

Foreword

Towards Zero Waste

We are convinced that our society is currently undergoing grand change processes. There are signs all around the world, across various levels and domains suggesting a shift of paradigms. Think, for instance, of recent protests in Turkey and Brazil, Occupy Wall Street, the booming domain of social entrepreneurship, countless grassroots initiatives addressing political as well as economic issues, and businesses adapting their business models to accommodate extended requirements that emerge from taking responsibility for social and environmental aspects.

The Good Tribe want to contribute to this kind of change. Our vision is to create a Zero Waste society. Looking at nature we find a world without waste, however, contemporary society created by man is anything but zero waste. Therefore we in The Good Tribe work towards this goal by providing knowledge and tools for businesses and organizations to become Zero Waste, both from a material and social point of view. This paper is one step in the process, intended to inform of an approach that we consider powerful enough to introduce change on systemic level.

There are many different approaches out there that challenge the linear way in which our society works today. For our purposes we consider Zero Waste to be the most comprehensive and best applicable approach. Zero Waste is more than just a principle. It is a philosophy, an economic model, and practical application. Everybody - every individual, organization, or company - can follow Zero Waste's simple principle of the three R's to rethink their consumption patterns and behavior. Zero Waste transcends conventional boundaries by looking at possible solutions for a Zero Waste happy planet from a technological, behavioral, political, and financial perspective.

Zero Waste illustrates the need to not waste any natural resources but also to promote human resources, talent, and capital through social inclusion. This social aspect tends to be underrepresented in the waste discourse since the waste discourse usually remains confined to environmental aspects. In The Good Tribe we explicitly want to highlight the social aspect when

speaking of Zero Waste, because we consider it paramount for a positive development of society. We support our clients in implementing a Zero Waste vision and developing strategies that enable them to adapt to and cope with the changes and challenges ahead. Zero Waste offers great opportunities for businesses, for instance by shifting strategy from turnover coming from an ever increasing number of short-lived products with a combination of durable products and a variety of lifetime services. We also work with public administration providing information and methods to introduce societal change processes, and empowering youth to embrace a sustainable lifestyle and to explore sustainable ways of conducting business.

Our activities in The Good Tribe include a broad range of products and services. With regards to Zero Waste we have organized a field trip that brought Brazilian business people and politicians to Scandinavia offering insights to innovative waste management systems; we are running Lindsberg, a meeting venue in Sweden dedicated to Zero Waste operation; and we are developing Zero Waste Apparel and Zero Waste Jam, both practical examples of Zero Waste circular business models.

Waste and the effects of our take make waste society affect us all. Hence we all need to take responsibility and work together to develop innovative approaches to resolve present and future challenges. Consequently, The Good Tribe works with different target groups by helping them to embrace their individual responsibilities in tackling the waste problem. It is this comprehensive approach and our ability to think outside the box, which enables us to help our clients to successfully operate in a changing world.

Happy Reading,

Saskia Tegnell and Michael Bauer-Leeb
The Good Tribe

Executive summary

Waste is becoming increasingly abundant in the world. Precious resources are being depleted, waste dumping is polluting the environment, and toxins released from the burning and burying of waste are ending up in the water and the air. Zero Waste is a strategy that uses easily understood principles to guide us towards a society without producing waste in the first place. When applying the three R's – reduce, reuse, recycle – and introducing producer responsibility aimed at designing for sustainability and using less toxins in production, a Zero Waste society is possible.

The implementation of Zero Waste strategies leads to a sustainable society and offers an array of opportunities to keep our economies alive and thriving, whilst avoiding both harmful and severe social and environmental side effects. Zero Waste strategies support all three of the goals of sustainability; economic well-being; environmental protection; and social well-being.

Economic well-being is improved by enabling organizations to identify inefficiencies in processes, products, and services and thereby finding cost-saving solutions. Furthermore, Zero Waste offers a chance for a new wave of technological and social innovation, as products and services are redesigned to avoid waste in the first place.

Environmental protection is enhanced by reducing hazardous and solid waste ideally to zero, and by reducing the need for energy generation and fossil fuel extraction.

Social well-being is enhanced through efficiency improvements that allow more resources to be available. In addition, more complete use of resources will create jobs and reprocessing activities. Community spirit will also be enhanced through the fact that people become a part of a system and get closer to the products they consume.

Waste creation is typically linear. Starting with the extraction of raw materials, manufacturing, distributing, consuming, and finally disposing of goods, everything is moving unidirectional to become unused waste buried in landfills or being incinerated, resulting in degradation of virgin materials and ecosystems. In order to achieve a functioning society where all three dimensions of sustainability are met equally, we have to challenge linear economics and the way of life connected to that. The world is already moving in this direction as Zero Waste is implemented around the world, both in companies, communities, and on individual levels.

In order to avoid serious negative consequences on a global scale there is a need for change. A system that works actively and prevents negative consequences in the first place, instead of reacting to and repairing the outcome, is urgently needed. Zero Waste provides a response to this need and moreover can have the power to benefit all of mankind, by integrating social, environmental, and economic perspectives into one approach.



The Good Tribe is a social venture that offers innovative tools to raise awareness and create passion for a Zero Waste society. In a Zero Waste society we care for material resources, as well as human capacity and talent. We address Zero Waste with social entrepreneurship, creativity and fun to make it understandable and accessible. We are active in Sweden and Austria.

www.thegoodtribe.com

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Towards Zero Waste

Introduction

Three years ago the waste collectors in Amsterdam went on strike. In just a couple of days streets were filled with fast food packaging, cigarettes, newspapers, you name it. On the other hand, waste littering the streets is something you see every day in a lot of countries, for instance in Tanzania. In most parts of this country there is no functioning waste management system whatsoever, causing plastic bags and aluminum cans to end up in rivers and in the soil. The complete opposite again can be seen when walking the streets of Monaco. No waste visible here at all, not even a chewing gum sticking to the pavement. Everything is wiped clean and the trash is consequently airbrushed out of the picture, ending up somewhere out of sight.

