

**Understanding NTNU's students' and employees' recycling
behaviour based on intervention strategies by applying a
comprehensive psychological model**



Master's Thesis in Risk Psychology, Environment and Safety
Norwegian University of Science and Technology, NTNU

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Trondheim, Autumn 2015

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Preface

This Master's Thesis is part of a Master's program in Risk Psychology, Environment and Safety at The Norwegian University of Science and Technology and was performed under the supervision of Professor Christian Klöckner and Dr Sunita Ofstad.

I am very grateful for the chance to pursue my education at one of the top universities, and to be part of such an interesting and exciting program at the Faculty of Psychology at NTNU.

I would like to take this opportunity to express my gratitude to Professor Christian Klöckner and Dr Sunita Ofstad for giving me the possibility to take part in such an interesting project, and for the excellent guidance and invaluable advice. Thank you for all the time you have committed to this master's thesis. I have learned more than I could have ever expected from being your student and I appreciate all the support you have given me throughout this time.

Also, I would like to thank Kyrre Svarva for helping with the production and scanning of the questionnaires. Furthermore, I would like to thank all students and employees at NTNU who took part in the study and contributed to the successful results.

And last but not least, I would like to thank my wonderful parents who always encouraged me and supported me through all my years of studies. My gratitude for your loving care and attention goes beyond words.

Monika Tobolova

Abstract

One of the solutions for the environmental problem of waste is proper waste separation by individuals. This Master's Thesis discusses the psychological variables of individuals' waste separation behaviour. Building on the *Theory of Planned Behaviour*, *Norm-activation Model*, *Habits* and the *Comprehensive Action Determination Model*, a questionnaire was created paying close attention to the intervention strategies implemented by the project group 'Klimafot Avfall' at The Norwegian University of Science and Technology to find out whether pre-designed interventions had an effect on psychological determinants for the recycling behaviour of employees and students. The data was collected in two rounds, before the intervention and after a three month pilot period with implemented interventions with a sample of 1269 students and employees. The results show that there was a change in waste separation behaviour after the intervention and intentions, social norms, personal norms, perceived behavioural control and habits also changed after the intervention period. All intervention elements were perceived by the participants; however, two of them had the strongest effect on participants: New waste stations and Removal of buckets from the offices.

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1. Introduction

There are several global threats due to environmental changes that have occurred over the past decades. Global warming, polluted water or any other environmental disasters caused by humans require our serious attention. Environmental degradation is considered one of the most serious issues in today's world (Dagher & Itani, 2014). Most of these changes in nature are caused by humans and their demand upon natural resources (Postel, 1994). Humans' overconsumption of natural resources arise the question about the future of the environment. Therefore, mankind developed technologies and implemented policies to protect the environment (Godbey, Lifset & Robinson, 1998). Furthermore, contribution of individuals and their behaviour that has effect on environment should not be underestimated. This goes for both positive and negative contribution, because, on one hand, individuals create a category of consumers and their higher needs and desires put the environment at risk (Dagher & Itani, 2014), while on the other hand, they can create habits that can save the environment (Klößner & Verplanken, 2012). Individuals have either direct or indirect control over the activities that can destroy the environment (Klößner, 2013). Studying, analysing and understanding people's behaviour is important in order to find solutions to apply changes in favour of stopping environmental-destructive behaviours and increase those that are good for society, nature and future generations (Bell, Green, Fisher & Baum, 2001; Paillé & Boiral, 2013). A part of the environmental destruction is caused by waste that humans produce and which is not handled properly. Hering (2012) states that waste is an unavoidable part of all processes and activities of humans and the only solution to end the problem of waste is to properly define and manage it. Since waste is part of people's everyday life, it is important to investigate psychological factors that mediate humans' behaviour towards handling the problem of waste.

Waste can be defined as an unwanted or undesired material or substance (Hollander, 1998). It can be leftover material from manufacturing, or unwanted element from any household activities and the fact that materials are not used effectively (Hollander, 1998). Godbey et al. (1998) state that waste is the result of consumption in modern life. They also claim that due to many social changes, nowadays society can be called the waste generation, because waste produced by humans is constantly increasing (Godbey et al. 1998). Improper handling of such materials can have a significant negative impact on the environment,

ecosystem and future generations (Hering, 2012). Bell et al. (2001) mention that many individuals think about their impact on the environment as insignificant and unimportant, while not realizing that if many people act with similar actions large global consequences occur. Education and knowledge about the problems plays an important role; however, changing people's attitudes and behaviour to limit their self-profitable acts in the benefit of environment is a long and difficult process (Klößner & Verplanken, 2012). A significant contribution to environmental protection is separation of recyclable materials in the household (Klößner & Oppedal, 2011). Past research indicates that there are two main ways individuals can contribute to the reduction of waste; they can reduce their consumption and/or they can separate the waste so it can be used in the future production of goods and materials (Dagher & Itani, 2014; Godbey et al. 1998; Klößner & Oppedal, 2011; Zurmuhlen, Frydelund & Alimaras, 2010).

There is little understanding in past literature concerning the impact on psychological factors with regards to waste separation behaviour. Past research and studies do not provide sufficient insight into how individuals are affected at a psychological level if changes in waste separation in the workplace or at home are implemented. This Master's Thesis will investigate, using a sample of students and employees at The Norwegian University of Science and Technology, how a pre-designed intervention affects psychological variables that are known to be predictors of environmental behaviour, in particular the behaviour of recycling¹.

In the introductory segment of this thesis, the environmental problem of waste is described. It presents the consequences of modern day people's consumption, gathering of waste, and subsequently, pollution of the Earth. Brief examples of what nations are doing in order to solve the problem of waste are described. Furthermore, green universities are mentioned as playing an important role in environmental actions. As NTNU is one of the biggest universities in Norway, it has to stand up against many environmental challenges by introducing among others project for better waste separation. NTNU's project *Klimafot Avfall* that has a goal of increasing the waste separation at university is described in the end of the chapter, following by research question. The second chapter presents the main psychological theories that have accounted for environmental behaviour and promotes the basis for the questionnaires construction and the study. The third chapter describes the method for the

¹ Both terms 'recycling' and 'waste separation' are used in this paper interchangeably.

study, design, sample, the measurement instrument and data processing. Results from the study are presented in chapter four. A discussion chapter integrates the results and provides an analysis of the hypotheses. Furthermore, this chapter presents the limitations of the study and gives a suggestions for further research. Finally, the conclusion chapter summarizes the paper.

1.1 The problem of waste

1.1.1. The problem

Waste is all unwanted or undesired substances or materials (Hollander, 1998). Often, the term waste is used to describe something we use inefficiently or inappropriate which leads to loss of resource (Hering, 2012). Substances and outcomes of natural processes are transformed into another processes or organism in an ecosystem, hence biodiversity in nature is sustainable (Vlek & Steg, 2007). Unwanted and undesired materials or substances are only product of humans because waste does not exist in the natural environment (Vlek & Steg, 2007).

Waste, as undesired materials and substances, can be either an outcome of production processes (industrial, mining, commercial or agricultural) (Hollander, 1998) or from community and household activities (Godbey et al. 1998). Human-made systems are rather destructive to the environment because they require natural resources and energy and in return they provide the environment with waste that damages nature (Godbey et al., 1998). Postel (1994) discusses the fact that in order to feed human-made systems, humans constantly require more natural capital which is finite; hence, the systems are not sustainable. With the overconsumption of natural sources human-made systems reduce the capacity on Earth to supply more materials in the future (Jansson-Boyd, 2011). Moreover, natural environment has a limited capacity for the absorption of human waste and valuable sources are lost due to waste disposal which in the long run destroy the ecosystems (Postel, 1994).

Godbey et al. (1998) calls nowadays society the waste generation. They connect the problem of waste with social and cultural growth and many changes that have occurred due to progressing human development. For example, in modern societies more women have entered the job market comparing to the past. This makes their time spent in the household shorter and results in the purchasing of goods convenient for fast meal preparation or

effective cleaning (Godbey et al., 1998) which thereby increases the amount of waste. Another example from today's society is the increase of single-person households (Godbey et al., 1998). While in the past one household was normally occupied by two to three generations, it became a trend to become independent from the family. Every household requires furniture, kitchen utilities, television, etc. regardless of the number of people living there. Hence, single-person households produce more waste per person than families (Godbey et al., 1998).

One of the most cited articles in social science addressing the topic of choosing to satisfy immediate personal interests with its prospect of negative future consequence for the society and nature was Hardin's (1968) publication of *The Tragedy of commons*. Hardin discussed the problem of overpopulation, and the fact that if all individuals will drive their behaviour by motives of self-satisfaction without consideration of others, it will lead to overuse of the natural resources; hence, tragedy of commons (Hardin, 1968). The tragedy of commons is very complex problem that among others includes aspects of environmental problems comprising the problem of handling the waste by individuals. For example, many people choose to throw all kinds of waste into one common trash bin. Markle (2014) says that pro-environmental behaviour, in particular recycling, is for people too great to sacrifice and individual cost/benefit outweighs the cost/benefit to the society. Hence, people do not recycle because it is convenient to them (Markle, 2014); people do not want to put extra effort to separate waste, they are not sure about which kind of materials go into which bin, it is easier and faster for them to dispose all waste from households outside into one large container and it also saves space in the house having only one trash bin instead of few. These and many other aspects lead consumers into the act of not recycling because of their own comfort (Godbey et al., 1998).

All individual preferences and intentions result in some sort of behaviour which can have further consequences on the environment. Individuals deal with, on one hand, a choice of satisfying their immediate needs with the prospect of negative future consequences to society and, on the other hand, the restriction of their needs and desires for further good of the community (Hardin, 1968). Unfortunately, people usually fail to respond to such challenges in the positive outcome to the society all alone (Markle, 2014). Markle (2014) addresses the problem of waste, and defines it by the limited actions of individuals towards this problem. Higher motives, other individuals, societies and authorities need to work on behavioural changes that individuals can acquire and follow. Solving environmental

problems such as waste are connected to humans' responsibilities and the performance of individuals in pro-environmental behaviours such as recycling (Markle, 2014). Humans produce significant amount of waste and by separating materials that could be further processed into another materials and goods people contribute to prevent the nature from over-contamination (European Commission, 2010). The main problem of waste is the amount of waste that humans produce and ineffective disposal management (Hering, 2012). Waste can be discarded or accumulated, stored, recycled, or treated physically, chemically or biologically prior to disposal (Hering, 2012).

Past literature addresses the problem of waste also in the context of the workplace (Manika, Wells, Gregory-Smith, & Gentry, 2013; Greaves, Zibarras, & Stride, 2013; Paillé & Boiral, 2013). Greaves et al. (2013) emphasizes the importance of understanding employees' behaviour in the workplace in order to achieve environmental improvements. They mention that while the majority of research focuses on environmental behaviours at home, there are very few studies investigating the workplace (Greaves et al., 2013). Pro-environmental intentions at home may differ from those at the workplace, as households are usually liable for costs of waste disposal or energy consumption while such costs might not be visible while being at work (Greaves et al., 2013). For example, households may be charged additional fees for the collection of non-recyclable waste which may increase their concern about the importance of separating waste. Paillé and Boiral (2013) mentions the problem of the unclear understanding of the specific nature of employees' involvement in pro-environmental behaviour and emphasizes the need for further investigation of such behaviours. Their findings indicate that employees are more committed to pro-environmental behaviour when they perceive organizational support and job satisfaction (Paillé & Boiral, 2013). Clearly, past research does not provide us with enough understanding of waste separation at work; therefore, this thesis will address the effect of the interventions on psychological determinants for waste separation behaviour in the workplace. There is also little known about recycling at universities, as a work place arena; hence this thesis will focus on waste separation behaviour of students and employees at university.

1.1.2. Towards a better understanding of solutions

An emerging social and environmental concern is the excessive solid waste that causes pollution and greenhouse gas emissions that contribute to climate change (European Commission, 2010). Such changes destroy the ecosystem on the planet; hence, waste reduces the amount of natural resources that are used as raw materials in all kinds of production systems (Postel, 1994). If waste was treated properly it would instead of reducing the resources provide us with valuable materials for further production (Hering, 2012). The main strategy to reduce huge amount of solid waste that is produced by society is proper waste management (Hering, 2012). Waste management includes practices like finding options of disposal, recovery, recycling, reuse, minimization and prevention from production of waste (Hering, 2012).

Unlike other environmental problems such as global warming or deforestation, the problem of waste is not only recognized and being of public interest, but it is categorized as a problem with clearly identified solutions (Stuart, 2000). Much of the waste we throw away can be recycled (Stuart, 2000). Recycling is one of the major practices that reduce the amount of waste while in the same time contributing to production of new goods (Halvorsen & Kipperberg, 2003). It reduces the amount of waste that ends up in landfill sites; moreover, it cuts down on the amount of material needed from the natural environment (Halvorsen & Kipperberg, 2003). Recycling is considered as public good because it leads to less waste sitting in landfills which are considered public bad (Halvorsen & Kipperberg, 2003). “Recycling is defined as the separation of materially salvageable items from composite trash” (Zurmuhlen et al., 2010, p.4). In other words, items like paper, glass, plastic, metal, food and many other, that are to be thrown away because the consumer does not need them anymore, should be handled in a way, so that, if possible, they will be reused again as a source for making new product. Recycling is one of the practices that extend the life stage of humans’ products beyond one use; therefore, it is a crucial part of sustainability (Zurmuhlen et al., 2010). Fractions from an old product are used as a material for production of a new product instead of using new resources from nature (Halvorsen & Kipperberg, 2003). Accordingly, the raw material extractions are reduced; therefore, pollution of the air, water, etc. is minimized (Zurmuhlen et al., 2010). Halvorsen & Kipperberg (2003) stated that secondary-material production pollutes less than extraction and processing of new materials, hence recycling is a form of environmental conservation.

The amount of waste is constantly increasing, and the nature of waste is changing due to the development of new technologies (European Commission, 2010). High technology products contain a complex mixture of materials such as plastic, precious metals or hazardous materials that are difficult to deal with safely (European Commission, 2010). Therefore, proper recycling of goods is important because it may have environmental and health impact on humans. Because humankind is dependent on the extraction of raw materials for production, recycling is a solution of providing industries with essential supplies recovered from waste such as paper, glass, plastic and metals, as well as precious metals from used electronic appliances without dangerous impact on environment (Stuart, 2000). Moreover, recycling also saves energy; for example, recycling an aluminium can saves around 95% of the energy needed to make a new one from raw material (European Commission, 2010).

