48
Antalpershushåll	4	2	3	3	2	3
1. Hur mycket tid i veckan lägger ni ner på sophantering? (min)	135,0	10,0	11,3	28,6	28,5	38,5
2 a. Vilka av följande alternativ sorterar ni ut i hemmet? Metall	9,9	1,9	,7	7,4	9,2	8,0
2 b. Vilka av följande alternativ sorterar ni ut i hemmet? Papper	9,9	2,2	6,3	9,5	9,3	8,9
2 c. Vilka av följande alternativ sorterar ni ut i hemmet? Plast	9,8	1,7	,7	6,9	8,5	7,7
2 d. Vilka av följande alternativ sorterar ni ut i hemmet?Glas	9,9	1,8	7,2	8,9	9,6	9,5
4. Hur mycket av er komposterbara avfall sorterar ni?Kompost	9,9	8,6	6,1	7,8	9,0	8,7
11. Hur värdefull anser ni att kompostering är för miljön?	7,0	9,3	8,3	8,4	7,8	8,0
12. Hur bra tror ni att komposteringsinsamligen kommer att fungera?	6,5	9,0	7,6	6,7	6,9	6,6
14. Hur bra är era kunskaper om kompostering?	7,1	8,7	4,1	7,0	7,0	6,8
15. Hur många fotbollsplaner tror ni att Gävles sopor täcker (på ett år)?	11,0	1000,0	20,0	128,6	14,6	200,0
21. Har eran kunskap om kompostering ökat p.g.a. den info ni fått från GÅ?	5,5	8,5	3,2	5,3	5,9	6,0
totala kunskaper F17-justerad	14,75	13,00	14,00	13,57	13,77	14,00
Återvinningsgrad	98,95	32,40	42,05	80,86	91,26	85,70

Generated at: 2010-Jan-18 12:16:10

Search for a formula f() that satisfies:

RR = f(cres, belief, actknow, eff, infomyth)

Building blocks:

operations(6): + , - , * , / , sin, cos

Data:

variables(6): cres, belief, infomyth, actknow, eff, RR

training samples: 132

validation samples: 55

Best Solutions:

BASED ON VALIDATION DATA

Complexity(Size)	Accuracy(Fitness)	Solution Formula
31	0.496648	f(cres,belief,actknow,eff,infomyth) = 89.7409 + 1.97415*infomyth + 0.335473/(actknow*cos(-1.14929*belief - 0.157819) - 0.0760836) + 2.80373*cos(-19.898*infomyth) - cos(infomyth)
19	0.497731	f(cres,belief,actknow,eff,infomyth) = 89.8891 + 2.41966*infomyth + 0.395284/(actknow*cos(-1.14925*belief - 0.157641) - 0.0763825)
17	0.507449	f(cres,belief,actknow,eff,infomyth) = 89.6494 + infomyth + 0.407014/(actknow*cos(-1.14932*belief - 0.157641) - 0.0767559)
15	0.514871	f(cres,belief,actknow,eff,infomyth) = 89.5929 + 0.380781/(actknow*cos(-1.14932*belief - 0.157641) - 0.0763825)
13	0.571772	f(cres,belief,actknow,eff,infomyth) = 86.7133 + 2.11206*actknow + 2.11206*belief/cos(actknow)
11	0.593505	f(cres,belief,actknow,eff,infomyth) = 89.4956 +

BASED ON VALIDATION DATA

Complexity(Size)	Accuracy(Fitness)	Solution Formula
		$0.488062/(\text{actknow} * \cos(\text{actknow}) - 0.0794264)$
9	0.595938	$f(\text{cres}, \text{belief}, \text{actknow}, \text{eff}, \text{infomyth}) = 87.9078 + \text{infomyth} + 0.0975939 / (0.0975939 - \text{infomyth})$
7	0.600899	$f(\text{cres}, \text{belief}, \text{actknow}, \text{eff}, \text{infomyth}) = 88.1515 + 0.0976161 / (0.0976161 - \text{infomyth})$
5	0.64262	$f(\text{cres}, \text{belief}, \text{actknow}, \text{eff}, \text{infomyth}) = 87.9292 + \text{belief} * \text{infomyth}$
3	0.651194	$f(\text{cres}, \text{belief}, \text{actknow}, \text{eff}, \text{infomyth}) = 88.2831 + \text{infomyth}$
1	0.654779	$f(\text{cres}, \text{belief}, \text{actknow}, \text{eff}, \text{infomyth}) = 88.9361$

Search Statistics:

Seach Time: 12h 28m 35s

Core Hours: 47.9108

Generated at: 2010-Jan-19 12:55:34

Search for a formula f() that satisfies:

rr = f(barr, soc, env)

Building blocks:

operations(6): + , - , * , / , sin, cos

Data:

variables(4): barr, env, soc, rr

training samples: 106

validation samples: 55

Best Solutions:

BASED ON VALIDATION DATA

Complexity(Size)	Accuracy(Fitness)	Solution Formula
23	0.54036	f(barr,soc,env) = 34.956 + 41.6116*cos(0.788778/(2.063 + barr)) - 13.2105*env - 6.60989*soc - 22.9191*barr
21	0.565	f(barr,soc,env) = 57.7155 + 15.5717*cos(barr*barr) - 12.6654*env - 6.93819*soc - 12.4111*barr
19	0.597472	f(barr,soc,env) = 47.8804 + 23.4066*cos(barr/(2.27796 + barr)) - 13.8188*env - 14.9233*barr
17	0.604625	f(barr,soc,env) = 71.0892*cos(0.410424/(2.0305 + barr)) - 13.9719*env - 16.9646*barr
13	0.618996	f(barr,soc,env) = 69.0914 - 6.03059*soc - 13.3817*env - 11.9791*barr
11	0.630761	f(barr,soc,env) = 68.7069 - soc - 15.0527*env - 9.67005*barr

BASED ON VALIDATION DATA

Complexity(Size)	Accuracy(Fitness)	Solution Formula
9	0.637018	$f(\text{barr}, \text{soc}, \text{env}) = 69.029 - 14.6337 * \text{env} - 8.83999 * \text{barr}$
7	0.663315	$f(\text{barr}, \text{soc}, \text{env}) = 611.913 / (8.89063 + \text{barr} + \text{env})$
5	0.685694	$f(\text{barr}, \text{soc}, \text{env}) = 68.6893 - 13.4719 * \text{env}$
3	0.74464	$f(\text{barr}, \text{soc}, \text{env}) = 70.872 - \text{env}$
1	0.75488	$f(\text{barr}, \text{soc}, \text{env}) = 71.5727$

Search Statistics:

Search Time: 20h 47m 16s

Core Hours: 74.9014

Total Function Evaluations: 1.39927e+012

Mean Solution Generations: 2.59777e+007

Mean Predictor Generations: 2.59777e+007

Mean Trainer Generations: 202951

Search Population Size: 256

Generated at: 2010-Jan-18 12:14:55

Search for a formula f() that satisfies:

$rr = f(\text{Aknow, clas, bel, comp, eff, info})$

Building blocks:

operations(6): + , - , * , / , sin, cos

Data:

variables(7): rr, clas, bel, comp, eff, info, Aknow

training samples: 77

validation samples: 42

Best Solutions:

BASED ON VALIDATION DATA

Complexity(Size)	Accuracy(Fitness)	Solution Formula
33	0.427032	$f(\text{Aknow, clas, bel, comp, eff, info}) = 79.998 + 0.964141 * \text{eff} + 14.8796 * \cos(64.1549 * \text{eff} * \text{eff} * \text{eff} - 68.6129 * \text{eff} * \text{eff} * \text{eff} * \text{eff} - 2.71526 * \text{eff} * \text{eff})$
17	0.478299	$f(\text{Aknow, clas, bel, comp, eff, info}) = 86.6145 + \text{eff} / (0.742882 + \text{eff}) + 11.8066 * \cos(2.34529 / (0.201694 + \text{eff}))$
15	0.492153	$f(\text{Aknow, clas, bel, comp, eff, info}) = 85.4586 + 11.8053 * \sin(5.31488 / (0.481691 + \text{eff})) - \text{comp} * \text{comp}$
13	0.501228	$f(\text{Aknow, clas, bel, comp, eff, info}) = 84.3535 + 12.9964 * \sin(1.05886 + 1.92956 / (0.0254785 + \text{eff}))$
11	0.516769	$f(\text{Aknow, clas, bel, comp, eff, info}) = 84.5934 + 12.6587 * \sin(5.31782 / (0.481685 + \text{eff}))$
9	0.590462	$f(\text{Aknow, clas, bel, comp, eff, info}) = 86.2327 +$

BASED ON VALIDATION DATA

Complexity(Size)	Accuracy(Fitness)	Solution Formula
		$\text{comp} \cdot \text{eff} / (0.742496 + \text{eff})$
7	0.615428	$f(\text{Aknow, clas, bel, comp, eff, info}) = 87.3104 + \text{comp} / (0.443625 + \text{bel})$
5	0.656048	$f(\text{Aknow, clas, bel, comp, eff, info}) = 86.9618 + 4.02625 \cdot \text{comp}$
3	0.681548	$f(\text{Aknow, clas, bel, comp, eff, info}) = 86.5718 - \text{Aknow}$
1	0.69507	$f(\text{Aknow, clas, bel, comp, eff, info}) = 87.7296$

Search Statistics:

Search Time: 11h 24m 42s

Core Hours: 37.0499

Total Function Evaluations: 0

Mean Solution Generations: 0

Mean Predictor Generations: 0

Mean Trainer Generations: 0

Search Population Size: 0

Understanding the effects of marginal utility and Says law is important here. In fact, deeming from my research I would strongly recommend further study into knowledgeable high-end users who are just a tad blasé as a means of streamlining a product and to gain a higher market penetration/market share. If a product or service is to become a general success changes need to be influenced by a manner of use that is closer to the average user's willingness to invest time into it rather than the enthusiasts.¹⁴⁴

On the system side the marginal effects of near system optimal recycling is covered by e.g. (Tucker et al., 2001; Bacot et al., 2002), however the recycling action as such is not detailed in those terms. Consumer side marginal behaviour is briefly touched upon in terms of using marginal prices to charge citizens for recycling services (Morris, 1997) but again it is not the action as such that is in focus.

Sometimes products and services inadvertently cater to the needs of the masses through concepts identified and popularised by the soft-core users. Such an example might be text-messaging on cell phones. Originally a hard-core tech-buff feature discovered by soft-core users and in turn brought to the general attention of the masses by their example. Blogging is another example, when blogs first arose on the internet it was the domain of the technically savvy and using them was a fine art wrought with complications. As blogging developed the hard-core users lead the way, but I would argue that it was the time-saving efforts of soft-core bloggers who refined on the technical aspects of blogging eventually opening up blogging as a means of expression for the masses as blogging services caught on. My point is that the way in which the semi-professional enthusiasts use a product is rarely a good starting point for anyone who wants to popularise a product. How a community of users define its use and refine its utilisation is a different matter however. Considering how non-coercive Etzionis vision

¹⁴⁴ I suggest that this is exactly the mechanism which explains the success of the massive-multiplayer-online (MMO) game World of Warcraft. Which built upon the experiences of “soft-core” players rather than “hard-core” players to construe a product that appealed to the masses. From its inception in late 2004 to 2008 it not only captured a market of 10 million players, it expanded the market for MMOs from about 500.000 to 11 million users! Talk about making the most of the experiences from the margins to capture the masses!

of “community” is, this may well be the technique whereby we explain the group behaviour under which positive recycling behaviour develops and spreads. “Moral dialogue” (Etzioni, 1968, 1988; Indik & Berrien, 1968) thus returns as an added instrument of choice in the arsenal available to the policy maker. We cannot all be experts in every field, but we may do well to learn from those who have found efficient ways of using new products to their full potential. Inspired by the soft-core way of recycling and “moral dialogue”, overall recycling rates could be raised without any of the costly and intrusive “value-marketing” otherwise needed to reach the recycling levels of the devoted group.

This brings up the issue of understanding the value attributed to recycling – a) to the value of the act of recycling and b) to the value of the recycled material.

Valuation of recycling	Low value of act	Indifferent to the act	High value of act
High or + material value	7	8	9
Indifferent to mtrl val	4	5	6
Low or - material value	1	2	3

The studied situation would be comprised mainly of citizens belonging to categories 1-3 and possibly 4-6, whereas 7-8 would be the exceptions. During an experiment with a temporary refund on car tires found in forests or along roadsides, tire recycling would be a temporary 9. To illustrate, the FormalCore would primarily be found in categories 6 and 9, whereas the CasualCore group would consist of 5's.

In fact this seemingly simple determinant influences what can and cannot be expected to be made to influence a person's future acts of recycling. As we have seen, waste in Sweden generally has a low or no monetary value; indeed it is more often than not associated with a direct or indirect cost of disposal as in most other western countries. Waste fractions that have a monetary value are so valued due to refund systems or other artificial measures and fines or forgone refunds attributed to wrongful disposal are merely seen as a price tag, one among many in the daily dealings of the household. This type of behaviour has been described before (Gneezy & Rustichini, 2000) and infringement or even systematic misuse of the fine has been seen as an overall good if we go beyond the immediate/partial goal of the fine. The reasoning is that a willingness to pay the fine allows for more flexibility in the system than an absolute norm. Especially when the degree of commitment is low, and the value of the competing activity is

higher, paying a fine (our in my case paying a higher fee) may be acceptable. This has to be taken into account.

Add to the above that most of the value attributed to waste and the act of recycling is non-monetary. This is to say that it might still be substantial and the individuals may be prepared to go to relatively great lengths to dispose of that waste fraction in the proper way. The very act of recycling may be attributed with a positive value. As has been shown (Bruvoll et al., 2002) this valuation does not take place in a vacuum though and the value attributed to recycling must at all times be compared to other activities with which it competes. It is this realisation, that recycling is only ONE of many household chores that opens up our understanding of recycling a more nuanced perspective. Seeing that recycling competes with other activities explains why the time allotted to recycling is so important to our ability to raise and influence it.