These examples illustrate the many faces and different aspects of waste in society and what message the visibility of waste in a country sends. The strike in Amsterdam made obvious all the waste that is produced in every big city, and thereby the tremendous consumption of the western hemisphere. An average person living in the EU throws away half a ton of household waste every year [1]. The plastic bags in Tanzania's rivers illustrate how visibly waste is connected to poverty. Huge waste dumps caused by the lack of waste management and illegal dumping of electronic equipment for instance from Europe cause heavy metals to leak into the environment [2,3]. In economically wealthier parts of the world, like in the example of Monaco, waste is not seen at all, this being a classic example of how waste is put out of sight and thereby out of mind in so many countries in the world. For instance almost half of the waste produced in the European Union is still going to landfill [1].

Now, let us imagine our planet without waste. If, no matter where we lived, those thousands of tons of waste now ending up in landfills and incinerators around the world weren't actually resources buried and burned but continued in their material cycle by being reused or recycled and not all forgotten about. Meaning that the waste collectors were actually considered as resource collectors steering the stream of resources to be reused or recycled. Packaging never ended up on the street because unnecessary packaging was never produced and the necessary packaging was made from compostable or recyclable material. If the citizens of developing countries could get hold of their own resources instead of them being taken away and given back in the form of second-hand goods that are not usable most of the times. If they could develop their own resource

“What if instead of living in a waste society we were living in a Zero Waste society?”

Saskia Tegnell & Michael Bauer-Leeb

management system and that way create jobs. Environmental hazards caused by green house gases and toxins from waste burning, burying and dumping could be avoided, new jobs created and our natural resources saved from being diminished, in all parts of the world. What if instead of living in a waste society we were living in a Zero Waste society?

The fact is that ever-increasing amounts of waste affect all of us. Waste production is said to be one of the biggest problems in today's society [1]. We – the one billion people living in the Western hemisphere – produce more waste than ever before in the history of mankind. While human population has increased fourfold over the last hundred years, material and energy use have increased even tenfold in the same period of time. The estimated world waste production is now approximately four billion tons of waste per year, of which only 20% are currently recovered or recycled [4: 156-158]. The rest ends up in oceans, landfills, or incinerators.

The linear way of directing precious virgin materials to consequently lose value and end up as unused and unwanted garbage creates a tremendous waste stream but also diminishes the so far seemingly infinite supply of raw materials [5]. 60% of the major ecosystems that provide virgin materials today are degraded already or used unsustainably [6] and it has been estimated that for instance both lead and zinc are likely to be depleted in approximately 20 years from now [4: 169].

Thus, the pressure from a growing population, continuing urbanization, and shortage of food, resources, water and materials calls for a new approach [4]. If nothing is done a serious shortage of supply and that of critical fuels and resources is the most likely outcome [7].

Zero Waste is an approach that handles the waste issue. What is Zero Waste and how can it be applied? How is it connected to other similar principles? Is achieving a Zero Waste society a realistic goal? These are all questions that are discussed in this paper in an attempt to illustrate the principle of Zero Waste and all its aspects.