Waste is part of humans' lives and it is impossible to avoid it completely. For the protection of the environment and ourselves, it is important to find the best solutions to deal with waste instead of piling it up in landfills, because the major source of pollution is waste sitting in landfills (Zurmuhlen et al., 2010). Finding possibilities to avoid waste is the best solution to preserve the natural environment.

Studies in the past have showed that problems of waste at households and at the workplace can be dealt with waste strategies such as waste separation and recycling (Klöckner & Oppedal, 2011, Zurmuhlen et al., 2010). However, studies also show that people do not necessarily have sufficient knowledge or information, structures and incentives at work in order to motivate change in waste separation behaviour (Zurmuhlen et al., 2010). Implementing such solutions in the workplace is key to providing a better approach to the problem of waste in the workplace.

1.1.3. The interventions

Bamberg (2013) provided a theoretical basis for the conceptualization of behavioural change for individuals over time. He described a construct of four stages for behavioural change that provided the criteria for transit from one stage of change to another for individuals (Bamberg, 2013). His results show that for successful change of behaviour one needs to form firstly a goal intention, then behavioural intention and then implementation intention in the third stage (Bamberg, 2013). For creating a goal intention, one needs to have

sufficient knowledge and possibilities for making such steps (Bamberg, 2013). Hence, there is need of spreading the knowledge about the environmental issues and possible solutions; but more importantly, there is a need for implementing various interventions so that people would act according to various possibilities and restrictions (Klöckner & Oppedal, 2011). An array of various interventions that have been implemented in the past will be discussed in the following paragraphs. Starting from a bigger picture, countries efforts will be discussed followed by companies and organizations' interventions which include institutions such as universities. This thesis will focus on interventions at universities and at the workplace.

When it comes to waste, many countries created various kinds of restrictions for separating different waste fractions in order to reduce the amount of waste. For example, the Australian government in (2014) introduced '*The national television and computer recycling scheme*' that requires the television and computer industries to fund the collection and recycling of televisions and computers disposed in Australia each year. The long term goal of the scheme includes the diversion of potentially hazardous waste from landfill and increase the recovery of useable materials (Australian government, Department of the Environment, 2014). Companies manufacturing or importing such goods are liable under the scheme and must fund co-regulatory arrangement to provide collection and recycling services for communities across Australia. The Department of the Environment (2014) in Australia estimated that a total of 137,756 tonnes of televisions and computers reached end of life in 2012–2013. They had a target to recycle 30% of this amount. They nearly reached the target and a total of 40,813 tonnes was recycled, equivalent to 98.8% of the scheme target. By the years 2021-2022 they aim to reach a goal of recycling 80% of such goods (The Australian government, Department of the Environment, 2014).

Another example from countries aiming to reduce waste is The European Union (EU) they have a goal to become a recycling society (European Commission, 2010). EU's waste management aims to reduce health and environmental problems by reducing greenhouse gas emissions (cutting emissions from landfills and by recycling materials which would otherwise be extracted and processed), and avoid negative impacts at a local level (such as landscape deterioration due to landfilling, local water and air pollution, and littering) (European Commission, 2015). The EU is trying to shift the approach to waste from the unwanted burden into a valuable resource. EU waste policy aims to ensure that waste is used wherever possible as raw material to make new products (European Commission, 2010). The

EU are expecting that EU Member States recycle 50% of their municipal waste and 70% of construction waste by 2020 (European Commission, 2010).

The EU applied a five-step waste hierarchy (European Commission, 2010) where prevention from production is the best option to avoid waste, followed by re-use of products, recycling and other forms of recovery, with disposal such as landfill as a last resort (see Figure 1).



Figure 1: The EU five-step waste hierarchy. (European Commission, 2010)

Moving up the waste hierarchy is the aim of The EU (European Commission, 2015). Good waste management begins with preventing waste being produced in the first place, because what is not produced does not have to be disposed of. Waste prevention is becoming a major interest for The EU because the global population is increasing and people are eating an infinite amount of natural resources (European Commission, 2010). The concept of prevention is rather clear; however, it is hard to evaluate something that has never been produced (European Commission, 2010). The next level in the hierarchy is the re-use of products (European Commission, 2010). Once a product is already made, it is important to use it for as long as possible. This means that instead of throwing it away, one can try to find a solution to upgrade the old product into a more suitable option, or pass it to someone who could still have some use of it. This approach allows people who do not have easy access to some products or the new products are too expensive for them to have it second-hand. According to a final report from a consumer study for second-hand cars in the EU (European

Commission, 2014), countries that entered the EU later (such as Poland, Slovakia, The Czech Republic, Bulgaria, Romania, Lithuania, Latvia and Estonia) are often buyers of used cars from abroad. Users reported that most often the countries of origin for their cars are Germany (42% of imported used cars), Belgium (9%), Italy (6%) and United Kingdom (5%) (European Commission, 2014). Such opportunities for selling/buying cars across borders reduces the amount of waste from the unwanted cars and production of new cars. The next stage in the hierarchy is recycling. The EU waste policy is trying to reach a level where most waste is used wherever possible as a raw material to make new products. This process helps to ensure that the highest possible quality materials are produced at the end of the recycling process. Quality materials from recycling increase the number of products that can be made from them and maximise the value of such products. According to Risk & Policy Analysts Limited (Kantor, Vernon, Goodbody & Van Acoleyen, 2012) Europe recycles approximately 50% of waste. When recycling is not an option, other kinds of recoveries might be. Energy recovered in the form of bio-gas or thermal energy can help in the fight against climate change (European Commission, 2010). Primarily in EU-15 Member states and especially in the northern countries occurs waste incineration, predominantly with energy recovery (Kantor et. al., 2012). Waste can also be used as fuel in certain industrial processes. Modern waste incineration plants can be used to produce electricity, steam and heating for buildings (European Commission, 2010). Landfill is the oldest form of waste treatment and the least desirable one. In the airtight conditions, materials cannot decompose fully and, in the absence of oxygen, they give off methane, a dangerous greenhouse gas (European Commission, 2010). Waste disposal through landfills is still significant in the Baltic EU member states, the Western-Balkan area and in the UK. EU member states such as Germany, Austria or Scandinavian countries decrease the use of landfills (Kantor et. al., 2012).

Norway has also proved to be reaching the good recycling system. Likewise EU, they adapted the waste hierarchy proposal: reduce, re-use, recycle, “waste-to-energy” incineration, and landfill disposal. According to The C40 Cities Climate Leadership Group (2012), Norway targets citizens with Oslo’s Waste Management Strategy to separate their waste so that 10 kg plastic packaging and 50 kg food waste can be separated per year which reduces the CO₂ emissions by 20,000 tonnes yearly in the capital city. In 2011, about 240,000 tonnes of household waste was collected, out of which 1% was reused, 33% recycled, 60% energy recovered and only 6% went to landfill (The C40 Cities Climate Leadership Group, 2012). That year, collection of plastic packaging and food waste contributed to a reduction of 6,000

tonnes CO₂, and the numbers are increasing year by year (The C40 Cities Climate Leadership Group, 2012). Norwegian government would like to reach at least 50% of the household waste recycled and all hazardous waste collected and treated securely (The C40 Cities Climate Leadership Group, 2012). Food waste is planned to be treated in biogas plants and transformed to biogas and bio-fertilizer. The biogas can be upgraded into fuel for city buses, reducing the environmental impact of public transport (The C40 Cities Climate Leadership Group, 2012).

It is clearly visible that the idea of recycling can be considered a public good. Countries are making effort to prevent the land from over polluting and finding alternatives to deal with waste (European Commission, 2010). Looking at a smaller scale, government organisations, institutions and private companies within countries are also making attempts to become more environmental friendly institutions. For example, Scandinavian hotel chain Scandic has received many awards for their environmental and sustainability efforts. Scandic Sweden was voted the most sustainable hotel brand by 9000 consumers already 4 times in a row in a survey conducted by Sustainable Brand Insight (2014). With regards to waste, Scandic hotel rooms have waste bins with three containers that allow guests to sort their waste. They also stopped using disposable container for shampoos in the room and also in the restaurant department for foods such as jam and butter (Scandic Hotels, 2009). This saves hotels a lot of money that they need to pay for dealing with waste and in the long run saves the environment (Scandic Hotels, 2009).

One of the biggest institutions that have high environmental ambitions are universities. The greatest challenge that universities face for sustainable development is efficient waste management (De Vega, Benitez, & Barreto, 2008). Considering that universities have large number of students and staff, a broad scale of complex activities and many operation processes, they produce big volumes of waste that have an impact on the environment (IARU, 2014). According to De Vega et al. (2008), universities and colleges have moral and ethical obligation to act responsibly towards the environment and they are expected to be the leaders for environmental protection. Proper and efficient waste management at universities would not only bring benefits to the environment but also reduce the costs (De Vega et al., 2008). Moreover, good waste management programmes would set a good example for students and communities (De Vega et al., 2008). Universities play a key role in practices of sustainability and a closer look at their waste separation system is

important because they can be easily adopted by students, who will shape society in the future, and also the society as a whole. Colgate University in the USA created a project that was directly aimed at identifying barriers related to recycling and the benefits of recycling perceived by university students (Zurmuhlen et. al. 2010). They found out that although students generally had a positive attitude towards recycling, they considered inconvenience as the main reason for poor recycling habits (Zurmuhlen et. al. 2010). They conclude their findings with suggestions on creating a Recycling Club at Colgate, so that students may be more inclined to recycle if they can get involved directly in the project and acknowledge the recycling behaviours (Zurmuhlen et. al. 2010). Past literature provides little understanding on the psychological factors that are connected to the waste separation behaviour of individuals. Therefore, investigating psychological variables with regards to waste separation behaviour at universities is important.

1.2 Green universities

Universities are no exception in the progress of finding environmental solutions (Bridgestock, 2009). In modern times, universities are emphasising the importance of environmental responsibilities more than ever before (De Vega et al., 2008). Universities are becoming very pro-active in environmental issues due to fact that they have the capacity and knowledge to test many environmentally-friendly solutions, technologies and systems (Butt, More, & Avery, 2014). Because of the quantity of highly educated professors, researchers and students within all fields of study, they have the possibilities to advance technologies and systems into more innovative systems more than any other organization or business can (De Vega et al., 2008). They are therefore one of the most important creators for the sustainable world (De Vega et al., 2008). Moreover, universities provide people with education that can help them to become future leaders of societies, hence pass the knowledge to the general public and the next generations and give us a picture of how the world should be (Butt et. al., 2014). Many universities already teach subjects connected to sustainability at their faculties and some have even whole study programmes connected to a green future; for example, The Norwegian University of Science and Technology (NTNU) has a master's programme in Sustainable Architecture, Industrial Ecology and many others (NTNU, 2011). As mentioned, university students are most likely future leaders; therefore, involving them in pro-environmental activities is crucial for the future (Butt et. al., 2014). In many cases, students are the main drivers and co-developers of the green projects (Butt et. al., 2014); for example,

students at NTNU collect food that would otherwise be thrown away because it does not meet the criteria to sell it from local grocery stores and they place them in the fridge located on the campus for students to take, in order to show how much good and eatable food in Norway is being thrown away (Grønne studenter, 2013). The International Alliance of Research Universities (IARU, 2014) created a guide that would help universities around the world go green. They represent the sustainability actions for university campuses by sharing best practices from sustainability initiatives from Yale, Cambridge, Peking and The University of Copenhagen (IARU, 2014).

Universities are investing in green buildings, greener practices and products and they are engaging staff and students (Bridgestock, 2009). For example, The University of Texas in Dallas has a building which is designed to stay naturally cool and light, cutting down on energy used for air conditioning and lighting (Bridgestock, 2009). Universities in Norway, for example, provide parking with re-charging stations for electric cars in order to promote green mode of travel (Bridgestock, 2009). Another example is University of Peru that is recycling paper and selling it to a private company, for the purpose of gaining money for scholarships for students with low-income backgrounds (Bridgestock, 2009). NTNU is one of the universities that has the goal of becoming a green university. Because recycling became one of the most popular environmental initiatives at the universities (De Vega et al., 2008); NTNU among other environmental approaches created a project for the environmental friendly handling of waste, with aim to become a unique and outstanding institution (Bjarghov, 2015). All above described examples of becoming a green university are presented on a bigger picture; however, there have been very few studies in the past that tried to look at specific behaviour connected to such actions. Behaviour of individuals, in particular students and employees of the university, is crucial to study for its better understanding and possible planning for making changes that will benefit both humans and the natural environment. In conclusion, this line of research with regards to intervention strategies that targets an investigation of psychological determinants of waste separation behaviour at NTNU is of potential contribution for future research and intervention development.

1.3 Klimafot avfall – NTNU’s project for better and more environmental friendly handling of waste

Norwegian University of Science and Technology (NTNU) is one of the biggest institutions in Norway (NTNU, 2011). The main mission of NTNU is to educate through research, have a positive influence on society and stimulate innovation. NTNU tends to develop science and technology that addresses global challenges (NTNU, 2011).

With regards to global challenges, NTNU’s leadership accepted in 2012 environmental ambitions in four sectors: transport, purchase, energy and waste (Bjarghov, 2015). With cooperation of academic staff, administrative and other employees, students and other institutions and private companies, the leadership of NTNU will aim to reach the goal of becoming a unique and outstanding institution that does not negatively affect the environment while providing our society with high quality education and academic development (Bjarghov, 2015). These ambitions will not only help NTNU to become a more environmental friendly university but also to be more competitive in terms of price and service level against other relative institutions and businesses (Bjarghov, 2015).

One of the first projects in the scheme of environmental ambitions is the project that has the main focus on reducing the universities waste. It is called ‘Klimafot Avfall’ (English translation: Environmental footprint from waste). The ‘Klimafot avfall’ group (project group) at NTNU’s central administration (contact: Wenche Karlseng, Steivor Bjarghov and Elin Sølberg) is introducing a waste separation system to increase the recyclability of the waste produced at NTNU within the next few years (Bjarghov, 2015). Among other targets, the project will focus on implementing various disposal bins for different kinds of waste, reducing the waste of furniture, finding solutions to dispose dangerous waste such as batteries or electronic devices, finding alternative solutions for disposing food waste or reducing the use of paper by using online alternatives. The main goals of the project are:

- NTNU aims to reduce the amount of waste in 2020 by 15% in relation to the level in 2011
- NTNU wants to increase the waste separation process by up to 85% by 2020
- The increase of waste separation would be done directly by NTNU’s employees and students
- The goals and results of NTNU’s waste separation system will be continuously available to employees and students

- Internal waste handling aims to be competitive with comparable businesses by price and service level (Bjarghov, 2015).