If the person in question is less well informed, the need to dispose of waste is urgent and the risk of being exposed for dumping is small and the fine moderate – then risk-seeking behaviour may well explain dumping practices. At the other end of the scale, the mere prospect of a potential reward may foster seemingly altruistic behaviour and recycling above and beyond the call of duty. So the span of potential actions is wide. Understanding the point for reference of each and every recycler makes it possible to design efforts that have a fair chance of promoting further recycling without being expensive, draconic or arduous. Deeming from my research prospect theory combined with the praxeological axiom of human action as ordinal and oriented towards removing the most pressing source of dissatisfaction, is what offers the best insights into what measures are available. As soon as waste disposal becomes the most pressing concern of the individual it offers us two ways of influencing the path which the individual chooses for disposal. Facing imminent waste disposal the individual has two principle choices; a) either dispose of the waste as the system intends or to b) dispose of it in some other way. If a) is chosen then everything is fine, but if b) is chosen the reason is either:

x) that the person feels that the potential future source of dissatisfaction i.e. the risk of being caught and punished is outweighed by the value of relief from removing the immediate source of dissatisfaction.

y) or that the person feels that removing the immediate source of dissatisfaction is worth more than a possible potential reward in the future – capable of removing future sources of dissatisfaction.

z) a combination of both.

This in turn offers those designing waste management systems a number of avenues of approach.

- X1) Increase the risk of being caught and the degree of punishment, effectively increasing the value of a possible future source of dissatisfaction as a means of deterrence. In order for it to be credible the risk of being caught needs to be high and equal (non-arbitrary, non-discriminatory) or else severe punishments will only be seen as unjust and/or draconic. This way of forcing compliance is of course associated with a considerable cost for the recycling company, both in terms of resources and in terms of credibility/social cost.
- X2) Foster a moral safe guard which takes precedent at the time of decision. Thus, the moral safeguard works as an immediate ethical principle which takes precedent at the time of disposal, and works through its proximity in time and its moral value. Effectively what it does is provide an immediate source of dissatisfaction (i.e. bad conscience) which needs to be addressed in the present and dealt with at once to be relieved (in fact even capable of reversing a “bad” decision). If possible to install, this is a very powerful tool. How to do it is less clear, communitarian principles, social pressure etc would seem to be possible avenues. High actual knowledge of the environmental effects of doing wrong can work both ways. Low risk recycling may decline if based on this principle, since one would have to be very conscientious indeed to have a bad conscience over e.g. some extra paper accidentally slipping into the compost bag. Whereas high risk (hazmat) recycling would surge, since no one would like to be responsible for e.g. an accidental mercury spill due to a compact fluorescent lamp breaking open in the compost waste room. Clearly then efforts in this field should concentrate on installing a moral safeguard with regard to fractions where recycling is imperative to avoid a sense of “crying wolf” when less dangerous fractions are concerned.
- Y1) The loss-aversion mechanism can be used to the effect of inducing the desired behaviour by offering a potentially great reward which the individual does not want to risk forgoing by

not disposing of the waste properly. This is the mechanism of the Dutch Melissen experiment and its potential is tremendous. This is arguably also the reward mechanism offered by the prospect of helping to save the planet by recycling, although it is questionable if that prospect is strong, or real enough to pose an important contribution to all but the most convinced recyclers. A balance must be struck between man's desire for immediate relief from dissatisfaction and possible future rewards. The likelihood, as well as the magnitude of the reward needs to be put into perspective and compared to the certain and immediate relief of dissatisfaction. Posit immediately flushing smelly prawn shells into the toilet to putting them into the compost bag for delivery into the recycling bin the next day. In the first instance the reward is immediate and very noticeable; in the second instance the likelihood of a correct disposal playing any significant part in saving the planet is negligible indeed. Now compare this to a situation where the second alternative is replaced to the certain future reward of a compost soil refund. Clearly this has a greater, albeit small chance of convincing the individual to do the right thing.

- Y2) This alternative is identical to X2 in that it also builds upon moral ground and acts on the basis of offering an even more immediate relief than the alternative.
- Z) A combination of motives corresponds to a combination of potential solutions.

To summarise, intervention to correct wrongful recycling behaviour can take place at any time, but depending on when and how the intervention takes place the method has to change. Punishment in hindsight, future gains or immediate reconsideration are the three principle mechanisms that I identify in this respect.

Punishment is the traditional way of dealing with offences, but it requires much in the way of authority to be successful. Authority which waste managers rarely have or which society is unwilling to yield to them. In addition it also needs to reflect the public stance on the offence and the punishment needs to be proportional to the offence. I question if this method is not redundant in a society where recycling is already mandatory

and compliance is by its very nature high. Starting to punish participants who already comply to a great extent is akin to the audience correcting the symphony orchestra... Counterproductive.