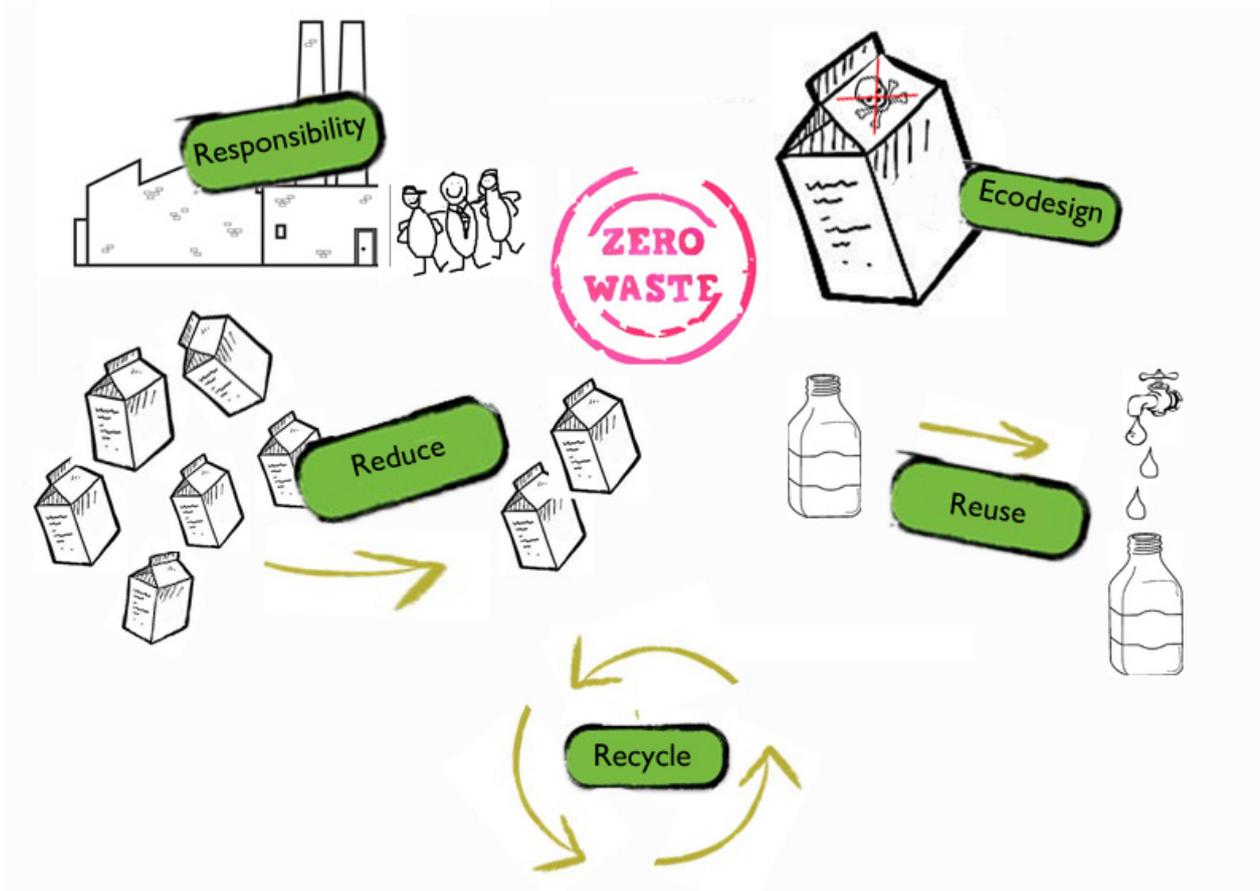


Figure 1 Zero Waste components
Own image based on “Zero Waste” by Robin Murray.

A Zero Waste Society

Waste is a complex problem to deal with, because it involves so many actors on so many levels, thus requiring a collaborative and multidisciplinary approach. Zero Waste is a concept that recognizes this complexity by viewing the matter from several interrelated perspectives: sustainability, behavioral change, consumption, technology, design, efficiency, and governance [8]. Essentially, Zero Waste is a way of thinking and doing by approaching our waste streams in a new way. Instead of considering waste as the remainder of production and consumption a problem which needs to be disposed of, it is rather understood as an opportunity that can be managed [4,9], or in other words moving the attention from the *back*, where waste disposal is managed, to the *front*, where resources are managed [5].

The Zero Waste framework includes the aspects of the “three R’s”; reduction; re-usage; and recycling; as well as producer responsibility and ecological design (see fig 1) [5,10: 3].

Reduce, Reuse, Recycle

Zero Waste uses the three R’s – reduce, reuse and recycle to explain how waste can become a resource. The first R – reduce – is the most important one for achieving a Zero Waste society [4]. It means that waste should not be produced in the first place. Industry has a part in this, as discussed in the next section, but reducing overconsumption is also an important component in order to reduce waste [5]. Even though reduction is the ultimate goal, in reality reusing and recycling waste are equally important in a Zero Waste society. A pile of trash can be seen as a failure but also represents jobs, financial opportunity, and raw material for new products [9]. Waste is simply a misallocated resource ready to be taken care of by recycling and re-usage [4].

Recycling is already widely practiced in many parts of the world and is considered as a way to contribute to “a wider social goal” [10: 42]. Murray makes one thing clear; the recycling done needs to be *upcycling* to have any effect. Most recycling processes known today are actually *downcycling* processes, meaning that product quality decreases after each recycling run. Instead, the production loop should ideally be an upward spiral – adding to the value of raw materials put