Before any action was taken, the project group analysed the waste separation system at NTNU; what was functioning well and what were the new challenges. They also examined how other companies and organizations deal with their waste. In addition, they contacted experts in field from within the university to get advice on what will be good procedure and how it will be the most convenient for users, the operation department and the environment (Bjarghov, 2015).

After the analysing phase, the group proposed a solution for all challenges and they decided to test their proposals in a pilot study before they implement the whole package of changes in all campuses. The pilot study started in April 2014 and lasted for three months. Prior to the pilot study, students and employees in most buildings at NTNU had an option to separate paper and residual waste. This means that paper and cardboards could be thrown in a separate bin which enables to process the fraction further, while everything that was not paper was basically thrown into one common bin. Not only glass and plastic, but even dangerous wastes were thrown into the residual waste. The pilot was supposed to give students and employees more options to separate other fractions such as plastic, glass and metal, batteries and electronic devices, bottles and cans that are returnable (PANT). The project group chose a building for the pilot study which represented most of the typical university aspects; it had lecture rooms, study rooms, laboratories, cantina, various departments and teachers' offices, and also a private company sitting in the same building. The most suitable building for the pilot study was Varmeteknisk Bygg/Kjellhuset at Gløshaugen campus (Bjarghov, 2015).

Strategic points, where people most frequently passed by, were chosen for placing the new waste stations (see Figure 2). Students, employees and guests should have easy access to these stations. The new waste stations are meant to influence users directly, as they represent a signal that something has been changed. The new waste stations are assumed to be raising the awareness about waste separation (Bjarghov, 2015). In most of the waste stations, the users of the building have an opportunity to separate paper, plastic, PANT bottles and residual waste. In the biggest halls and by the entrance, there are stations including bins to separate glass and metal and dangerous waste such as batteries, cables, chargers or small

electrical devices. Maps (please refer to Figure 3) about where to find the nearest waste stations were placed on the walls around the building.



Figure 2: New waste stations at Varmeteknisk/Kjellhuset.

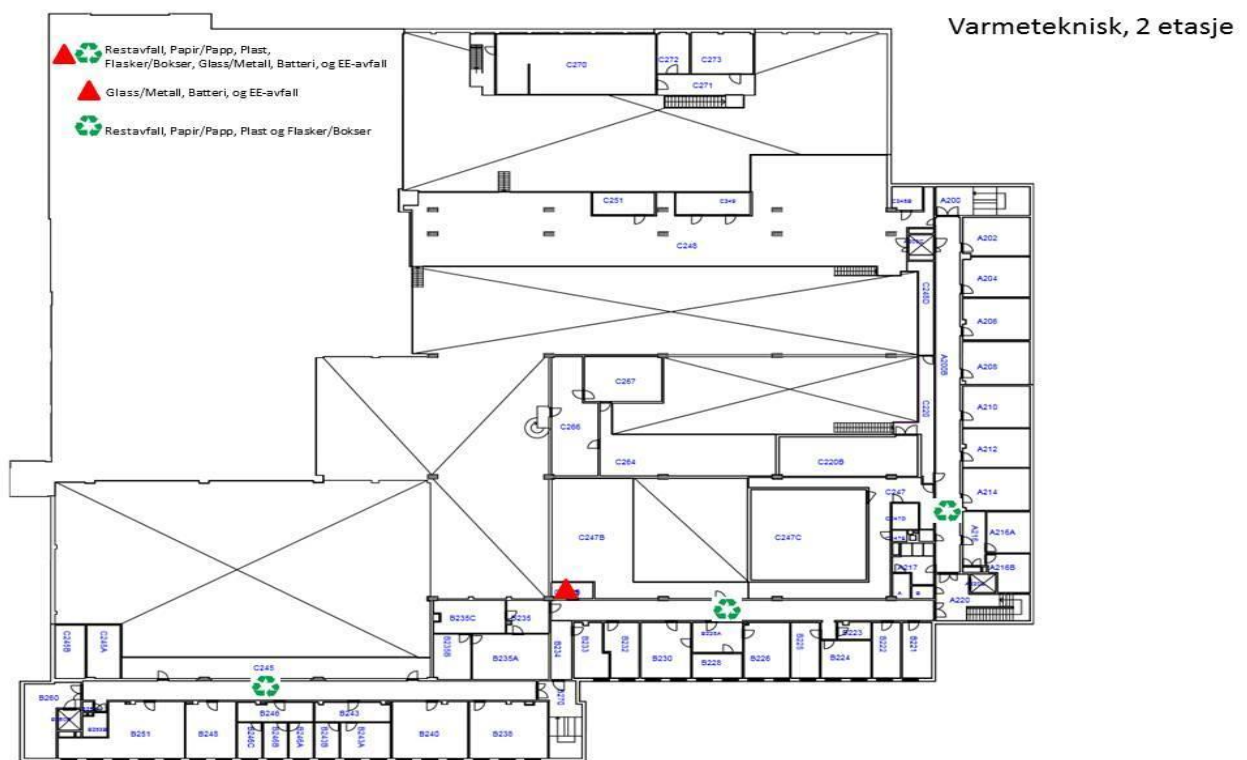


Figure 3: Map indicating where to find New Waste Stations.

Another measure that was tested in a pilot study was the removal of all individual garbage bins inside the offices. All the garbage bins that were inside the private and common offices were removed, so that the users have to come to the waste stations in order to get rid of their garbage. The purpose of this action was that students and employees should not store

garbage in their offices, but they should go out with it to common waste stations and throw/separate it there (Bjarghov, 2015). This will make it easier for cleaners to collect the waste and empty the waste stations faster and more effectively, and they could use the saved time for other tasks. It may also keep the environment of the offices cleaner and fresher (Bjarghov, 2015).

Various kinds of communication were used from project group's side to inform and instruct users of the building about the use of the new waste stations. There were TV-screens with information in the main corridors, flyers (please refer to Figure 4) in the cantina area and information cards from the maintenance crew. The internal website INNSIDA included a wikipage with all kinds of information about the project and informed users about what fractions can be separated into different waste stations, which fractions are not part of the stations but may be disposed of in another place. This website will also provide updated information on which building achieved goals from the project and show actual results. The project group also conducted meetings with employees of NTNU and private companies sitting in the building, and meetings with the reference group which included people from the operations department, users representatives (employees and students), HSE-department, companies renting areas on campus and other resources used by people and cooperating partners. The purpose of these meetings were to provide the employees and other representatives with information about the project and ask them to put ideas and suggestions about the project. They were also asked to spread the information about new waste project further.



Figure 4: Flyers.

The pilot study also tested an IT solution to reuse furniture at NTNU. In addition, project groups inspected the process of the transport of waste from the buildings and tested the most effective and environmentally friendly solutions with the least pick-up locations. Furthermore, they examined possibilities to separate food waste from cantinas and dining areas.

The pilot study is a crucial part of the ‘Klimafot Avfall’ project, as it gives an overview of what is functioning well, and what needs to be changed from the previous project ideas. The evaluation part is very important for the research group to see what conclusions can be made and what solutions are best to implement on all campuses in all university buildings of NTNU.

The subject of my master’s thesis is connected to the waste project ‘Klimafot Avfall’, in particular the interventions this project group implemented with a direct impact on users of the building. I am going to examine the effect of the interventions on the psychological variables for recycling behaviour of employees and students at NTNU and analyse whether the different parts of the intervention had an impact on recycling behaviour and its determinants of the users of the building.

1.4 Research question

This Master's Thesis is exploring the aspects of recycling behaviour of students and employees at The Norwegian University of Science and Technology. NTNU introduced a new waste separation system that started with a three months pilot study. With a connection to the pilot study *Klimafot Avfall*, A paper-based questionnaire was created in order to test the before and after results from the intervention of self-reported waste separation behaviours and its determinants. The purpose of this study is to investigate whether the intervention strategies NTNU implemented had an effect on behaviour and its determinants and if so, whether this was a positive effect towards the increase of recycling behaviour at work. With this in mind, the following main research questions were formulated:

Q1: Was there a difference in self-reported behaviour between the pre and post intervention study? Has the intervention had an effect?

Q2: Which intervention elements were perceived by the participants and which of them were regarded as helpful?

Q3: Did the interventions changed some of the psychological determinants and in which direction?

The next chapter describes the main psychological theories that account for environmental behaviour and are the base for building up the above questionnaire which will measure psychological determinants for waste separation at NTNU and the effectiveness of intervention programs.

2. Theories

In the field of social science, many models were developed to study environmental behaviour. For the purpose of this thesis, four theories were chosen as most theoretically rigorous and well-grounded as well as relevant to the topic. The *Theory of planned behaviour* (Ajzen, 1991), The *Norm-activation theory* (Schwartz, 1977), *Habits* (Verplanken & Aarts, 1999, Klöckner & Verplanken, 2012) and *A comprehensive action determination model* (Klöckner & Blöbaum, 2010) are assumed to be of much relevance for the current study of recycling behaviour. These theories have been applied in hundreds of different behavioural change studies and are well grounded and well applied in a lot of behavioural science areas. The reasons for choosing these theories are variables included in their construct that are believed to be relevant for this topic and the areas of their application that include the study of environmental behaviour, change of behaviour in relation to the environment and recycling. The main constructs of these theories together with examples from recycling studies are presented in this chapter. Given the knowledge gaps in the understanding of the waste separation behaviour at work, it is important to draw on a well-grounded rigorous framework that had been tested and applied in the studies related to waste separation. Hypothesis of the study are provided at the end of this chapter.

2.1 Theory of planned behaviour

In the early 1990's, Icek Ajzen developed a theory that became a major framework for understanding, predicting and changing human social behaviour, the *Theory of Planned Behaviour* (TPB). This theory assumes that intentions are an immediate antecedent towards a behaviour. Intention itself is an integration of variables that are based on the belief about the likely behavioural consequences, the perceived expectations of other people, and the presence of factors that control behavioural performance (Ajzen, 2012). These variables are called attitudes, subjective norms and perceived behavioural control (Ajzen, 2012).

The theory of planned behaviour is in fact an extension of Ajzen and Fishbein's *The Theory of Reasoned Action* (TRA) (Ajzen, 1991) (see Figure 5). TRA argues that behaviour is not preformed automatically or regardless of thoughts, but it follows reasonably and consistently from available relevant information (Ajzen, 1991). Individual behaviour is driven by behavioural intention (Ajzen, 1991). Behavioural intentions are a function of two

main aspects, attitudes and social norms (Ajzen, 2012). Attitude toward behaviour is defined as an individual's overall evaluation about performing behaviour; therefore it predicts and explains an individual behaviour (Ajzen, 2012). Moreover, a major part in one's considerations towards certain behaviour are also social norms (Ajzen, 2012). Subjective or social norms are defined as an individual's perception of whether people important to the individual think that behaviour should be performed (Ajzen, 2012).

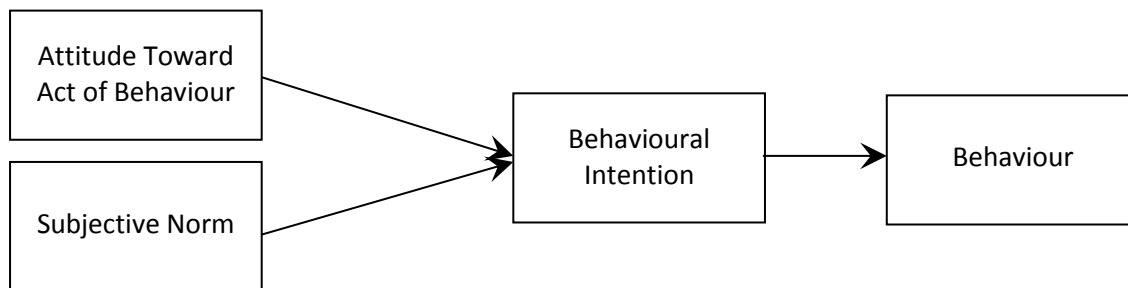


Figure 5: Theory of Reasoned Action. (Ajzen, 1991)

In order to incorporate a wider variety of behaviours into the model, Ajzen (1991) designed the *Theory of planned behaviour* (see Figure 6). This extended theory includes an additional factor to predict intentions and behaviours, the perceived behavioural control (Ajzen, 1991). TPB proposes the model which measures how human actions can be guided (Ajzen, 1991).

The theory of planned behaviour presents **intention** as the immediate factor of behaviour. Intention is the cognitive representation of a person's willingness to perform a given behaviour (Ajzen, 2012). The intention itself is generated by three variables: attitude towards the behaviour determined by behavioural beliefs, subjective norm as a normative beliefs, and perceived behavioural control as a control beliefs (Gangé & Godin, 2000).

Attitude is generally defined as an evaluative reaction towards an object, a person, a behaviour, an issue or an entity (Gangé & Godin, 2000). Attitude is related to or caused by a number of ideas about the object of attitude and it is related to behavioural tendencies (Staats, 2003). Attitudes are enduring and global evaluations of a person, object or issue based on beliefs, feelings, emotions and behaviour (Strathman, Boninger, Gleicher & Baker, 1994; Zimbardo & Leippe, 1991). They can change at some point over a period of time, but they are rather stable and do not change from one day to another (Strathman et. al., 1994; Zimbardo &

Leippe, 1991). Gangé and Godin (2000) define the attitude component in the TPB as the personal evaluation of the behaviour in question. An attitude is a result of not only behavioural beliefs that people hold in relation to behaviour, but also the values attached to the outcomes of the behaviour (Gangé & Godin, 2000). Assuming that beliefs regarding all alternative behaviours are held, a weighting process of the potential outcomes of the behaviour takes place and alternatives become either favourable or unfavourable (Gangé & Godin, 2000). However, only beliefs that are readily accessible to one's memory are concerned (Ajzen, 2012). Intention and behaviour at a given point of time are influenced by attitude, social norms and perceived behavioural control that are guided by beliefs that are considered at that time (Ajzen, 2012).

Subjective norms are a person's own estimate of the social pressure to perform the behaviour (Ajzen, 2012). They are expectations of other people relevant to one about which behavioural alternative should one perform and willingness to comply with the expectations (Ajzen, 2012). In other words, subjective norms are beliefs about how other people would like one to behave. Ajzen (2012) argues that while attitudes and social norms are conceptually independent variables, in practice there is a relationship between them. While it may happen that one holds a positive attitude towards a behaviour and perceived social pressure is in favour of not performing the behaviour, in practice these variables are rarely completely opposite to each other (Ajzen, 2012).