Immediate reconsideration through moral guidelines is a very strong mechanism of intervention. However, its main drawback is the difficulty in installing it among the public, fostering a set of new moral values is indeed a daunting task, especially in a post modern society which oftentimes frets at non-relativistic moral compasses. In those whose minds it settles it will remain strong and durable and in conjunction with environmental impact assessment/valuation of different waste fractions I see no hindrance for a moral compass to take precedent with regard to haz-mats for example.

The last method seems most promising. By offering rewards for further and higher compliance to already dutiful participants it builds upon their goodwill and trust of the system to refine and expand on participation and quality of participation. The potential reward may also be once or twice removed, as the compost soil refund from the compost programme in Gävle illustrates. Participation in the programme yields a reward of two plastic bags of compost soil per household and year. Thus the immediate act of recycling does not yield an immediate monetary reward but a year later free of charge compost soil is made available. With more than 30% of eligible households taking advantage of this benefit in 2007 it clearly shows that it is valued. The realisation that rewards only need to be potential and intermittent to have this effect is an indication that it needs not be expensive to implement. Indeed loss-aversion might work to engrain the individual recycler with a passion for recycling which would otherwise be absent. For the already knowledgeable and confident this mechanism is of course less important but for the mass, for those who will never aspire to be expert recyclers or who lack the resolve to be confident in their ability to recycle, intermittent future rewards is a promising way forward.

Imagine if you will the haz-mat recycling lorry of GÅ described before; today it makes its runs gathering the waste of the knowledgeable, but if disposal through this system gave rights to a lottery for a bike or a grocery gift certificate, many other groups would also find it worthwhile to learn what it takes to be a part of haz-mat recycling. The unsure would enquire as to what was needed to participate and be confirmed in their knowledge, the boisterously over-confident would partake if only to stand to profit, and the unknowledgeable would perhaps find out about haz-mats recycling in the first place. Finally, mainstream recyclers would have to change their rationale and valuation of the haz-mats recycling act, likely pushing many

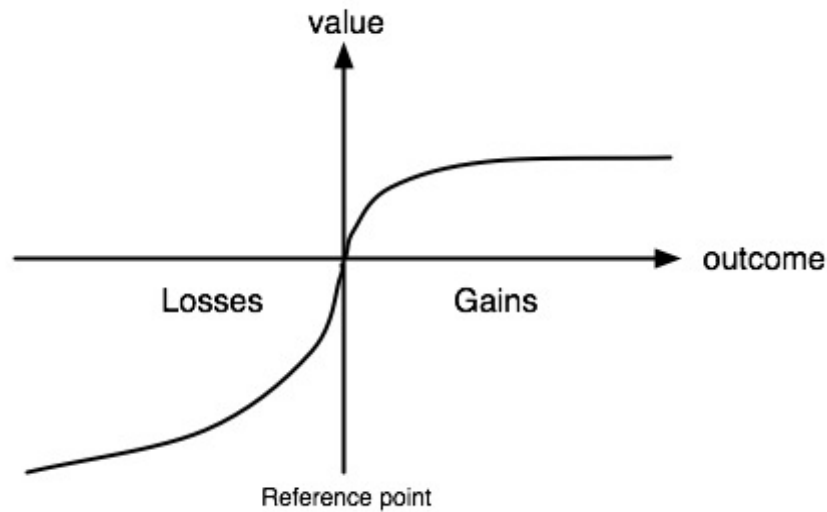
over the top. It is difficult to conceive of any population segment which would be detracted by this manner of incentive. For those few for which the gain is too small or of the wrong type to encourage participation, they would either continue to recycle as before and regard any chance winning as a windfall or silently take offence at the blatantly materialistic approach and most likely continue to recycle as before. In neither case is it likely that we would see the same kind of negative protest reaction conceivable if draconic and arbitrary punishments for not recycling in the proper way was enforced.

Appendix 15 Loss aversion and recycling

A special note should be awarded to the mavericks of the recycling system. Recycling companies often marvel at the apparent irrationality of those who prefer to dump their waste in a bag in the forest over dumping it properly recycled at a recycling station. However, if we consider that they are acting in a situation that promotes “risk-loving” behaviour it is perhaps stranger that not more people follow in their tracks and take their chances in the forest or along the roadside. Clearly, for those who face an additional fine for recycling e.g. small-business waste the risk they run of being discovered and fined must be weighed towards the certain sur-charge of doing the proper thing. Uncertainty as to the existence of a sur-charge or the extra cost of actually going to the closest recycling centre would also play into the valuation of this action. I hold that this explains substandard recycling behaviour even at the lowest level. When e.g. an elderly lady opts to dump the meagre leftovers from her dinner into the toilet bowl instead of into the compost recycling bag (which she will not fill to a level which warrants taking it out for several days) she weighs the minute risk of causing a clog in the sewer system against the extra toil of collecting smelly leftovers for a period of several days before venturing to the recycling station in her area. The same mechanisms are also at work when haz-mats, especially small and infrequently discarded such, are put in with regular household waste because it is simpler and the benefits at the time far outweigh the extra burden of getting a separate collection vessel for batteries which in turn will take up extra space for a long time between filling up.