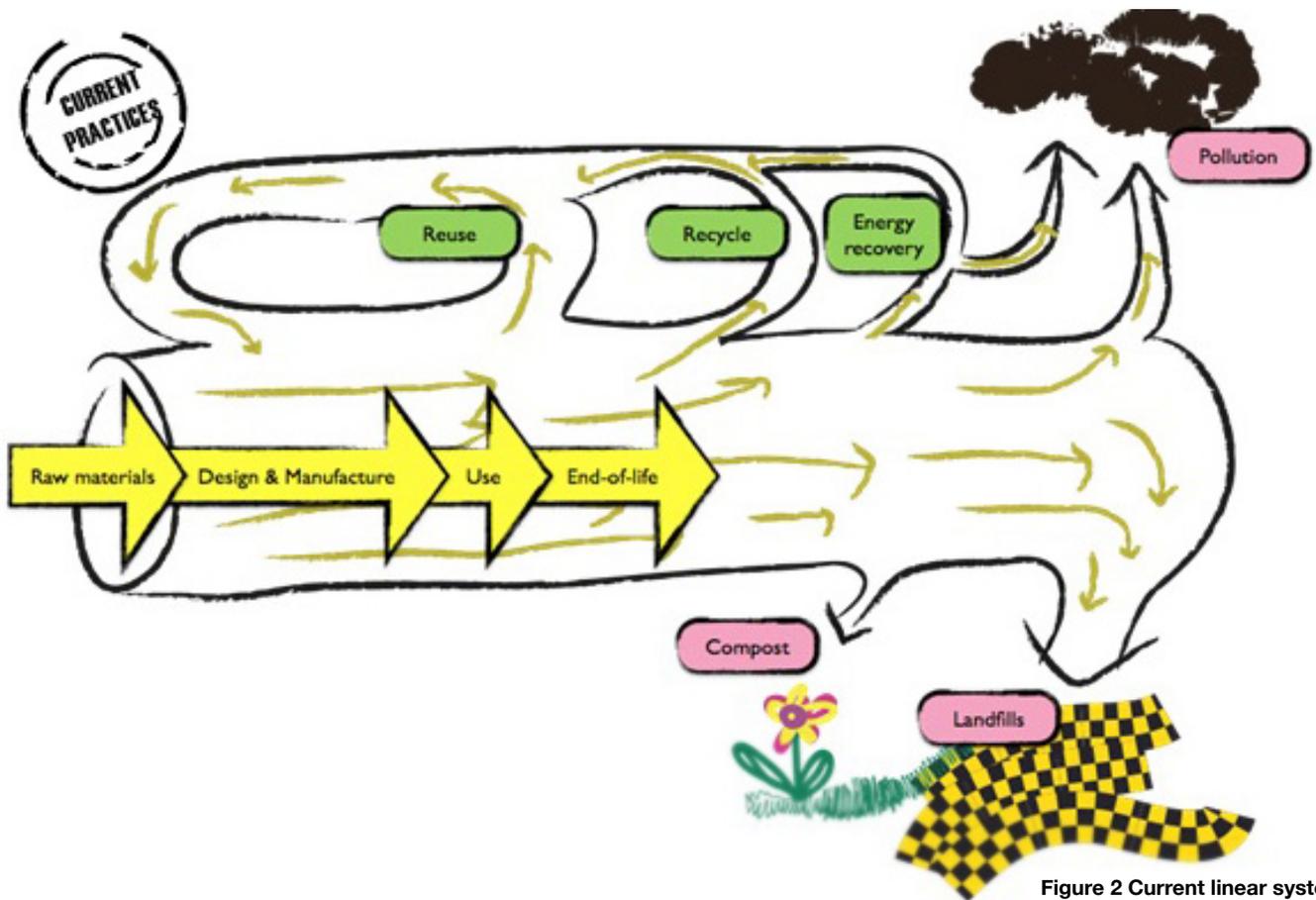


Figure 2 Current linear system
Own illustration based on “The Case for Zero Waste” by Zero Waste Alliance, www.zerowaste.org.

into the product for every time it is recycled. The recycling of rice husks proves to be an example. Rice husks have been found to be an extremely effective fire-resistant building material, therefore this is a case where recycling is mutually beneficial: it adds to the value of the raw material and extends the life of buildings [10: 27]. Creativity and corresponding changes in production are key in this context. Our own creativity is the only limit to finding new ways to reuse and recycle products and the willingness to change industrial production to make upcycling possible.

Producer Responsibility and Ecodesign

Even if recycling is a powerful instrument to reduce waste and uses less energy and materials than production from scratch there is more to be done. Lehmann argues that recycling in itself is not enough; it only delays the rate at which our non-renewable materials are depleted [4]. As it is today, not all products can be recycled. Research has shown that about one fourth of the municipal solid waste stream is not recyclable [11,12]. This is why the three R's need to be combined with a fourth one – responsibility.

Producer responsibility demands from the industry and other producers the obligation to *design for sustainability*. In order for Zero Waste to become possible, products need to be recyclable and/or reusable in the first place. This means that the parts put into a product should be designed for recycling and the product itself designed for disassembly. Further it means that the materials put into the parts of a product need to be reusable or recyclable.

Rethinking the material input to production, so called ecological design (or in short Ecodesign) aims at minimizing resource use and diminishing the amount of toxins that go into a product. Today, one hundred thousand synthetic chemicals can be found in products we use, many of which are toxic. However, these can possibly be replaced by non-toxic substances or be removed [13]. *Clean Production*, striving to avoid using toxins, is therefore an important part of producer responsibility and one of the three basic shifts in production needed for a Zero Waste society, as stated by Murray. The other two are *Sufficient Production* and *Cyclical Production*. Sufficient Production focuses on the material flow going into a product and optimizing this in order to minimize overproduction as well as improving the lifespan of products

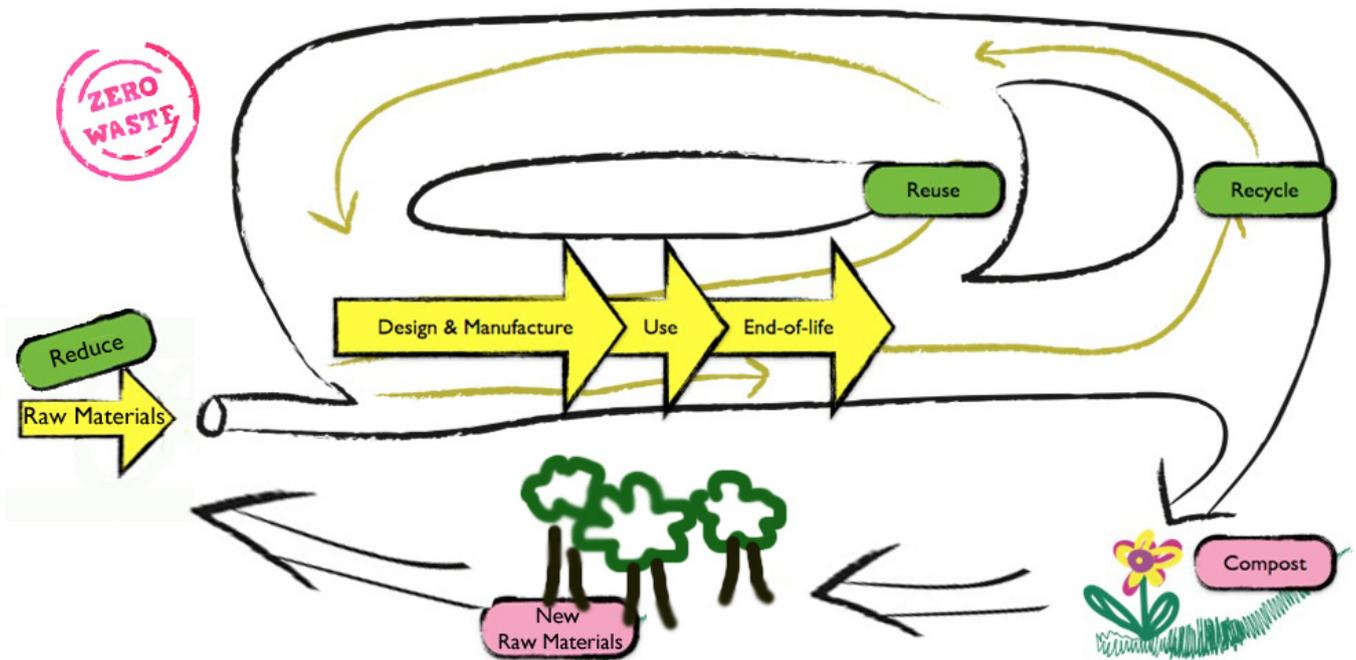


Figure 3 A circular economy used in a Zero Waste Society
 Own illustration based on “The Case for Zero Waste” by Zero Waste Alliance, www.zerowaste.org.