Perceived behavioural control is a measure that captures the extent to which a person has the opportunity and ability to perform a certain behaviour (Ajzen, 2012). It considers how much one believes he or she can perform a behaviour he or she decides to. It is determined by controlled beliefs about the power of both situational and internal factors to inhibit or facilitate the performance of behaviour (Ajzen, 2012). This variable is comprised of two components. Firstly, it is controllability, which measures how much a person has control over their behaviour (Ajzen, 2012). Secondly, self-efficacy which refers to the ease or difficulty of performing the behaviour; how confident a person feels about being able to perform or not perform the behaviour (Ajzen, 2012). Despite existing strong intentions, in some situations behaviour might be difficult to perform and even be dismissed. Under certain conditions, perceived behavioural control can have a direct impact on behaviour; for example, when situational factors change before the behaviour is performed (Ajzen, 2012). Therefore, this variable can be used as a tool to achieve a better realistic prediction of behaviour, in addition to intention (Ajzen, 2012).

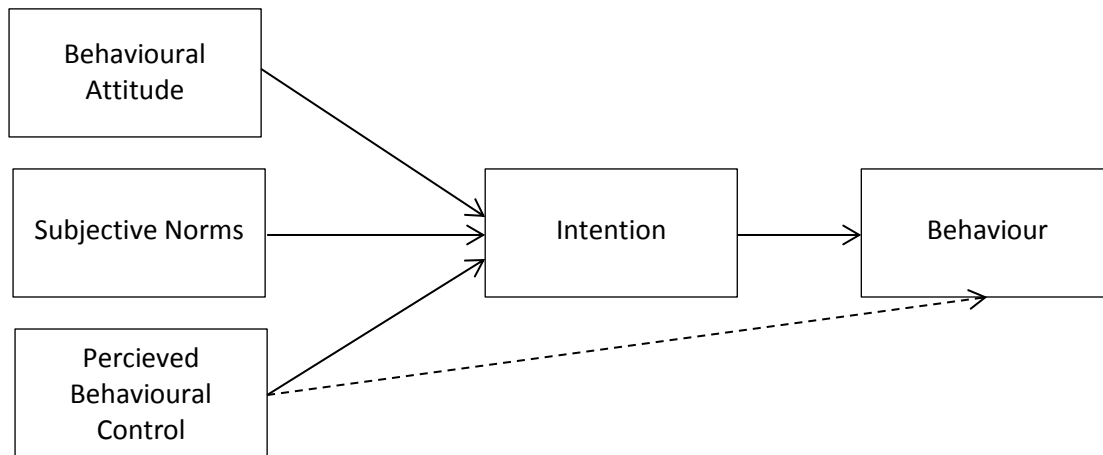


Figure 6: Theory of Planned Behaviour. (Ajzen, 1991, p.182)

Ajzen (1991) emphasized also that there is no fixed hierarchy regarding the relative importance of intentions and perceived behavioural control in the prediction of behaviour. This importance however varies according to situations and behaviours. Ajzen (2012) argues that the intention itself can be an accurate prediction of behaviour as long as control is systematically high so that anyone could perform the behaviour if desired. Nonetheless, the degree of control among individuals may vary, and therefore, both intentions and control affect behavioural performance (Ajzen, 2012).

The theory of planned behaviour has been widely applied in various studies on environmental behaviour, social and sexual behaviour and health, and it is the most popular of the reasoned action models (Ajzen, 2012). Knowledge gathered using this theory provides a basis for effective interventions, aimed at modifying behaviour in a desirable way (Ajzen, 2012). The model is supported by many study applications and analysis about recycling at work and home (Cheung, Chang & Wong, 1999; Manetti, L., Pierro, A. & Livi, S., 2004; Greaves, M., Zibarras, L. D., & Stride, C., 2013; Boldero, 1995; Taylor & Todd, 1995). Mannetti et al. (2004) were studying behavioural intentions concerning household recycling. They also used questionnaires and examined 230 students and young workers. Their results confirm that TPB variables explain a substantial proportion of variance of the intentions to

recycle and that the most important predictor of intentions is perceived behavioural control, while the weakest is subjective norms. Greaves et al. (2013) explored environmental behavioural intentions in the workplace using TPB. Apart from switching off the PC every time an employee left their desks for more than an hour, using the video conference for meetings instead of travel, they also examined recycling in the workplace (Greaves et al., 2013). Having 449 participants filling the questionnaire, TPB constructs explained between a 46% and 61% variant in the level of employee intentions to engage in three environmental behaviours. A variant of 53% in TPB construct accounted for recycling (Greaves et al., 2013). Cheung et al. (1999) applied the theory to examine wastepaper recycling behaviour among college students in Hong Kong. Their data was collected in the form of a questionnaire and had 282 participants. They found out that both behavioural intentions and actual behaviour were predicted by the Theory of planned behaviour constructs (Cheung et al., 1999). They also stressed a difference between perceived difficulty and perceived control, where perceived difficulty predicted behavioural intention and moderated correlations between intention and behaviour and perceived control had no significant effect (Cheung et al., 1999). In the present study the focus will be on PBC and not on the mediating effects of perceived difficulty because the task of waste separation in itself is intrinsically not perceived as 'difficult' but rather whether the person has control over the act itself.

Rivis and Sheeran (2003) suggested another predictor for TPB, **descriptive norms**. They discuss separate sources of motivation towards behaviour and they stress out the significant difference between what significant others think the person ought to do (subjective norms) and what significant others themselves do (descriptive norms) (Rivis & Sheeran, 2003). Based on a sample of 8097 candidates from their literature search, they quantified the relationship between descriptive norms and intentions and found out that there was a medium to strong sample-weighted average correlation between these two variables (Rivis & Sheeran, 2003). According to regression analysis, descriptive norms increased the variants explained in the intention by 5 percent after attitudes were assessed, subjective norms and perceived behavioural control had been accounted for (Rivis & Sheeran, 2003). Descriptive norms will

be included in the variables in the present study; however, in the factor analysis they will be combined with subjective norms because the results from analysis show that they both fall into one common factor. Although TPB is widely applied, there are many significant theories that has been used in the environmental psychology and one of them is the Norm-activation model.

2.2 Norm Activation Model

Focusing explicitly on moral and normative dimensions, *The norm-activation theory* (Schwartz, 1977) was developed with regards to altruism and pro-social behaviour. Schwartz (1977) suggests that people help others if they feel morally obliged to. The main assumption of this theory is that moral behaviours emerge as a result of personal norms, which are the reflexion of the personal value system activated in the situation before emerging the behaviour (Schwartz, 1977). Personal norms have two main constructs, awareness of consequences of one's own actions, and ascription of responsibility as an ability and willingness to accept these consequences (Schwartz, 1977). Norm activation theory focuses strongly on moral drivers for pro-social behaviour (Schwartz, 1977) and its model (Norm activation model, NAM) (see figure 7) includes three main variables, personal norms, awareness of consequences and ascription of responsibility.

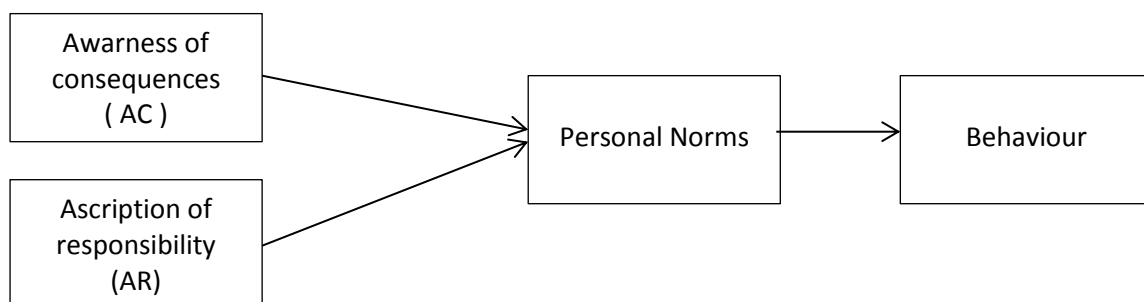


Figure 7: *The Norm-activation Model. (Schwartz, 1977).*

Personal norms are moral feelings about what is right or wrong from a person's own perspective (Schwartz, 1977). Personal norms differ from subjective norms earlier described

in TPB in terms of one's own self-concept. They do not perceive the social concept as social norms would. Even Ajzen (1991) agreed that in some situations and contexts where the need for social pressures is needed to perform behaviour, personal feeling of moral obligation or responsibility to perform the behaviour plays its role.

Two direct prediction for personal norms are **awareness of consequences** (AC) and **ascription of responsibility** (AR) (Schwartz, 1977). AC is knowledge about the consequences of certain kinds of behaviour that might occur after a person performs that behaviour, and AR is the acceptance of responsibility for this behaviour (Schwartz, 1977). Thus, a person needs to be aware of the unfavourable consequences of an action and believe that they pose a threat to others; moreover, he or she needs to acknowledge that his or her actions might avert the situation in order to engage in pro-social behaviour. AC and AR are components that activate the personal norm and that the personal norm has a direct impact on behaviour (Schwartz, 1977). If personal norms are relevant and applicable for the situation, they will activate the behaviour (Schwartz, 1977).

Considering that NAM has been developed to describe altruistic behaviour, a connection to environmentally relevant behaviours might be considered. Thøgersen (1996) mentions that environmental behaviour is not only the result of cost-benefit considerations like it would be when taking into account TPB, but also moral beliefs about what is right or wrong. On this belief he created a link between NAM and behaviours that are relevant to the environment (Thøgersen, 1996). When NAM is applied to pro-environmental behaviour, it suggests that the behaviour occurs in response to personal norms about the environmentally friendly actions. These actions are activated when individuals believe that environmental conditions are at threat and they are aware of the consequences (Thøgersen, 1996). Individuals also believe that their actions could help to prevent such consequences (Stern, Dietz, Abel, Guagnano & Kalof, 1999). Many studies investigating pro-environmental behaviour applied variables from NAM to their study design (Hopper & Nielsen, 1991; Thøgersen, 1996; Hunecke, Blöbaum, Matthies & Höger, 2001). Hopper and Nilsen (1991) tested the model on the recycling behaviour. They examined the extent to which recycling

could be perceived as an altruistic behaviour. In the study with large urban neighbourhood they initiated two interventions (Hopper & Nielsen, 1991). Firstly, they introduced a block leader that would talk to their neighbour about recycling programs and encourage them to separate waste. Secondly, they distributed flyers that introduced recycling programs. They found out that the block leader had the biggest impact on recycling behaviour as it raised people's altruistic norms (Hopper & Nielsen, 1991). Their results proved that Schwartz's altruism model is applicable to environmentally relevant behaviours, as recycling showed to be shaped by moral norms (Hopper & Nielsen, 1991).

With regards to criticism, the norm activation model was expanded by various researchers (Stern et. al., 1999; Steg, De Groot, 2010). *Value-Belief-Norm Theory* developed by Stern et. al. (1999) includes a richer relationship between values, beliefs, norms and attitudes. Steg & De Groot (2010) examine factors of pro-social intentions by four factors; personal norms, awareness of consequences, ascription of responsibility and perceived behavioural control.

Neither TPB nor NAM that are used in number of studies investigating environmental behaviour include the construct for repeated automatic behaviour; therefore, it is important to understand how habits impact recycling behaviour.

2.3 Habits

Many of our everyday routines are rather automatically repeated behaviours instead of processes of weighing pros and cons of the outcome (Klößner & Verplanken, 2012). Individuals do not realize or think about attitudes, beliefs or norms when switching off lights when leaving the room or throwing packages after unpacking groceries but they act rather automatically because such behaviours are performed and repeated very often and became habit (Klößner & Verplanken, 2012).

Habit is an acquired behavioural pattern regularly followed until it has become almost involuntary and it automatically determines future behaviour (Klößner & Verplanken, 2012). Measures of past behaviour are typically found to be significant contributors to measures of future behaviour. Learned, goal-directed acts that become automatic response in specific situations are called habits (Knussen & Yule, 2008). Past behaviour is considered to be part of the construct that forms the future behaviours (Knussen & Yule, 2008). Ouellette and Wood (1998) suggested measuring past behaviour as a reflection of habitual behaviour if the following conditions are fulfilled; firstly, the behaviour was performed relatively frequently (daily or weekly), and secondly, the behaviour was performed in rather stable conditions (in the same environment or same conditions). They measured past behaviour and intentions, and found strong relationships between them if the past behaviour was categorised as habitual (Ouellette & Wood, 1998). Thus, people who performed a behaviour frequently and under stable conditions were more likely to perform the same behaviour in the future. Verplanken (2006) presented evidence that the frequency of behaviour itself does not lead to enhancement of habit automatically. The situation determined reasons might deliberately change the decision making process and be against behaviour becoming automatic. Therefore, stability of the situation is very crucial in forming the habit (Verplanken, 2006).

Klößner and Verplanken (2012) discussed four key features of habitual behaviour: frequency, stability, success and automaticity. Behaviours can be classified as

habits because they were performed frequently (almost every day), under the same conditions (same location or circumstances), they were successful in reaching the intended goals and they are likely to automatically be repeated next time (Klößner & Verplanken, 2012).

When behaviour is performed for the first time the intentions should be the strongest predictor, while the more often the same behaviour is repeated the stronger the influence of habit becomes (Klößner & Verplanken, 2012). When such behaviour is performed only annually, for example, it is strongly predicted by intentions; however, then it is repeated daily or weekly in a stable context the intentions are significantly weaker and past behaviour has bigger influence (Klößner & Verplanken, 2012). Repeating the same behaviour in a stable context creates a link between behaviour and situational cues. When this link becomes strong enough, instead of enhancing the whole process of decision-making it will be enough to encounter relevant cues (Klößner & Verplanken, 2012). Verplanken and Aarts (1999) emphasize that habitual behaviours can be performed unintentionally, uncontrollably, efficiently and without awareness. This automatic processes might be considered positive as it enables people to perform behaviours without focusing on what they do; hence, people can focus on doing something else while performing habitual behaviour (Verplanken & Aarts, 1999).