Add to risk-loving the mechanisms of praxeology as previously described and the explanation of behaviour on the margins of recycling are turned even more clear. The discomfort relieved by immediately dealing with and getting rid of food-scrap or old batteries risks outweighing the far removed

and unlikely discomfort of being caught as cheat in the recycling system. Unlikely punishment is always far removed from the anxiety relief of immediate actions of the individual, no matter how draconic the punishment may be – otherwise there would be no crime. Only two principle alternatives remain that can quell the initial impulse for immediate satisfaction. Either by squaring off and matching the relief from immediate disposal with an equally immediate response of the mind. I am thinking of course of avoiding a bad conscience. If the individual knows by heart and mind what is the right and proper course of action, she can avoid getting a bad conscience by doing the right thing. This has the advantage of being a response of the same kind as the incentive to do badly. From a praxeological point of view, both help the individual to improve the current situation by avoiding a future loss (bad smell versus bad conscience) and they compete for immediate attention. Depending on the level of knowledge, a high level of knowledge makes it more likely that an environmentally sound decision will be taken. The other possibility hinges, not on the prospect of future losses but on future gains. This opens up other avenues, since a focus on future gains turns individuals to emphasise risk-averse behaviour. Suddenly following the routines of the compost recycling system is seen as a valuable contribution and as instrumental to the potential gain of a couple of bags of composted soil next year. Similarly the urge to conveniently dump a discarded beer can among general household waste is to be compared to the potential monetary gain from refunding it in the proper fashion. Again the driving force towards a “simple” solution is faced with potentially strong countering factors, factors that can be deliberated and utilized.



To conclude this line of reasoning. In order to counter a “bad” behaviour there are only three alternatives. Either through later punishment and loss, or through immediate, more pressing conscientious concerns that override the urge to do badly, or alternatively the prospect of future advantages of doing correctly in the present. The latter of course needs to provide benefits that outweigh any advantage of acting badly.

The only possibility to change a “bad” waste management behaviour is to provide the individual with alternatives EITHER BETTER OR WORSE than the reference point!!!

Conscientious concerns provide the individual with escape from a somewhat grave potential loss of value to the individual, and can, if strong enough, be enough to counter losses incurred due to the extra burden imposed by correct handling of the waste.

Appendix 16 Say's law and recycling implications – supply or demand driven recycling?!

On the supplyside mechanics of societal governance

We can well imagine how the first bridge by an old ford changed behavioural patterns for a Viking village. Some surely deemed it unsafe and continued to ford, others continued fording just to protest the central government, but most probably adapted quickly to the new commodity in

place and learnt how to use it effectively and safely. The same goes for all public goods, we can not expect total and unabiding compliance over night, and perhaps it is for the better that changes are allowed to take some time. How often do we not hear that things change too fast or that the pace of life is too high? As with all innovations it takes time to realize their full potential, to find out all of their uses and how to employ them into the everyday routine so as not to interfere with other things we want to do. Recycling is, as we have seen, no different and in fact I would say that it is remarkable how quickly Swedish society has attained the overall high recycling rates that we have. Instead of fretting about goals yet unfulfilled, we would do better to study what has gone well and apply our societal efforts to promote solutions that our citizens have found to serve them well. Is that not the role of the scientist and indeed the policy maker to humbly take in what she finds and act as the arbiter of these findings spreading what is serves the task at hand and studying what is not, so as to understand and remedy it?

Enter Say's law

Yet another eye-opener among my results is how radically different the possibilities to influence recycling are depending on whether we view it as supply or demand driven. This mindset is also closely related to how the individual recycler values the very action of recycling.

In short these perspectives explain yet more in-depth what and how increasing recycling rates can be addressed. Applying Say's law to recycling I claim that the value of the last piece of waste disposed of defines and sets the value of all preceding recycling. Thus, while the first act of recycling may be most rewarding in itself, the umpteenth recycling act leads to all the preceding being no more valuable than the very last one. Effectively this leads to monotonous and repetitive chores being devalued.¹⁴⁵

This realisation helps us understand how the effective soft-core and dedicated hard-core recyclers differ in how they deal with waste disposal. In order to motivate the very last effort the hard-core recycler has to inflate the value of recycling, in order for all the previous recycling acts to retain some measure of value. The soft-core recycler is (and needs) to be less

¹⁴⁵ A principle we can recognize from many fields – while the first strawberry out of the box was very good, the last one out of the third consecutive box not only makes us sick – it deprives us of and lowers the value of the entire batch.

worried about the value of recycling, since soft-core recycling is more time effective. Recycling is already from the start an action very low in intrinsic value, and the loss of value due to many consecutive rounds of recycling is not as big. This ensures that the marginal effect on the recycling value strikes much harder at the hard-core recycler than at the soft-core recycler.