[10], thus avoiding so called planned obsolescence. Planned obsolescence is a way of altering materials or technology put into a product. Thereby the lifespan is often decreased and the demand for the product superficially increased [14,15]. There are many examples of planned obsolescence, one of the most known examples being the light bulb. In North America, 99% of the consumed goods become waste within six months of their purchase [16]. Finally, Cyclical Production, being the last pillar of producer responsibility, stands for thinking of production as a closed loop [10]. This leads us on to the next aspect of Zero Waste and circular economy.

Zero Waste needs a Circular Economy

Although the three R’s and producer responsibility and ecodesign are principles that are at the heart of Zero Waste, it is also a wider concept, including industrial and economic redesign [10: 20]. Numerous measures have been undertaken to address the well-known and documented social and environmental impacts of waste, for instance methane emission and leachate spilling from landfills, uncontrolled waste dumping, or overconsumption. Most of these measures, however, only focus on managing the symptoms and use an end-of-pipe approach. Greyson argues that “[...] the incremental approach of minimizing impacts has not worked and should be replaced [by] an approach which aims to prevent rather than just reduce the accumulation of waste” and “the counter-productive competition between the

economic, social and environmental goals illustrates the need to review and adapt (rather than balance and compromise) ...” [17:1382-1383]. Zero Waste is an approach that meets these requirements by introducing a new way of thinking.

Currently many parts of society promote consumption-centered lifestyles that require continuous material streams, which consequently lead to depleting natural resources and cause severe negative environmental and social impact [5,19]. It is a continuous linear machinery that takes resources, creates toxins, and pollutes the air we breathe, the water we drink, and the food we eat (see fig 2).

The Zero Waste approach challenges this linear system intending to turn it into a circular one where the actual value of resources is recognized and in which all products stay in the cycle and are reused or recycled – a system where nothing ends up as waste [4,5,14,17] (see fig 3). As Zero Waste International Alliance states, “Zero Waste is a goal that is ethical, economical, efficient and visionary, to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use. Zero Waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them. Implementing Zero Waste will eliminate all discharges to land, water or air that are a threat to planetary, human, animal or plant health.” [20]

This definition includes a very important and basic principle in order to achieve Zero Waste; do not burn or bury waste. Burning and burying waste means losing resources that could create new products as well as sustainable job opportunities. Avoiding incineration (burning) and landfill (burying) of waste reduces the amount of green house gases emitted into the atmosphere and reduces the need for extraction of new raw materials and associated emissions. In addition, it allows for initial resource extraction to be avoided in the first place [21,22].

The circular approach can be divided into two cycles, the biological and the technical. In the biological cycle biodegradable material is returned to the environment through composting, and can thereby rebuild depleted soils and in turn create new biodegradable material. In the technical cycle reusable materials, so called technical nutrients, are used and designed in a way that they can remain in the cycle throughout their lifecycle [10:27].

Zero Waste may sound visionary, almost utopian to many people. Yet it is not. First, when we look into nature, we detect no waste. Every bit of waste of one species is food for another. Second, even mankind has seen times during its history where there was almost no waste. Almost everything was used up entirely and almost nothing was left over or discarded as something of no value. Non-renewable resources like minerals and metals have been used but not to the extent we see today. Up until the beginning of the fossil fuel period and the age of industrialization and heavy population growth the flow of materials was – if you will – a closed loop. The smaller human population meant that natural resources were abundant enough not to be depleted and nature could be given time to heal but all materials taken from nature went back to nature [23]. With a growing population of the world where nature does not get time to heal, it is even more crucial to hold on to this circular way of production. In order to accommodate for the increase in population we shall employ technological and social innovation.

This is being acknowledged by more and more people, companies and communities around the world, showing that Zero Waste is applicable in today's society. Zero Waste goals have already been implemented for instance in San Francisco, USA, as well as in the country of New Zealand [23]. The municipality of Capannori in Italy has already achieved Zero Waste by reusing and recycling 92 % of their waste stream and is not stopping there [25]. Global companies like Honda, Bell Canada and Hewlett Packard are aiming towards Zero Waste. In Japan, being one of the first countries talking about a Zero Waste approach, Toyota and Fuji Xerox have been great Zero Waste pioneers [10,22]. Fuji Xerox already achieved Zero Waste to landfills in the Asia-Pacific region in 2009 through their special internal recycling system [26].

Any company, community, or individual can apply Zero Waste in their everyday life. All that's needed is creativity and willpower, and help from smart political incentives [9,27].

Social, Environmental, and Economic Aspects of a Zero Waste Society

Social Aspects of Zero Waste

There are at least three dimensions to be considered when speaking of the social aspects of Zero Waste. First, Zero Waste could help prevent the health issues that waste causes today, and secondly it would increase social wellbeing in terms of access to resources and opportunities [28]. A third social dimension is the Zero Waste approach of using human resources, talent, and capital that are now often ignored.