Habits are constructs that received much attention in environmental psychology. The study of habits is important as it is assumed to be one of the predictors of environmentally relevant behaviour (Thøgersen, 1994; Klößner & Matthies, 2004; Verplanken, 2006; Fransson & Gärling, 1999). In the context of environmental issues, habits are usually conceived as barriers against pro-environmental behaviour. For example, habit of driving car every day instead of taking public transportation, makes it difficult to change behaviour even if the intentions of taking bus are formed (Klößner & Matthies, 2004). Strong old habits usually interfere with pro-environmental intentions and norms. However, it is important to mention that not all habits are against environmental good; for example, habit of taking quick shower instead of bath or turning off the tap when brushing teeth is saving a

lot of water (Gilg & Barr, 2006). Various studies have been made in the context of recycling habits (Ittiravivongs, 2011; Knussen & Yule, 2008; Morgan & Britwistle, 2009; Carrus, Passafaro & Bonnes, 2008). Knussen & Yule (2008) investigated two measures of potentially habitual recycling behaviour: past recycling behaviour and perceived lack of habit as a reason to previous failure to recycle. With their sample of 252 participants they proved that lack of previous recycling behaviour (lack of recycling habits) gives significant contribution to variance of intention to recycle (Knussen & Yule, 2008). Lack of habit improved the attitude-intention relationship (Knussen & Yule, 2008). Those who had failed to recycle because of lack of habit may have had on the other hand habit of treating all recyclables as garbage (Knussen & Yule, 2008).

It is important to mention that habitual behaviours related to environment can be changed (Thøgersen & Ölander, 2006). If interventions are implemented that target properly certain conditions, it might be possible to remove barriers in order to act towards better environment (Klößner & Matthies, 2004).

Looking at all these important frameworks of *Theory of planned behaviour*, *Norm activation model* and *Habits*, it is important to acknowledge the importance of these variables and their impact on behaviour. A comprehensive action determination model is therefore suggested as a way to integrate all the previous frameworks in order to better understand waste separation behaviour at work.

2.4 A comprehensive action determination model

In environmental psychology, different models and theories have been proposed and developed in order to examine and change environmentally relevant behaviours. They contain large variety of variables which help us to explore the aspects of behaviour. Klöckner & Blöbaum (2010) addressed the need for a comprehensive theory that would combine existing theories as more promising approach. They suggested a model that would be helpful to reduce the complexity of environmental psychological theory by integrating the most successful theories into a general theory (Klöckner & Blöbaum, 2010). This model would apply to all behavioural situations by describing all relevant factors influencing behaviour (Klöckner & Blöbaum, 2010). This would not only ease the predictions of behaviour but also it would be easier to plan relevant designs of intervention strategies (Klöckner & Blöbaum, 2010).

“Integrating the major models and theories into a comprehensive model that then could be used as a framework for identifying potentially relevant variables across behaviours and cultures would increase the impact that environmental psychology could have in the debate about mitigation of environmental problems.”
(Klöckner, 2013, p.1029)

Klöckner & Blöbaum (2010) developed the first version of an overall theoretical framework of ecological behaviour based on Theory of planned behaviour, Norm-activation model, habits and Ipsative theory of behaviour. They called it *Comprehensive Action Determination Model* (CADM). As the model assumes, the environmentally relevant behaviour is determined directly by intentions and perceived behavioural control. Moreover, there is third direct predictor of the behaviour, habits (Klöckner & Blöbaum, 2010). While Norm-activation model assumes that personal norms are direct predictor of behaviour, in CAMD the influence of these variables are not direct, but rather mediated by intentional and habitual

processes (Klößner & Blöbaum, 2010). Personal and social norms are considered together with attitudes and perceived behavioural control to be predictors of intentions in a decision making process (Klößner & Blöbaum, 2010). Intention is generated immediately before a behavioural decision is made (Klößner & Blöbaum, 2010). All the above sources, intentional processes, situational processes, habitual processes and normative processes do not exist independently of each other, but they interact with each other over time (Klößner & Blöbaum, 2010). Normative processes have influence on how intentions are formed and they also influence habits because of their temporal stability (Klößner & Blöbaum, 2010). It is assumed that the norm itself creates value system existing for a longer period of time and can potentially be activated in any situation, but not always (Klößner & Blöbaum, 2010). Personal norms can become relevant in generating an intention when awareness of need and awareness of consequences are generated and a necessary perceived behavioural control is fulfilled (Klößner & Blöbaum, 2010). Personal norms are rather stable but their impact may vary according to different situation. However, it is assumed that they may adjust to situational conditions over a long term because norms to behave will change or be deactivated in the long term (Klößner & Blöbaum, 2010). By successfully performing stable behavioural pattern, in a stable situation, habits are generated (Klößner & Blöbaum, 2010). Therefore, crucial variable to establish habits is stable past behaviour. Constructs that demonstrate long-term stability are related to habits. Strong old habits or low perceived behavioural control can interfere the performance of the behaviour even when strong intentions were formed (Klößner & Blöbaum, 2010).

Klößner (2013) has tested the model in a meta-analytical structural equation modelling approach across a large variety of environmentally relevant behaviours. He claim that this model is applicable to a wider range of situations and behaviours while being more general than the individual models (Klößner, 2013). He also includes assumptions about how the variables of different models relate to each other across different model traditions (Klößner, 2013). Additionally, while in the individual models assumptions about relationships between certain variables cannot be made, CADM makes it possible (Klößner,

2013). Based on 56 different data sets that measure a large variety of different behaviours and collected in different countries, Klöckner (2013) was able to produce a strong argument for the validity of purposed model. Supported by the data used for analysis, CADM could be used as “a general model of environmental behaviour which has important implications for how human dimension in global environmental challenges are understood and addressed with interventions” (Klöckner, 2013, p.1036). A comprehensive model explains why some strategies alone will most likely fail and how they need to be combined in order to design a practical intervention strategy to deal with global environmental challenges (Klöckner, 2013).

Series of studies has been conducted which provided good empirical support for the model (Klöckner & Blöbaum, 2010; Klöckner & Friedrichsmeier, 2011; Klöckner & Oppedal, 2011; Sopha & Klöckner, 2011,). Klöckner & Oppedal (2011) tested the model on 697 undergraduate students who were asked to report their degree of participation in the local recycling scheme for paper/cardboard, glass, metal, and plastic in a paper-based survey. They found out that general recycling behaviour is well predicted by intentions to recycle and recycling habits. Perceived behavioural control mediates the influence of the recycling scheme type, distance to recycling containers, and transport mode used to reach the recycling containers (Klöckner & Oppedal, 2011).

2.5 Hypothesis

Based on the TPB, NAM and CADM model this study uses the psychological variables as a framework in formulating the following hypotheses.

H1: Foreseeing an effect of interventions on the participants, it is predicted that there will be differences in self-reported behaviour between the pre and post intervention study.

H1a: The post intervention score will be higher on the self-reported behavioural scale than before intervention in the experimental group.

H1b: There will be no changes in behaviour in control group.

H2: The experimental group will score higher on the scale measuring intention, perceived behavioural control, social norms and personal norms in the post-intervention study. Accordingly, they will score higher on the scale measuring self-reported behaviour at NTNU and habits at NTNU after the intervention. There will be no changes in the control group.

H2a: As predicted by TPB and CADM models, psychological variables such as attitudes, habits at home and behaviour at home will not significantly change after the intervention period.

H3: All of the intervention elements will be recognized and perceived with a significant effect on participants' waste separation behaviour in the experimental group.

The following chapter describes the design of the study, the questionnaire components, the data analysis and processing.

3. Method

The pilot study of the project 'Klimafot Avfall' was conducted at Varmeteknisk/Kjellhuset building at Gløshaugen campus. Intervention strategies were applied at chosen building for the period of three months. The data for this study was collected at the beginning of the pilot period before the interventions were implemented and after the pilot was completed.

3.1 Design of the study

Data was collected by paper-pencil questionnaire and most of the participants were approached in person asking for their participation. Participants were able to opt out of the study at any time with no questions answered and were made aware of the anonymity of the study. Students were approached in the cantina area, in the study rooms, in the PC labs, and during the lecture breaks. Student participants were informed that they would receive small chocolates after participation in order to motivate them to participate. Employees were not offered any treats. Most of the employees received the questionnaire in their university intern mail boxes and they were informed about the study via emails from the secretary. They were asked to return the completed questionnaires to the folder located in the secretary's office. This may have caused some inconvenience for them; therefore, the number of participants from the employees' group was lower than expected. The number of employees that have an office in the experimental building was 85; out of which 33 answered the questionnaire (about 40% of employees).

The questionnaire was created in 2 different versions. This was due to the fact that there were 2 groups, experimental and control, and also because the study was repeated twice, before and after the intervention. The experimental group were people visiting the Varmeteknisk/Kjellhuset building, where the pilot study was conducted. Control group

included people working and studying in the Materials Technology building and Natural Science building, where no intervention was implemented. The control buildings were chosen because they had similar concept as Varmeteknisk/Kjelhuset; they had private and shared offices, study rooms, private companies renting part of the building, cantina, laboratories, etc. One version of the questionnaire was used in the first round in both experimental and control group. The first round was conducted before the intervention started; therefore, there was no need for different types of questions as the waste separation options in both groups were the same. The second round of the study was conducted four months later, when the pilot study was finished and users of the experimental building got familiar with the new waste separation system. In the second round, the same questionnaire was used in the control group, as there was no difference in waste separation conditions in these buildings. Experimental group received second version of the questionnaire in this round, where items about intervention were included.

The samples before and after the intervention were independent from each other. All the participants in both experimental and controlled groups took part in the study only once. This was controlled by the unique ID code they were asked to provide in the beginning of the questionnaire. The study was conducted across two semesters, in spring 2014 and autumn 2014, which means it took place over two academic years. The longitudinal design of the study were therefore impossible, due to the fluctuation of the people in the buildings.

3.2 Sample

The final sample in this study contains 1269 cases. 19 cases were removed from the study prior to analysis because of the lack of data in most of the items. There were 586 females, 645 males and 38 participants who did not specify their gender. The majority of participants, 87.1%, were students, 12.3% were employees of NTNU or other private companies sharing the same building, and 0.6% were visitors. Because of large number of student participants, about 70% of all cases were in the age group between 20 and 25 years old, about 12.6% were under 20, 7.8% were between 26 and 30, 4.1% were between 31 and 40, 2.4% were between 41 and 50, 1.7% were between 51 and 60, and 1.3% were over 60 years old. All data was collected at NTNU's campus Gløshaugen. 48% of participants came to campus 5 days per week and more, about 16% came 4 days per week, 11,5% came 3 days per week, 13,4% came 2 days per week and 8,3% came to the campus 1 day per week.

The sample is described according to different groups (before/after intervention, experimental/control group, status of student/employee, gender) in tables 1 and 2.

Table 1. Number of participants before and after intervention according to gender and experimental group.

Group	Gender	before intervention	after intervention	Total
Control group	Female	111	219	330
	Male	90	192	282
Experimental group	Female	85	171	256
	Male	144	219	363
Total	Female	196	390	586
	Male	234	411	645
Total		430	801	1231

Table 2. Number of participants before and after intervention according to status and experimental group.

Group	Status	before intervention	after intervention	Total
Control group	Student	147	402	549
	Employee	62	28	90
Experimental group	Student	198	358	556
	Employee	33	33	66
Total	Student	345	760	1105
	Employee	95	61	156
Total		440	821	1261

3.3 Questionnaire components and Measures

The main part of the questionnaire was built based on ‘The comprehensive action determination model’ which combines variables in TPB, NAM and habits (Klößner, 2012). The items in the questionnaire were adapted from the previous research projects (Klößner & Blöbaum, 2010; Klößner & Friedrichsmeier, 2011; Klößner & Oppedal, 2011; Sopha & Klößner, 2011). Included items from the model were: attitudes, intentions, descriptive norms, personal norms, subjective norms, perceived behavioural control, awareness of needs, awareness of consequences, ascription of responsibility and habits. All variables for the psychological model were measured by two to four indicators. Items were presented as statements where participants declared to what extent they agree with each statement on a scale 1 to 7. The number of indicators and its Cronbach’s Alpha for each variable is presented in the table 3.

Table 3. Number of indicators for the variables and Cronbach's Alpha.

Variable	Nr. of indicators	Cronbach's Alpha
Attitude	3	0.77
Intention	2	0.84
Descriptive norms	2	0.68
Perceived behavioural control	3	0.77
Personal norms	2	0.86
Subjective norms	2	0.67
Ascription of responsibility	2	0.85
Awareness of needs	2	0.83
Awareness of consequences	2	0.79
Habits at home	4	0.92
Habits at NTNU	4	0.97

Furthermore, self-reported behaviour was measured by series of questions asking participants about their current behaviour at home and at NTNU in terms of separating waste. Each question was divided into sub-questions, according to different fractions that can be recycled, such as paper/cardboard, plastic, glass, metal, food and dangerous waste. Participants reported in these self-rating items about how often they separate these fractions on a scale from 1 to 7, where 1 was never and 7 was always.

As mentioned earlier, there were two versions of the questionnaire. The first version was used before the intervention in both groups and in the control group in the second round of the study. Another version of the questionnaire was used after the intervention in the experimental group where the pilot study was done. In the second version, respondents had to answer whether they noticed or did not notice various interventions that NTNU has done in past few months and how strong was the effect of each noticed intervention on them. The following items were included in the question: new waste stations at Kjelhuset/Varmeteknisk, removal of waste buckets from offices, information cards in canteen and kitchen areas, information on TV screens, meetings with representatives from NTNU/SINTEF, information cards from the maintenance crew, reference group meetings and information in Innsida/Scala. Scaling from 1 to 7 was used where 1 meant no effect on the waste separation and 7 was very

strong effect. This allowed participants to express their own experience and state an efficiency of various types of intervention that has taken place on campus.

The questionnaire also included background data such as age, gender, status of student, employee or visitor and how many days per week does participant come to Gløshaugen campus.

The questions were formulated in English and later translated into Norwegian. It was then printed in both languages, with the majority of prints in the Norwegian version, assuming that most participants were fluent Norwegian speakers. Participants could choose language version that was more convenient for them.

The questionnaire (in English) is presented in appendix.

3.4 Data processing

The questionnaire was created and printed in a computer scanned format. The filled questionnaires were scanned and automatically transformed into SPSS data file. 19 cases were removed from the data set because of the lack of data in crucial variables.