Compared to other household chores that need to be done, like vacuuming, laundry etc and imagine how those would feel if their respective values were inflated or kept at a mundane level.

The time-effective soft-core homeowner vacuums and does so as effectively as possible in the allotted time. Given experience and a clever choice of equipment and approach 90% is well done with a minimum of fuzz. A hard-core homeowner raises vacuuming to the highest order of chores and allows for it to take up whatever time is needed to attain perfection. However, due to technical limitations, dust settling again and the human factor the hard-core vacuumer will still find 100% cleanliness as good as impossible to attain. While the soft-core user can look back at her work with relative satisfaction on a work well done and within time, the hard-core vacuumer looks back at a room where dust is already beginning to settle in spite of a vast and strenuous effort. Uneasiness and frustration ensues, maybe just one more round with the vacuum – at the expense of every other chore that needs to be done. This is the very basic difference between hard- and soft-core approaches to any activity. An inflated valuation of an activity is not always, as one might think, beneficial to the total outcome, on the contrary.

This leads me to conclude that, along Austrian principles, it is the supply-, and not the demand side which has primacy. Effective recycling is primarily determined, not by the loud demands for it by hard-core recyclers, but by a well designed supply of services which cater to and fulfil the eventual need for it. Recycling behaviour on the margins of recycling confirm this. Lets deliberate on the two alternative perspectives and their implications:

If recycling is driven by the supply side: In this case access and convenience would be instrumental to the recycling rate. As long as the recycling bins are where they are expected to be, emptied on regular intervals, the system is readily understood or if people are given enough time to acclimatise then recycling rates will increase. As recycling rates increase new room is opened up to refine and expand upon the existing system, and as long as the changes are not too sudden or dramatic recycling rates will continue to increase. The simple reason for this being that it is in fact easier to comply

with the existing system than not to.¹⁴⁶ This perspective also requires less motivation and a lower valuation of the act of recycling than the alternative. This is something that a supply-side driven system stands to gain from at higher recycling levels as the effect of a diminishing marginal utility is less abrupt than in a demand-sided system.

If on the other hand recycling is driven by demand the entire outlook changes. Today GÄ tries to increase recycling rates through increasing awareness and knowledge etc. This leads, and even aims at increasing the value of recycling in the hearts and minds of the citizens. However, unintentionally this increase is relative to the other chores with which recycling competes for time and resources. While this may well provide an initial boost to recycling rates at the inception of a system, I argue that it will eventually be the primary source of its downfall. Pushing the initial value of recycling up only exacerbates the effect of the marginal utility of recycling at higher recycling rate levels and increase the costs and problems of attaining the highest levels of overall recycling. Once the last piece of waste has been disposed of not much of the original value and enthusiasm will remain.

Obviously both perspectives exist among those who design recycling systems, and I would argue that classic determinants of recycling rates can (ought?) to be divided according to what side they influence. Perhaps this is the best available taxonomy of recycling determinants. My impression after all of my work on recycling is that the demand side is easier to influence initially. I would acknowledge that this is probably how recycling systems come about – through demands from politicians and concerned citizens (future hard-core recyclers). However, the supply-side is also active from day one, albeit more reclusively. Supply and demand must match in order to avoid an unfortunate backlash. Important to remember in this context though is that the basic need for waste disposal (as opposed to waste recycling) is constantly high compared to recycling which may change depending on circumstance. This needs to be understood and dealt with. The basic need catered for is waste disposal, whether this then is done by traditional landfill or recycling is of little concern to meet the basic need. In a system with no demand for recycling, recycling would still ensue and attain high levels if landfill was replaced by recycling as the only means of waste disposal – simply because that is the waste disposal service which is supplied! Demand for recycling may change the means of how waste is

¹⁴⁶ The current system removes sources of dissatisfaction in the easiest way.

disposed of but it does not necessarily need to be the primus motor of recycling rates.

What drives the individual to recycle is another matter. Whether it is a true conviction that recycling is the way to go (demand) or a way to accede to existing needs (supply) is an interesting question. I maintain that a supply side rationale is often clad in demand side arguments, because it is politically correct, a part of the what is expected of the citizen, and since it is a way to avoid having to explain more base reasons to comply with the system.