Health issues connected to waste often relate to emissions from landfills and incineration as well as illegal dumping of waste. Also extraction of raw materials and manufacturing that both use a lot of toxins and benefit from bad working agreements are contributing to health issues in many developing countries [5,14]. These kinds of health issues seem to be especially present for marginalized groups in society. Incinerators and landfills are likely to be placed in areas where marginalized groups live [29: 14-19]. These are also areas that are affected by illegal dumping of waste. People are not only affected by the pollutants emitted into water and air from these dumps but those who are working to retrieve e.g. heavy metals from electronic equipment have no protection against the toxins [2:85-95]. Also in the case of landfills and incinerators a negative effect on air and water quality is observed [10]. As a result these marginalized groups develop higher rates of cancer or other severe health problems compared to the average population. An example is an electronics recycling area in China where 80 % of children suffer from respiratory diseases [2]. In addition, these people typically achieve below average income, are poorly educated about the health effects and have almost no representation among lobby groups. Hence they have a hard time fighting off the operators of these facilities that back their operations with considerably larger financial funds [29:14-19]. Also, developing countries have no way to take care of the waste in a sustainable way and so not only peoples' lives are risked but precious materials are lost and the environment damaged. The illegal waste business has also been seen to be one of the fastest growing areas in organized crime. Thus, this issue is not only a health issue but also one of human rights [2,3].

Concerning the second dimension, a Zero Waste approach would improve access to resources and opportunities and thereby social wellbeing through "...efficiency improvements that allow more resources to be available for all. In addition, more complete use of wastes will create jobs [within the area of] return logistics and reprocessing activities. This can result in waste managers becoming resource managers, opportunities in return logistics and new products from recovered materials" [20].

Greyson adds an aspect to the issue of availability of resources, saying that "there are strong links between linear economies and anti-social activities, such as a need to compete for scarce resources", which leads to uncooperative behavior within a society. This can result in mere bad manners but may also lead to war for a specific resource. He continues that this issue cannot be resolved with the established measures of today – increasing security by backing up police force, building more prisons, and buying more weaponry – because again these measures only manage symptoms instead of tackling the actual underlying cause. Thus, as Zero Waste helps to reduce the scarcity of resources, ideally to a point where all human beings have equal access to abundant resources; it helps to avoid uncooperative behavior [17].

Let us now look in more detail at the third dimension of wasting human resources. Already in the 19th century Oliver Wendell Holmes stated, "The biggest tragedy in America is not the great waste of natural resources, though this is tragic; the biggest tragedy is the waste of human resources because the average person goes to his grave with his music still in him" [30].

Especially within organizations and businesses it is of relevance to look at the human capital, which "refers not only to the output and product of employee labor, but the total innovation potentiality of the employee workforce within an organization. Maximizing yield on human capital investment involves employee motivation, continued learning and resource development, and an organized management philosophy and practice" [31]. To maximize the human capital in an organization therefore means to unleash creativity, passion, and potential within employees. Not doing so therefore is a source of huge waste. A happy employee will be more productive than one that is not [32].

Inclusion and involvement on a community level is another very important component in order to transition to a Zero Waste society. If society fails to include individuals in a meaningful way, an atmosphere of hopelessness and despair develops. This results in giving up on the will to manage pressing issues, like the issue of waste, that society faces today [22]. Social stigma, like segregated neighborhoods and inherited poverty work over a long period of time and on a large scale. Hence consequences of a failed public policy

"Breaking the pattern of overconsumption is necessary to create a society that does not produce waste at all."

Steffen Lehmann

against social exclusion, can in the worst case not only lead to exclusion here and now, but also for future generations [33]. A Swedish study describes how social exclusion affects young people's views on and their expectations for the future. The study shows that young people in segregated areas generally have a less optimistic view of their future prospects than people from other areas, when also taking into account factors such as the degree of education of the parents and family finances [34].

Returning to the concept of waste – the creation of societies where large numbers of youth from certain areas lack positive expectations of their future, is a serious trend both on an individual and a societal level. Furthermore, "[the] world is facing a worsening youth employment crisis: young people are three times more likely to be unemployed than adults and over 75 million youth worldwide are looking for work. The ILO has warned of a scarred generation of young workers facing a dangerous mix of high unemployment, increased inactivity and precarious work in developed countries, as well as persistently high working poverty in the developing world" [35].

As previously mentioned, increased re-usage and recycling is expected to lead to increased job opportunities. In addition, recycling and composting has been proven to contribute to community spirit [22]. In Sweden a survey has shown that 70 % of the Swedish people recycle to be a part of a bigger system and for the sake of the environment [2:42]. Despite this, more needs to be done. Breaking the pattern of overconsumption is necessary to create a society that does not produce waste at all [4]. It is only possible to reach Zero Waste when today's waste is made visible, thereby making us immediately concerned and inspired to do something about it in order to prevent it. After all it is us who have created waste in the first place [5,7].

Environmental Aspects of Zero Waste

There are two main features to consider when investigating the environmental aspects of today's waste producing linear economy. One is the pollution of the biosphere by continuous extraction of raw materials for the production of goods, and the associated transportation, disposal in landfills or incinerators and the dumping of waste in the environment. The other aspect is the loss of biodiversity as a result of pollution, mining and logging operations.

“Incineration converts three to four tons of trash into one ton of ash that nobody wants. Zero Waste converts three tons of trash into one ton of compostables, one ton of recyclables, and one ton of education.”

Paul Connett

Greyson states that, “[nature] conservation is currently a losing battle since the steady dismantling of nature and the loss of resources as wastes is available for free to today’s linear economy. A circular economy would recognize the need to maximize nature’s productive capacity to reprocess all the biodegradable wastes of industrial and human activity” [17:1387].