Principal component analysis (PCA) was conducted on data with 1269 cases with oblique rotation (direct oblim). Before the initial analysis, the pre-analysis with separate PCAs for the indicators of each variable was taken in order to check whether items that are assumed to measure the same variable are one-dimensional. All items for the psychological constructs turned out to be one-dimensional when analysed variable by variable. Afterwards a PCA with all items at once was conducted. The Kaiser-Mayer-Olkin measure of sampling adequacy (KMO) was $KMO=.900$, which verified that the patterns of correlations are relatively compact and that factor analysis should produce distinct and reliable factors (Field, 2013). All KMO for individual items were above the accepted limit .5 (Field, 2013). Bartlett's test of sphericity $\chi^2(378)=24159.777$, $p<0.001$, indicated that correlations between

items were sufficiently large for a meaningful analysis. The initial analysis was performed in order to obtain eigenvalues for each component in the data. With regards to Kaiser's criterion that suggests to maintain components with eigenvalue greater than 1 (Field, 2013), analysis resulted with extraction of 6 factors. This criterion refers to an analysis with sample size greater than 250 and average communality value after extraction level higher than 0.6, which in the present analysis is fulfilled. A Scree Plot was used with the aim of supporting the number of extracting factors, which proved to be showing the same result. Based on Kaiser's criterion, with the support of a Scree Plot, 6 factors were extracted for the analysis, which together explain 72.35% of the variance.

Based on the analysis, factors were created for the selected items showing high loading for that factor. When items show high loading for particular factor, it means that it is statistically meaningful for that factor (Field, 2013). The items that cluster on the same factor suggest that factor 1 represents awareness towards the environmental impact, factor 2 habits at home, factor 3 habits at NTNU, factor 4 attitude, factor 5 descriptive and subjective norms and factor 6 represents perceived behavioural control. In general, items clustering on the same components represent a unified dimension. However, for the further analysis of the results for this study there are 2 minor changes to the suggested SPSS components in order to obtain a better comprehensiveness to the data. Two items measuring intentions had loadings on more than one factor; moreover, these loadings were substantially lower than the rest of the factor loadings in the pattern matrix. This split is based on theoretical background with the assumption of intentions being generated by attitudes, norms and perceived behavioural control (Ajzen, 2012). Another two items measuring personal norms, also show rather low loading in the pattern matrix. This can also be explained by the theoretical background with the assumption that personal norms are mediated by habitual and intentional processes. A pattern matrix that features these factors is presented in the appendix (see appendix 3).

In order to test the internal consistency of the items, a reliability test was done for each factor that includes more than one variable, using the measure of Cronbach's α . All Cronbach's α were higher than .77, which according to Field (2013) is high reliability. Factors, variables included and their Cronbach's α is presented in the table 4.

Principal component analysis was also used for analysis of self-reported behaviour at home and at NTNU. With 1269 cases and oblique rotation (direct oblim), $KMO=.741$, $\chi^2(66)=6354.486$, $p<0.001$, criteria are fulfilled and PCA can be applied. Analysis resulted in extracting 3 factors that explained 63.13% of variance based on Kaiser's criterion with eigenvalue higher than 1. Items clustering on the same factor suggest that factor 1 represents waste separation at NTNU, factor 2 represents waste separation at home and factor 3 represents waste separation of food both at home and NTNU. A pattern matrix that features these factors is represented in the appendix (appendix 4). Cronbach's α for the first factor is $\alpha=.85$, for the second factor $\alpha=.76$ and for the third factor $\alpha=.62$.

Items measuring the same aspect, clustering on the same factor, are combined into one variable for that factor for the further analysis.

Table 4. Extracted factors and their variables.

Factor name	Variables	Cronbach alpha
1 awareness of needs/awareness of consequences	<ul style="list-style-type: none"> • I feel responsible for the environmental problems that result from not separating my waste. • Refraining from separating my waste at NTNU is an important problem for the environment. • I feel personally responsible for issues that arise from poor waste separation or lack of waste separation at NTNU. • When I refrain from separating my waste when I am at NTNU, I contribute to environmental problems in Trondheim. • It is really important to do something against environmental destruction caused by refraining from separating my waste when I am at NTNU. • If I separate my own waste at NTNU, I personally contribute to saving the environment 	0.91
2 habits at home	<ul style="list-style-type: none"> • Separating my waste at home is something I do automatically. • Separating my waste at home is something I do without thinking. • Separating my waste at home is something I do without having to consciously remember. • Separating my waste at home is something I start doing before I realize I am doing it. 	0.92
3 habits at NTNU	<ul style="list-style-type: none"> • Separating my waste at NTNU is something I do automatically. • Separating my waste at NTNU is something I do without thinking. • Separating my waste at NTNU is something I do without having to consciously remember. • Separating my waste at NTNU is something I start doing before I realize I am doing it. 	0.97
4 attitude	<p>For me, separating my waste when I am at NTNU, instead of throwing it all in the residual waste, would be...</p> <ul style="list-style-type: none"> • good/bad • useful/useless • unpleasant/pleasant. 	0.77
5* subjective and descriptive norms	<ul style="list-style-type: none"> • Many people who are important to me separate their waste at their workplace or place of study. • I think many people who are important to me expect that I should separate my waste when I am at NTNU. • My colleagues or fellow students at NTNU who are important to me, separate their waste when they are at NTNU. • People who are important to me try to influence me towards separating my waste when I am at NTNU. 	0.79
6 perceived behavioural control	<ul style="list-style-type: none"> • Separating my waste when I am at NTNU is easy for me. • There are conditions that force me to refrain from waste separation when I am at NTNU. • If I wanted to, I could easily separate my waste when I am at NTNU. 	0.77
7 intention	<ul style="list-style-type: none"> • My intention to separate waste when I am at NTNU in next 7 days is strong. • I plan to separate waste when I am at NTNU in the next 7 days. 	0.84
8 personal norms	<ul style="list-style-type: none"> • Because of my principles, I feel personally obliged to separate my waste when I am at NTNU. • Based on values important to me, I feel obliged to separate my waste when I am at NTNU as best as possible. 	0.86

*Subjective and descriptive norms are later in result and discussion chapters referred as Social Norms.

4. Results

A two-way analysis of the variance (ANOVA) was conducted on four independent groups to explore the differences in eight psychological variables earlier extracted in the factor analysis for each of the groups. Two fixed factors in the analysis were used; experimental/control group and before/after intervention group. The results from 2-way ANOVA (F-ratio for interaction effects) are presented in the Table 5.

Homogeneity of variance (assumption that samples are obtained from population of equal variance) for each group was checked by running the Levene's test. When Levene's test is non-significant (p is greater than .05) the variability of scores for each of the groups is similar. If Levene's test was significant, it would suggest that variance of groups are not equal (Field, 2013). Results from Levene's test are presented in Table 5. Looking at significance test, the results suggest that for three variables the Levene's test significant and do not fulfil the criteria for running ANOVA (Behaviour at NTNU $p < .05$, Perceived behavioural control $p < .05$ and Awareness of consequences and Awareness of needs $p < .05$). Andy Field (2013) states that if the assumptions are violated many statisticians recommended some adjustment to correct it. However, he mentions that nowadays people stopped using this approach if they have an equal group size and the samples are rather large (Field, 2013). In the present study, the samples are rather large, in both experimental and control group there was about 200 participants in each group before intervention and about 400 participants in each group after intervention; therefore all variables are considered acceptable in the analysis.

Looking at the effects for each variable, there is significant interaction effect between before/after intervention group and experimental/control group on following variables: Behaviour at NTNU ($F_{(3,1263)}=33.47$, $p < 0.001$), Intention ($F_{(3,1259)}=9.06$, $p < 0.001$), Perceived behavioural control ($F_{(3,1255)}=21.5$, $p < 0.001$), Habits at NTNU ($F_{(1,1239)}=23.75$, $p < 0.001$), Social norms ($F_{(1,1253)}=9.09$, $p < 0.001$) and Personal norms ($F_{(1,1255)}=7.06$, $p < 0.1$). These effects indicate that participants in before and after intervention groups were affected differently by experimental group they belonged to.

To check where the differences between four groups lie, planned comparisons were used, because we already have hypotheses that we want to test (Field, 2013). Mean scores were extracted for each group for each factor and the results are also presented in Table 5. Planned comparisons revealed that after the intervention the experimental group (Group nr.4) had significantly higher mean scores than the other three groups in the variables with significant interaction effect. Participants from the experimental group scored higher on self-reported behavioural scale measuring waste separation behaviour at NTNU after intervention (M=4.221) than before intervention (M=3.395). Control group had similar score in both rounds of study (M=3.637 before intervention and M=3.283 after intervention) which confirms hypothesis H1b. Conclusion can be made that the intervention has improved self-reported waste separation behaviour which confirms hypothesis H1 and H1a. Intention, Perceived behavioural control, Habits at NTNU, Social norms and Personal norms also show the highest score for the group 4 (See Table 5). These results confirm hypothesis H2. Graphical representation of these six variables is shown in Figure 7. The results also show no change in items Behaviour at home, Habits at home and Attitudes, which confirms hypothesis H2a.

Table 5. Psychological determinants with their mean score in four experimental groups, Levene's test and 2-way ANOVA.

Variable	Mean for group (SD)				Levene's test	2-way ANOVA before/after*group
	1	2	3	4		
Behaviour at home	5.373 (.096)	5.390 (.092)	5.250 (.067)	5.410 (.070)	F(3,1265)=.83, p>.05	F(3,1265)=.75, p>.01
Behaviour at NTNU	3.637 (.120)	3.395 (.114)	3.283 (.083)	4.221 (.087)	F(3,1263)=3.18, p<.05	F(3,1263)=33.47, p<.01
Intention	4.452 (.113)	4.541 (.107)	4.264 (.079)	4.932 (.082)	F(3,1259)=.83, p>.05	F(3,1259)=9.06, p<.01
PBC	3.869 (.107)	3.941 (.101)	3.725 (.074)	4.640 (.077)	F(3,1255)= 5.8, p<.05	F(3,1255)=21.5, p<.01
AN_AC	4.366 (.102)	4.350 (.096)	4.291 (.071)	4.520 (.073)	F(3,1243)=6.55, p<.05	F(1,1243)=1.99, p>.01
Habits at NTNU	3.931 (.119)	4.025 (.112)	3.268 (.083)	4.348 (.085)	F(3,1239)=2.10, p>.05	F(1,1239)=23.75, p<.01
Habits at home	5.452 (.097)	5.495 (.091)	5.419 (.067)	5.384 (.069)	F(3,1240)=1.64, p>.05	F(1,1240)=.23, p>.01
Attitude	2.046 (.079)	2.106 (.075)	2.179 (.055)	2.023 (.057)	F(3,1257)=.62, p>.05	F(1,1257)=2.57, p>.01
Social norms	3.404 (.086)	3.415 (.081)	3.472 (.059)	3.922 (.062)	F(3,1253)=.61, p>.05	F(1,1253)=9.09, p<.01
Personal norms	4.505 (.114)	4.380 (.108)	4.403 (.079)	4.793 (.082)	F(3,1255)=1.03, p>.05	F(1,1255)=7.06, p<.01

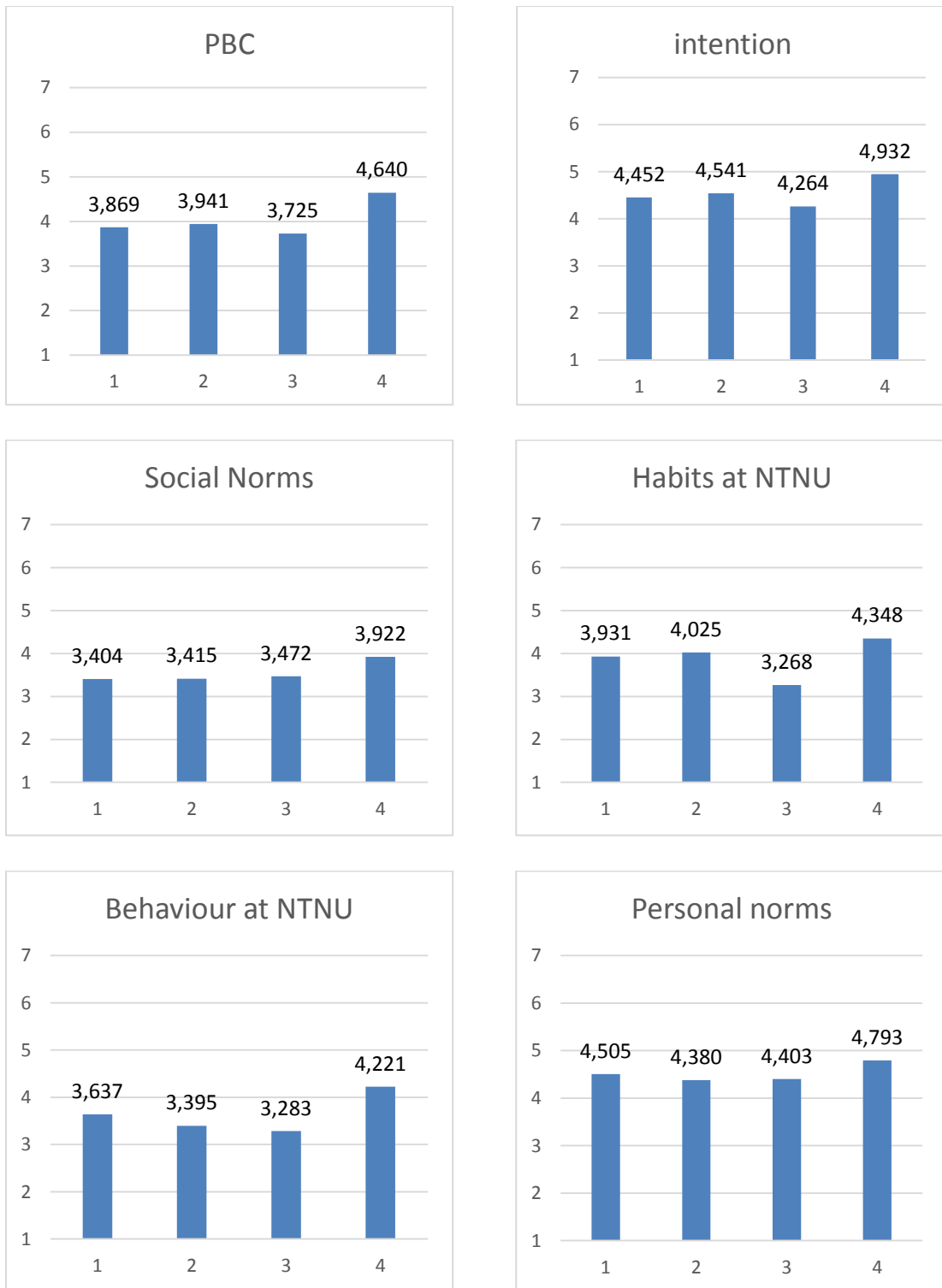


Figure 8: Six variables that had a significant higher score in the experimental group after the intervention. Group 1=Control group before intervention, Group 2= Experimental group before intervention, Group 3=Control group after intervention, Group 4=Experimental group after intervention.