The demand driven recycler admits from the onset that recycling is allowed to take what time it may, as it is highly valued and it is important to do everything correctly. The supply driven recycler meanwhile recycles as best the system allows, and initially may make many mistakes. Mistakes that have as much to do with their relative disinterest in recycling as it has to do with the design of the system. As the system develops and all parties accumulate experience the image changes. When demands for higher precision in recycling ensue the supply driven recycler simply adapts to the changes made to the system, without any greater level of reflection or concern. She simply continues to recycle to the extent which the system allows. The demand driven recycler on the other hand welcomes the changes with enthusiasm - finally her concerns have been acknowledge by the authorities. However, requirements have increased and since her valuation of recycling remains high additional of her limited resources are committed to the effort to meet every new requirement.

How these two extremes deal with milk and juice cartons is a good example of the difference I try to illustrate. A demand driven recycler immediately adopts the practice of carefully rinsing all cartons and meticulously removes all of the small plastic caps from them. To them this extra attention is a tangible evidence of the high intrinsic value of recycling, and a way to further increase the value of their efforts. They do this although they may very well know that the recycling machine is capable of separating the plastic caps - but what if the machine fails to do this, and think about how much better it was if there were no plastic caps. The supply driven recycler immediately stopped removing plastic caps upon hearing about the machine removal and saved some time by doing so. She also stopped rinsing the cartons upon realising that this is only really necessary to avoid bad smell in the recycling room. Instead she makes sure she empties the carton well and ensures that the collection bin is always emptied well before smell ensues. Besides, leaving the cap on also stops bad smell from seeping out, and the fresh water and time saved from not rinsing

can instead be spent on other environmentally friendly activities. Thus while the demand recycler is still in the kitchen cleaning the umpteenth carton, feeling frustration at how recycling has become such a burden, the supply driven recycler is already out in the sun spending the time saved on something else.

Enter compost recycling

It is in this context that the introduction of compost recycling should be seen. Prior to the central composting scheme, composting was restricted to those who could arrange it for themselves. Primarily those with a garden or a country house to place a compost heap in. The need to dispose of food-scrap was there, but catered for by the regular waste disposal system. Thus, the approximately 10% who had very strong feelings about compost recycling made their own arrangements and the rest acceded to the regular system. The demand side cared for itself one might say. Political pressure, environmental concern and a general sense that it was incompatible with the idea of recycling to mix food-scrap with regular mixed household waste and incinerate it prompted the new recycling system which turned out to be a fairly good system with compliance and participation rates fully compatible with the much more mature recycling fractions as we have seen.

If we look at this as a demand side solution, then we could explain the relative success by wide spread sentiments that compost recycling was indeed what citizens wanted. It was morally wrong not to reuse perfectly good compost material, the time was right etc. These are all intangible demand side arguments, looking at the more tangible arguments it is notable that users were given the alternative to opt out completely or arrange composting of their own. If the environmental good had been in first place and the demand for an authoritative solution had been the primary concern, had it then not been better to handle this waste fraction as all other waste fractions in Sweden, namely mandatory participation with no possibility to opt out? While framed as such and arguably good for the environment, composting was hardly the result of broad public concern and demand. Instead it bears all the hallmarks of a politically initiated programme framed as catering to the public good and demand, though conducted through the supply side.

If we look at this as supply side solution, the system introduced offered an equally good or better, more convenient way of disposing of a large part of a household's daily trash in a way which was less smelly, less sticky, and

more sensible than the previous alternative. The introduction of special compost bags, a special holder for these bags (in many cases installed into the apartment by the landlord) and a spatula for gathering and collecting compost waste all made the new system convenient through its seemingly endless supply of handy contraptions to aid in daily chores. Add to this the person to person information campaign where every household got a personal visit from compost informants and the yearly “refund” of compost soil to all participants and we can see that the supply side is indeed very well catered for in this example. Given this barrage of supply side incentives it is little wonder that so many followed suit.

In conclusion, people will always dispose of their waste somehow. This is the central demand that needs to be catered for. Supplying different solutions as to how the disposal is carried out is in the end what determines the outcome of recycling or other means of waste disposal. The demand to recycle is not universal in the same sense that waste disposal is and never will be. Recycling is a means, and only one mean at that, through which the goal of waste disposal can be carried out. Inability to acknowledge this may be harmless at the inception of recycling system, but is crucial as a recycling system matures and nears recycling close to perfection.

In short:

- Supply driven as opposed to demand driven recycling – an important realisation, otherwise no progress possible at higher levels of compliance!
- Soft-core recyclers as the somewhat counterintuitive forerunner, not ineffective hard-core recyclers – this is perhaps my most ground breaking conclusion, applicable to many other fields of business research!
- The valuation of the recycling act explains the difference between soft- and hard-core, as does diminishing marginal utility and extremely high recycling rates, all of which serve to exacerbate the problems of boosting overall recycling rates further.

Appendix 17 Conceptual image of the different stages of recycling