Establishing a closed loop economy such as described by Zero Waste and other similar concepts would reduce the need to continuously extract virgin materials. Hence, such an approach would reduce the negative effects of mining operations, due to the emerge of higher efficiency in material use, reusing current extracted material, and the substitution of fossil fuels and metals with other materials.

A Zero Waste approach would further decrease the wide usage of landfills and incineration as an end-of-life solution. Therefore emissions of methane and other gases into the air would decrease [4,5,29,36] as well as toxins in the form of leachate from landfills, and sludge and ash from incineration to nature [1,37].

Organics, such as food scraps, currently buried and burned would be composted and the nutrients would return to the soil instead of being polluted through the mixing with other kinds of waste. Long term this would lead to a reduced need for synthetic fertilizers made from fossil fuels. Returning organic material to the soil also reduces erosion and retains moisture. As previously mentioned, raw material resources would be saved and green house gas emissions decreased [4,5,10]. Another possibility is using the biodegradable waste to produce biogas, allowing energy to be gained in the form of fuel from the organic material [1].

As Murray puts it, recycling is a way to avoid waste, unnecessary material production as well as energy usage [10:15-16]. From an energy point of view, there are many studies showing that using recycled materials is superior to using virgin materials as a resource. It has also been shown that recycling as an end-of-life alternative is conserving more energy than extracting energy through waste incineration or from landfill gas [39,40]. For example, recycling PET plastic saves 26 times more energy than is created through burning it. Another extreme example is making products from recycled aluminum which requires only 5% of the energy needed when using virgin aluminum. 50% of the energy is

saved when for using recycled paper instead of virgin wood in the production of new paper. Even if energy necessary for collection, processing and transportation of recyclables is included in the calculation – recycling is more energy efficient than landfilling or incineration [5].

Incinerating waste, or energy recycling as it is often called, is used as a way to solve the waste issue as the waste is used to produce energy. One hardly discussed, though quite important aspect of burning waste for energy production is the fact that one fourth of the waste burned in incinerators turns into toxic ash that requires disposal [5,36]. As Connett swiftly states, “Incineration converts three to four tons of trash into one ton of ash that nobody wants. Zero Waste converts three tons of trash into one ton of compostables, one ton of recyclables, and one ton of education” [5].

Economic Aspects of Zero Waste

Following contemporary understanding of sustainability, social and environmental dimensions constitute two of three pillars. Hence, next to social and environmental impact there is also an economic perspective to be investigated. It is expected that costs for managing the severe negative effects on the environment resulting from waste will rise considerably in the near future. Costs of climate change have been expected to rise as high as five to twenty percent of the global GDP without immediate action, compared to one percent of GDP if counter measures are taken immediately [41] In this context Zero Waste is also crucial from an economical point of view.

Zero Waste presents a broad array of business opportunities, making a transition from today’s linear to a future closed-loop or circular economic system worthwhile. With regards to preventing waste in the first place, as is the primary objective of Zero Waste, there would be an increased need for new designs, better production facilities, and new skills. Today’s short-lived products would be substituted step by step with more advanced and durable products, which would then require a new set of services for refurbishment, repair, and improvement over a considerably longer lifespan. The focus of business could be realigned away from making product after product in ever shorter periods of time towards provision of services, such meeting an entirely new range of customer needs [5,9,17,27]. Such redesigning of products and services could trigger a wave of innovation and provide great opportunities for our economies also by developing new technologies to increase resource efficiency and by making use of waste as raw materials [4].

The need for extracting virgin natural resources would decrease, and the demand for labor would increase, helping to solve the issue of unemployment [5,9,17,27]. The European Union estimates that if its member states would recycle 70% of their waste it would create half a million new jobs. At the same time a lot of the 5.25 billion Euros worth of



	Linear flow of resources from nature to dumps	→	Cyclic flow of resources with minimized inputs and outputs
Systemwide principles	Many environmental costs not accounted for	→	Accounting for environmental costs and benefits
	Lack of producer responsibility for environmental and social impacts of products and packaging	→	Responsibility by producers for the life-cycle impacts of products and packaging, creating incentive to design more benign products
Government principles	Manage waste as taxpayer expense	→	Eliminate waste by holding producers responsible for impact
Raw materials	Emphasis on virgin resources with harvests determined by commodity cycles	→	Emphasis on recycled material use and sustainable harvesting of natural resources
	Trying to manage toxic materials	→	Emphasis on use of non-toxic materials
Manufacturing principles	Some attention to design-for-recycling, clean production, or design-for-environment where public attention is focused	→	Focus on waste minimization, durability, repairability, and recyclability
	Focus on short product lifespan to maximize sales	→	Maximized lifespan of products
	Companies strive to minimize compliance costs with end-of-pipe emission regulations	→	Companies minimize resource use and environmental emissions and use a precycling approach
Distribution and consumption principles	Wholesalers and retailers assume no responsibility for environmental management	→	Feasible products are leased, with ownership retained by the producer
	Consumers select products based on price and quality	→	Consumers select products based on environmental performance, price, and quality and participate in recycling and reuse programs
End-of-life management	Taxpayers bear most costs of disposal, including landfill and recycling	→	Producers bear most costs of disposal
	Secretive and complicated accounting processes	→	Programs create strong incentive to maximize diversion

Table 1: Principles of Zero Waste based on the principles stated by GRRN (source: www.grrn.org)

materials that are sent to landfills in the EU every year could also be saved and the need for virgin material extraction and import would decrease significantly [1].

The above mentioned company Fuji Xerox, said to be one of the pioneering companies actively pursuing Zero Waste, has had a major achievement of their waste free product goals with the diversion of 163 million pounds of material from landfill already in 1999. The energy efficiency features on their products also enabled energy savings of 387 million kilowatt hours that year. Fuji Xerox estimated that their reduce, reuse, and recycle initiatives resulted in a cost savings of USD 47 million in 1999 [42]. Another example of how improved waste management can result in savings is Wal-Mart. Being one of the world's largest retail companies they expect annual cost savings of USD 20 million by recycling waste and diverting it from landfills [43].