Statistics show that all intervention elements were recognized by both students and employees in the experimental group. The most noticed interventions by students were ‘New waste stations’ (58,8% of participants noticed the intervention), ‘Information on TV screens (43%) and ‘Information cards in kantina’ (41,3%). Among employees, the most noticed interventions were ‘New waste stations’ (87,9%), ‘Removal of waste buckets from offices’ (87,9%), ‘Information cards in kantina’ (72,7%), ‘Information on TV screens’ (72,7%) and ‘Information on Innsida/Scala’ (72,7%). Statistic show that interventions that had strongest effect on participants were ‘New waste stations’ and ‘Removal of buckets from offices’, which implies that physical change in environment has stronger effect on people than provided information via internet, Tv-screens, flyers or meetings. Interventions reported with rather lower effect on participants were ‘Meetings with representatives from NTNU/SINTEF’ and ‘Reference group meetings’ (mean scores for all interventions are presented in Table 6.). These results confirm hypothesis H3 that intervention elements would be recognized by participants in experimental group with a significant effect.

The next chapter discusses the results with relation to psychological background and chosen theories for the study.

Table 6. Number of students and employees in the experimental group with percentage of noticed interventions, mean score for intervention elements.

Intervention	N		% noticed		mean
	student	employee	student	employee	
New waste stations	352	33	58.8%	87.9%	5.48
Removal of waste buckets from office	351	33	24.2%	87.9%	4.86
Information cards in kantina	351	33	41.3%	72.7%	4.64
Information on TV screens	351	33	43.0%	72.7%	4.50
Meetings with representatives from NTNU/SINTEF	350	33	14.0%	45.5%	3.84
Information cards from maintance crew	350	33	20.3%	57.6%	4.32
Reference group meetings	351	33	14.5%	48.5%	4.01
Information on Innsida/Scala	351	33	25.1%	72.7%	4.35

5. Discussion

5.1 The results

The study of this Masters' Thesis aims at investigating if the intervention elements implemented by the project 'Klimafot Avfall' in the Varmeteknisk/Kjellhuset building at NTNU had an effect on students' and employees' recycling behaviour. The purpose of the study is to see whether any psychological determinants have changed after the interventions and a period of three months and in which direction is the change. Moreover, the study is examining which of the intervention elements are most perceived by the participants and which are regarded as effective.

Based on aspects from chosen theories that are broadly applied in environmental psychology (Theory of planned behaviour, Norm-activation model, Habits and Comprehensive action determination model), the questionnaire was formed accounting for content of these theoretical constructs for waste separation behaviour. Hypotheses were formulated according to theoretical construct and practical application of the above theories. The interventions that were used were developed, designed and implemented by NTNU's project group 'Klimafot Avfall'.

The results show that the implemented intervention strategies can be considered as successful. Firstly, there are significant differences in self-reported behaviour between pre and post intervention study in the experimental group. Secondly, participants in the experimental group reported awareness and recognition of the intervention elements and perceived them with a positive effect. The findings of this study show that the most important characteristics and predictors of the waste separation behaviour are intention, perceived behavioural control, habits, social norms and personal norms. These relations imply that firstly, in order to increase waste separation, one needs to perceive a control over the

performed behaviour. Secondly, social and personal norms must be formed, which then mediates intention to perform the behaviour. Finally, by repeating the same behaviour over a period of time, habits can subsequently be created. These findings support the chosen theories for this study.

In relation to the hypotheses, the results support all of them. Following findings support hypotheses:

H1: Foreseeing an effect of interventions on participants, it is predicted that there will be differences in self-reported behaviour between the pre and post intervention study.

H1a: The post intervention score will be higher on the self-reported behavioural scale than before intervention.

H1b: There will be no change in behaviour in control group.

The results show the differences between pre and post intervention study on relation to self-reported behaviour (H1). The experimental group scored higher on the scale measuring self-reported behaviour in the post-intervention study (H1a), which shows the effect of the intervention strategy. Students and employees coming to Varmeteknisk/Kjellhuset building reported to separate more waste after three months of intervention period.

According to results, control group shows no change in behaviour (H1b). The fact that control group shows no difference in the results in pre and post study proves that the differences in experimental group are due to intervention strategies implemented by 'Klimafot Avfall' project group.

H2: The experimental group will score higher on the scale measuring intention, perceived behavioural control, social norms and personal norms in the post-intervention study.

Accordingly, they will score higher on the scale measuring self-reported behaviour at NTNU and habits at NTNU after the intervention. There will be no changes in control group.

H2a: As predicted by TPB and CADM models, psychological variables such as attitudes, habits at home and behaviour at home will not significantly change after the intervention period.

The results fulfil the expectations and fit into theoretical construct of this thesis. This has significant implications for the use of the rigorous theoretical frameworks such as the CADM model when attempting to understand waste separation behaviour. Results show that all the psychological determinants that were expected to be predictors of waste separation behaviour supported the hypothesis (H2). Future research could be aimed at understanding how each of these psychological determinants mediate and impact waste separation behaviour at work.

Firstly, intention to separate waste shows to be stronger in the post-intervention study in the experimental group. Perceived behavioural control, social norms and personal norms also have a higher score in the post-intervention study in the experimental group. This result implies that intervention designs and development should target people using the normative route with strategies such as social acceptance, normative influences and influencing degrees of how much control person has over waste separation behaviour. Control group shows no difference in results in these variables. This indicates that the experimental design of the study was successful and that the interventions designed clearly had an impact on experimental group's behaviour towards waste separation.

According to *Theory of planned behaviour*, **intention** is the main predictor of behaviour (Ajzen, 1991). Hence, change in waste separation behaviour in the experimental group is clearly adjusted by stronger intentions to recycle after intervention period. Intention as immediate antecedent towards behaviour is an integration of attitudes, subjective norms and perceived behavioural control (Ajzen, 1991).

Separate sources of motivation towards behaviour were differentiated by Ravis and Sheeran (2003) when they discussed difference between what significant others think the

person ought to do (subjective norms) and what significant others themselves do (descriptive norms). However, present factor analysis showed that descriptive and subjective norms were falling into one factor, later called social norms. **Social norms** result in combining beliefs regarding the extent to which others want them to perform the behaviour (Ajzen, 2012). In the present study, the results show that participants in the experimental group increased their feeling of social pressure in terms of waste separation at NTNU. It can be assumed that when interventions were implemented and people started to recognize them, they saw that other students and employees started to separate waste, as well as they felt an expectation from others in their environment to behave in a certain manner.

Personal norms, as a feeling of moral obligation and responsibility to perform a given behaviour (Schwartz, 1977), also increased for this group. The assumption that social and personal norms will change after the intervention period has been confirmed. This further indicates the need to focus on a target people's social and normative influences when designing interventions about waste separation at work.

The score for **perceived behavioural control** has also increased in the post-intervention study. Participants felt they have stronger control over waste separation after the intervention period. Availability, accessibility and situational conditions are the main aspects of perceived behavioural control (Ajzen, 1991). The intervention strategy allowed people to access new waste stations on the main strategic points so they can handle their waste easily with possibilities to separate paper, plastic, glass, metal, dangerous waste and residual wastes. Participants believed that they can perform the behaviour better after the intervention period; they had the ability to separate their waste and the waste stations were accessible and easy to find. They had the necessary information from the flyers, TV screens, information emails and other sources about what to recycle and how. The presence of factors that may facilitate the behaviour, the easiness of performing it and the feeling of control over the performed behaviour are the main components of this psychological determinant (Ajzen, 2012). A sense of being in control at work is an important one for waste separation behavioural change and

therefore designing and implementing any interventions should focus on creating a sense of empowerment and control.

Results show that waste separation **habits** at NTNU have increased after the intervention in the experimental group. Regularly repeated behaviour may become habit, involuntary and automatically determined future behaviour (Klöckner & Verplanken, 2012). Therefore, habits were mentioned as an additional predictor of behaviour and included in CADM (Klöckner & Blöbaum, 2010). According to Verplanken and Aarts (1999), habits become automatic behaviours that can be performed without awareness, unintentionally, uncontrollably and efficiently. When students and employees had an opportunity to separate their waste on a daily basis, they acquired this behaviour as a habit; hence the score for habits at NTNU got higher. On the contrary, habits at home did not change. This is due to the fact that habits are not adapted behavioural patterns that are performed everywhere and every time, but they are performed in rather stable conditions – in the same environment and under the same circumstances (Ouellette & Wood, 1998). These findings support hypothesis H2a.

Attitudes are a personal evaluation of the behaviour and they are a result of the belief people have in relation to behaviour and values attached to its outcome (Ajzen, 1991). Number of ideas about the object of attitude or relation to the object is related to the behavioural tendencies (Staats, 2003). It is not only relation to performed behaviour but also values connected to the outcome of the behaviour that are forming the attitude (Gangé & Godin, 2000). The hypothesis H2a predicted no change in attitudes after the intervention period because attitudes are enduring and global evaluations of a person, object or issue based on beliefs, feelings, emotions and behaviour (Strathman et. al., 1994). They can change at some point over a period of time, but they are rather stable and do not change from one day to another (Strathman et. al., 1994; Zimbardo & Leippe, 1991). In the present study, the results show that attitudes had not changed after the intervention period and the score for all the groups are similar. This could be explained by the fact that people in general believe that

waste separation is good and useful; therefore, their attitudes towards waste separation at NTNU did not change after the intervention period.

H3: All of the intervention elements will be recognized and perceived with a significant effect on participants' waste separation behaviour in the experimental group.

All the intervention elements were recognized by the participants and they were perceived with a positive effect on their behaviour which supports the hypothesis H3. Statistics show that four intervention strategies were most successful and received highest score from the participants: new waste stations, removal of buckets from the offices, information cards in cantina and information on TV screens. This is primarily due to the interventions being pre-designed and placed specifically targeting the experimental groups without the target samples needing to do anything in addition to seek out extra information or intervention materials. In other words the interventions were provided and pre-specified to the respondents without them having to make any further efforts such as meetings with reference group or information on Innsida webpage. These afore-mentioned extra information are perceived also with positive effect but with lower score comparing to the former targeted designed intervention strategies. Two main interventions, new waste stations and removal of buckets from offices, has a higher (more positive) attitude score and were most noticed by the participants, which supports the hypothesis that perceived behavioural control had a direct impact on the participants' behaviour. Implication is that when there is a possibility to separate waste at work and it is convenient task, people are most likely to perform the behaviour.

These results support the hypotheses from the chosen theories. This is a significant finding as this clearly indicates a need for utilizing and adapting psychological variables and frameworks when designing and implementing interventions and campaigns to drive change in behaviour. Additionally this study uses the integrative CADM model which provides a deeper understanding of the complexities of intentions towards behaviour and habits. As a theoretical framework, this model has provided a rigorous approach in the understanding of

waste separation behaviour at work. The study however, did not test if waste separation behaviour is dependent on the psychological determinants of the mentioned models. This is a potential opportunity for future research direction.

5.2 Limitations

Before concluding on this thesis's results, weaknesses of the study need to be acknowledged. There are several limitations for the study that call for careful interpretation of the results. Firstly, the intervention strategies were pre-designed by the NTNU's project group 'Klimafot Avfall'. Hence, no possible adjustments or input on the design of the interventions were possible. The project group decided on intervention strategies and the questionnaire was designed according to the proposed interventions. The study was strictly limited to the implemented interventions at one of the chosen building (prechosen by Klimafot Avfall group) at NTNU's campus.

Secondly, because of the limited time for the deadline for this Master's Thesis, long term effects were not possible to examine. If there was more time to conduct the study, more rounds of the questionnaire study would be possible. In such a case, it would be possible to identify any potential long term effects of the interventions. Replication after longer period of time is desired.

The possibility of biases should also be taken into consideration regarding the reliability of the data due to the use of self-reported methods. People may be inadequate when estimating their own abilities and vulnerability (Breakwell, 2007). Perrin and Barton (2001) mention that self-reported recycling behaviour is known to be exaggerated. Hardman (2009) stated that people motivate their reasoning based on positive information about themselves; therefore, based on knowledge about positive effects of recycling, many can overestimate their actions.

Considering the given limitations, careful interpretation of the results is suggested. Future research in this area could be directed at understanding long term intervention and communication strategies effect on recycling behaviour in the workplaces.

5.3 Conclusion

This thesis pointed out the main aspects of psychological determinants in terms of waste separation. The most important psychological variables accounted for waste separation behaviour proved to be intentions, perceived behavioural control, personal norms, social norms and habits. Proper waste separation behaviour of individuals in the workplace can significantly reduce environmental destruction caused by waste produced by humans. This Master's Thesis analysed and discussed psychological determinants for waste separation behaviour based on the interventions strategies implemented by project group 'Klimafot Avfall' at Norwegian University of Science and Technology. In order to analyse the psychological aspects of waste separation behaviour, a questionnaire was designed based on Theory of Planned Behaviour (Ajzen, 1991), The Norm-activation Model (Schwartz, 1977), Habits and A Comprehensive Action Determination Model (Klöckner, 2012). Pre-designed intervention strategies at experimental building were noticed by the students and employees using the experimental building and they were proved to be effective in terms of increased waste separation behaviour based on a self-reported behavioural scale. No difference in waste separation behaviour was observed in the control building. The interventions designed by the project group 'Klimafot Avfall' had an effect on the waste separation behaviour of the participants. The analysis in this study shows that waste separation behaviour is predetermined by the intentions, perceived behavioural control, habits, social norms and personal norms which support the chosen theories for the study. Interventions targeting the increase in waste separation rose participants' intentions to act towards such behaviour. Participants' social and personal norms increased towards the waste separation behaviour and their perceived behavioural control also increased. Habits of separating waste at workplace

also increased among participants from experimental group after the intervention time which suggests that appropriate intervention strategies can create the everyday routines and make pro-environmental behaviour, such as waste separation, automatic for individuals. These results suggest that targeting above mentioned psychological determinants when aiming for a behavioural change, including the increase in waste separation at workplace, is crucial step in achieving satisfactory results.

While results clearly support the chosen theories for the study, further research is suggested specifically for investigating the long term effects of intervention strategies on individuals' behaviour. Applying changes in favour of stopping environmentally-destructive behaviours are good for society, future generations and nature (Bell, Green, Fisher & Baum, 2001). Therefore, studies of humans' behavioural change are very important in consideration of the future of our environment.

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Appendix

Appendix 1: Questionnaire for control group

WASTE SEPARATION AT NTNU

The purpose of this survey is to find out how students and employees at the Norwegian University of Science and Technology (NTNU) separate their waste and what their attitudes towards waste separation are. Survey results will be used in my master's thesis and maybe in a scientific paper.

Participation is voluntary, and all participants are anonymous. Individual answers will be kept confidential, and results will be presented as group data so that individual participants may not be recognised. You may withdraw from the study at any time you wish.

Please note that the deadline for answering is **November 30th, 2014**.

Thank you for your participation,

Monika Tobolova, Master's degree student

Christian Klöckner, Professor, thesis supervisor



<p>PLEASE READ THIS BEFORE YOU START.</p>	<p>This form will be read by machine. Please follow these guidelines:</p> <ul style="list-style-type: none"> • Use a black or blue ballpoint pen. Write clearly, and not outside boxes. Mark boxes like this: <input checked="" type="checkbox"/> • Errors may be cancelled by filling the entire box completely. • Mark one box only per question unless otherwise directed.
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Anonymous ID code: Since this survey is conducted in two rounds, we need an anonymous ID code in order to link your answers from the two survey rounds. For this purpose, please fill in the fields below. Please write clearly, using CAPITALS only in the letter fields.

First letter of your mother's maiden sur-name (i.e., before she married): ⇒	<input type="text"/>	First letter of the name of the place (city, town) where you were born: ⇒	<input type="text"/>
First letter of the name of the first school you were enrolled in as a child: ⇒	<input type="text"/>	The last two digits of your current mobile telephone number: ⇒	<input type="text"/>

1. On the scale from 1 to 7, how often do you usually separate these waste fractions when you are *at home*? ⇒

Note: Please mark one box per line.

	Never	1	2	3	4	5	6	Always	7
1. Paper/cardboard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Plastic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Glass	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Metal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Food	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Dangerous waste (e.g., batteries) ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. On the scale from 1 to 7, how often do you usually separate these waste fractions when you are *at NTNU*? ⇒

	Never	1	2	3	4	5	6	Always	7
1. Paper/cardboard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Plastic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Glass	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Metal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Food	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Dangerous waste (e.g., batteries) ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

KS-14 37-2	E	C	1
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Before continuing, please ensure that you have not forgotten anything on this page.

Mark one box only per question.

3. For me, separating my waste when I am at NTNU, instead of throwing it all in the residual waste, would be ... ⇨
- | | | | | | | | | | |
|----|------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|----------|
| 1. | good | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | bad |
| 2. | useful | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | useless |
| 3. | unpleasant | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | pleasant |

4. On the scale from 1 to 7, to what extent do you agree or disagree with the following statements?
- | | Totally disagree | | | | | | Totally agree | | | | | | | |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1. My intention to separate waste when I am at NTNU in next 7 days is strong | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Many people who are important to me separate their waste at their workplace or place of study | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Separating my waste when I am at NTNU is easy for me | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Because of my principles, I feel personally obliged to separate my waste when I am at NTNU | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. There are conditions that force me to refrain from waste separation when I am at NTNU | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. I think many people who are important to me expect that I should separate my waste when I am at NTNU | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. If I wanted to, I could easily separate my waste when I am at NTNU | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. I plan to separate waste when I am at NTNU in the next 7 days | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. My colleagues or fellow students at NTNU who are important to me, separate their waste when they are at NTNU | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Based on values important to me, I feel obliged to separate my waste when I am at NTNU as best as possible | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11. People who are important to me try to influence me towards separating my waste when I am at NTNU | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

5. I currently sort my waste at home ... ⇨
- | | Separately | Partly | Not at all | Don't know |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| | 1 | 2 | 3 | 4 |
| 1. Paper/cardboard | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Plastic | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Glass | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Metal | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Food | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Dangerous waste (e.g., batteries) ... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

6. When I need to get rid of my waste at home, I separate my waste ... ⇨
- | | Always | Sometimes | Never | Don't know |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| | 1 | 2 | 3 | 4 |
| 1. Paper/cardboard | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Plastic | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Glass | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Metal | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Food | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Dangerous waste (e.g., batteries) ... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

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Before continuing, please ensure that you have not forgotten anything on this page.

Mark one box only per question.

7. I currently sort my waste at NTNU ... ⇨

	Separately 1	Partly 2	Not at all 3	Don't know 4
1. Paper/cardboard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Plastic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Glass	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Metal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Food	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Dangerous waste (e.g., batteries)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. When I need to get rid of my waste at NTNU, I separate my waste ... ⇨

	Always 1	Sometimes 2	Never 3	Don't know 4
1. Paper/cardboard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Plastic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Glass	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Metal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Food	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Dangerous waste (e.g., batteries)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. Separating my waste at home is something ... ⇨

	Never 1	2	3	4	5	6	Always 7
1. ... I do automatically	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. ... I do without thinking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. ... I do without having to consciously remember ..	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. ... I start doing before I realize I am doing it	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. Separating my waste at NTNU is something ... ⇨

	Never 1	2	3	4	5	6	Always 7
1. ... I do automatically	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. ... I do without thinking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. ... I do without having to consciously remember ..	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. ... I start doing before I realize I am doing it	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11. On the scale from 1 to 7, to what extent do you agree or disagree with the following statements?

	Totally disagree 1	2	3	4	5	6	Totally agree 7
1. I feel responsible for the environmental problems that result from not separating my waste when I am at NTNU	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Refraining from separating my waste at NTNU is an important problem for the environment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I feel personally responsible for issues that arise from poor waste separation or lack of waste separation at NTNU	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. When I refrain from separating my waste when I am at NTNU, I contribute to environmental problems in Trondheim	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. It is really important to do something against environmental destruction caused by refraining from separating my waste when I am at NTNU	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. If I separate my own waste at NTNU, I personally contribute to saving the environment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Appendix 2: Questionnaire for experimental group

WASTE SEPARATION AT NTNU

The purpose of this survey is to find out how students and employees at the Norwegian University of Science and Technology (NTNU) separate their waste and what their attitudes towards waste separation are. Survey results will be used in my master's thesis and maybe in a scientific paper.

Participation is voluntary, and all participants are anonymous. Individual answers will be kept confidential, and results will be presented as group data so that individual participants may not be recognised. You may withdraw from the study at any time you wish.

Please note that the deadline for answering is **November 30th, 2014**.

Thank you for your participation,

Monika Tobolova, Master's degree student

Christian Klöckner, Professor, thesis supervisor



PLEASE READ THIS BEFORE YOU START.	This form will be read by machine. Please follow these guidelines: <ul style="list-style-type: none"> • Use a black or blue ballpoint pen. Write clearly, and not outside boxes. Mark boxes like this: <input checked="" type="checkbox"/> • Errors may be cancelled by filling the entire box completely. • Mark one box only per question unless otherwise directed.
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Anonymous ID code: Since this survey is conducted in two rounds, we need an anonymous ID code in order to link your answers from the two survey rounds. For this purpose, please fill in the fields below. Please write clearly, using CAPITALS only in the letter fields.

First letter of your mother's maiden sur-name (i.e., before she married): ⇨ <input style="width: 40px; height: 20px;" type="text"/>	First letter of the name of the place (city, town) where you were born: ⇨ <input style="width: 40px; height: 20px;" type="text"/>
First letter of the name of the first school you were enrolled in as a child: ⇨ <input style="width: 40px; height: 20px;" type="text"/>	The last two digits of your current mobile telephone number: ⇨ <input style="width: 40px; height: 20px;" type="text"/>

1. On the scale from 1 to 7, how often do you usually separate these waste fractions when you are *at home*? ⇨

	Never	1	2	3	4	5	6	Always	7
1. Paper/cardboard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Plastic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Glass	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Metal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Food	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Dangerous waste (e.g., batteries)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note: Please mark one box per line.

2. On the scale from 1 to 7, how often do you usually separate these waste fractions when you are *at NTNU*? ⇨

	Never	1	2	3	4	5	6	Always	7
1. Paper/cardboard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Plastic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Glass	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Metal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Food	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Dangerous waste (e.g., batteries)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Mark one box only per question.

3. For me, separating my waste when I am at NTNU, instead of throwing it all in the residual waste, would be ... ⇨
- | | | | | | | | | | |
|----|------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|----------|
| 1. | good | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | bad |
| 2. | useful | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | useless |
| 3. | unpleasant | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | pleasant |

4. On the scale from 1 to 7, to what extent do you agree or disagree with the following statements?
- | | Totally disagree | | | | | | Totally agree | | | | | | | |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1. My intention to separate waste when I am at NTNU in next 7 days is strong | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Many people who are important to me separate their waste at their workplace or place of study | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Separating my waste when I am at NTNU is easy for me | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Because of my principles, I feel personally obliged to separate my waste when I am at NTNU..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. There are conditions that force me to refrain from waste separation when I am at NTNU..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. I think many people who are important to me expect that I should separate my waste when I am at NTNU..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. If I wanted to, I could easily separate my waste when I am at NTNU..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. I plan to separate waste when I am at NTNU in the next 7 days | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. My colleagues or fellow students at NTNU who are important to me, separate their waste when they are at NTNU | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Based on values important to me, I feel obliged to separate my waste when I am at NTNU as best as possible | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11. People who are important to me try to influence me towards separating my waste when I am at NTNU | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

5. I currently sort my waste at home ... ⇨
- | | Separately | | Partly | | Not at all | | Don't know | |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1. Paper/cardboard | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Plastic | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Glass..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Metal..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Food..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Dangerous waste (e.g., batteries) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

6. When I need to get rid of my waste at home, I separate my waste ... ⇨
- | | Always | | Sometimes | | Never | | Don't know | |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1. Paper/cardboard | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Plastic | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Glass..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Metal..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Food..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Dangerous waste (e.g., batteries) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

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Before continuing, please ensure that you have not forgotten anything on this page.

Mark one box only per question.

7. I currently sort my waste at NTNU ... ⇨

	Separately 1	Partly 2	Not at all 3	Don't know 4
1. Paper/cardboard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Plastic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Glass	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Metal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Food	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Dangerous waste (e.g., batteries) ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. When I need to get rid of my waste at NTNU, I separate my waste ... ⇨

	Always 1	Sometimes 2	Never 3	Don't know 4
1. Paper/cardboard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Plastic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Glass	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Metal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Food	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Dangerous waste (e.g., batteries) ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. Separating my waste at home is something ... ⇨

	Never 1	2	3	4	5	6	Always 7
1. ... I do automatically	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. ... I do without thinking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. ... I do without having to consciously remember ..	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. ... I start doing before I realize I am doing it	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. Separating my waste at NTNU is something ... ⇨

	Never 1	2	3	4	5	6	Always 7
1. ... I do automatically	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. ... I do without thinking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. ... I do without having to consciously remember ..	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. ... I start doing before I realize I am doing it	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11. On the scale from 1 to 7, to what extent do you agree or disagree with the following statements?

	Totally disagree 1	2	3	4	5	6	Totally agree 7
1. I feel responsible for the environmental problems that result from not separating my waste when I am at NTNU	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Refraining from separating my waste at NTNU is an important problem for the environment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I feel personally responsible for issues that arise from poor waste separation or lack of waste separation at NTNU	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. When I refrain from separating my waste when I am at NTNU, I contribute to environmental problems in Trondheim	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. It is really important to do something against environmental destruction caused by refraining from separating my waste when I am at NTNU	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. If I separate my own waste at NTNU, I personally contribute to saving the environment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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E E 3

Before continuing, please ensure that you have not forgotten anything on this page.

Appendix 3: Pattern matrix from PCA featuring factors.

Pattern Matrix^a

	Component					
	1	2	3	4	5	6
Attitude (bad-good)	-.014	.002	-.017	.865	.067	-.007
Attitude (usefull-useless)	-.092	.062	-.002	.815	.026	-.033
Attitude (unpleasant-pleasant) (REVERSED)	.062	-.010	.009	.763	-.041	.071
Intention	.079	.191	.034	-.365	.401	.115
Intention	.091	.178	.014	-.275	.384	.341
Descriptive norms	.042	.002	.022	-.106	.674	.031
Descriptive norms	-.078	.089	-.032	.005	.662	.342
Perceived behavioral control	.040	.228	-.080	.014	.235	.649
Perceived behavioral control (REVERSED)	-.012	-.083	.047	-.002	-.209	.886
Perceived behavioral control	.016	.113	-.068	.076	.229	.733
Personal norms	.209	.197	.089	-.202	.433	-.034
Personal norms	.180	.167	.096	-.264	.437	-.087
Subjective norms	.054	-.058	.061	-.006	.799	-.123
Subjective norms	.047	.019	.030	.118	.744	-.005
Asc. of responsibility	.798	.052	-.083	.056	.109	-.008
Asc. of responsibility	.771	.018	-.078	.086	.158	.009
Awareness of need	.872	-.044	.014	.000	-.004	-.012
Awareness of need	.857	-.011	.037	-.031	-.046	-.036
Awareness of consequences	.880	-.014	.043	-.017	-.061	.055
Awareness of consequences	.746	.007	.082	-.107	-.126	.004
Habits at home	-.005	-.068	.897	-.037	.077	.002
Habits at home	-.024	-.005	.928	.027	.039	.015
Habits at home	-.006	.021	.924	.024	-.007	.001
Habits at home	.027	.089	.826	.025	-.036	.004
Habits at NTNU	.019	.928	-.025	-.019	.002	.029
Habits at NTNU	-.004	.961	.022	.018	-.016	.000
Habits at NTNU	-.019	.982	.036	.024	-.050	-.015
Habits at NTNU	-.005	.977	.024	.021	-.056	-.026

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 9 iterations.

Appendix 4: Pattern matrix from PCA for self-reported behaviour.

Pattern Matrix^a

	Component		
	1	2	3
Paper/cardboard (Frequency at home)	-.153	.715	.213
Plastic (Frequency at home)	-.089	.757	.264
Glass (Frequency at home)	.142	.779	-.195
Metal (Frequency at home)	.105	.802	-.137
Food (Frequency at home)	.010	.189	.800
Dangerous waste (Frequency at home)	.447	.443	-.215
Paper/cardboard (Frequency at NTNU)	.520	.079	.249
Plastic (Frequency at NTNU)	.662	-.040	.308
Glass (Frequency at NTNU)	.899	-.022	-.048
Metal (Frequency at NTNU)	.881	-.051	-.005
Food (Frequency at NTNU)	.449	-.223	.626
Dangerous waste (Frequency at NTNU)	.814	.050	-.141

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 7 iterations.