A way to diminish waste and extend producer responsibility, discussed above, is selling services instead of products. It is another way of creating new jobs as well as a way to change the way we look at products. Leasing of cars is already a concept offered by companies like BMW, Citroen, and Daimler, but could be extended to include washing machines, refrigerators etc. Further, swapping and sharing is a way to keep products that are already produced in use. Several online sites offer opportunities to swap and share, for instance usetwice.at in Austria, or yerdle.com in the US. Also offline alternatives are available, like so called "umsonstladen" a new concept in Germany, a shop where products are swapped and shared for no cost [44].

Overall, old markets would not be lost when transitioning to a Zero Waste world, because aside from the fact that people still need shelter, warmth, and sustenance there would also be demand for goods and services beyond the fulfillment of basic needs. A service based economy would be a way to decrease the necessity for possession and replace this with a change in culture whereby instead of selling a car you would sell mobility, instead of selling a washing machine, washing service would be provided [10:76-78]. People would still want to watch TV, travel, communicate with their mobile phones, go out for a nice dinner, and so on and so forth. The only thing that would change is how those goods and services were provided [5,9,17,27].

Approaches to achieve Zero Waste

Guiding principles of Zero Waste

Some organizations have developed specific business principles derived from Zero Waste's three R's (Reduce, Reuse, Recycle) that are intended to function as guiding

instruments for companies and communities as they work towards Zero Waste [9,28,38].

The Grassroots Recycling Network provides an overview of Zero Waste principles, at the same time comparing them with principles guiding current practices. Thereby the areas that need to change are specifically highlighted. The typology distinguishes the aspects of eight domains, from system wide principles through government policies, raw material supply, product and packaging design, manufacturing processes, sales, distribution and consumption to end-of-life management. Thereby all the various intertwined actors along the entire value chain and how they should change is described. Also, the necessity of the different sectors and society to take responsibility together in achieving a Zero Waste society is illustrated (see table 1).

Next to these already quite comprehensive guiding principles there are a few more worth mentioning, for instance:

- **Commitment to the Triple Bottom Line** ensures that social, environmental, and economic performance standards are all met. This means that profits are achieved to sustain business, considering social and environmental aspects. In other words, profit maximization (resulting necessarily in overruling social and environmental issues) is replaced with maximization of common welfare.
- **Application of precautionary principles** before introducing new products and processes. This is connected to precycling (see below) and designing for sustainability and means to avoid the production of products and practices that are wasteful or toxic.
- **Buy and use reused, recycled, and compostable products** in all aspects of operations, including production facilities, offices, and in the construction of new facilities. Compostable or degradable materials like natural polymers shall be used in disposable packaging and products.
- **Ensure highest and best value** by continuous evaluation of markets and redirection of discarded products and packaging to recover the highest value of their embodied energy and materials. This should be done according to the following hierarchy: reuse of the product for its original purpose; reuse of the product for an alternate purpose; reuse of its parts; reuse of the materials; recycling of inorganic materials in closed loop systems; recycling of inorganic materials in single-use applications; composting of organic materials to sustain soils and avoid use of chemical fertilizers; and composting or mulching of organic materials to reduce erosion and retain moisture [16,28].

Zero Waste Production Approaches

Different principles are found that apply these guidelines. An example of a form of producer responsibility, called Extended Producer Responsibility, is a principle that attaches responsibility for end-of-life management of a product to the producer of that product. This has already been introduced in the European Union, for instance [1]. Other hands-on suggestions for improved production systems to achieve Zero Waste come from Hawken and Greyson, among others.

Hawken describes a so called “Intelligent Production System” that has to include three basic principles: compostables or reusable material should be used, products should be designed for disassembly and “unsalables” (e.g. toxins and heavy metals) should belong to the original maker. The “unsalables” are suggested to be marked by a molecular marker in order to be able to determine where they come from [16].

Greyson suggests to introduce a precycling insurance, as he calls it. An insurance premium would be connected to the recyclability of a product and would be included in its price. Thus the price signal would help create fair competition between recyclable and unrecyclable products. Every product and service would be treated fairly, and companies assuming social and environmental responsibility would be rewarded through lower premium. Since recycling of the product is guaranteed, waste and pollution from dumping or incineration would be diminished [17].

Zero Waste End-of-Life Approaches

Concerning end-of-life management Murray points out the necessity of involving the community. Recycling and reusing systems should not be too complicated and should combine meaning and quality in order for people to participate voluntarily and actively. Simplicity and convenience are important in this context. Recycling can be made easier through; advice, design of recycling boxes, equipment and containers, and continuous feedback can contribute to an improved system [10:57-58].

End-of-life management or waste disposal can also be improved further by introducing waste analysis centers. These centers will analyze incoming waste streams and conduct research [5,10:64-65]. EU’s “REACH” project is a step in this direction. Its prospect is to put pressure on industry to identify substances they are using in order to help detecting so far unknown harmfulness of components in products. The project will identify such components’ impact on the environment as well as how they can be substituted with chemicals that are harmless or at least less harmful [6].

Zero Waste in relation to other, similar concepts

Zero Waste is The Good Tribe’s approach of choice, however, there are several other ideas, theories, and concepts resembling Zero Waste and that in some form or another address the issue of waste and problems related to the production and management of waste in modern society.

Some of these approaches are formulated as theories intending to promote and establish alternative economic paradigms, for instance circular economy or natural capitalism. Others represent detailed practical approaches, which aim to help organizations implement waste avoiding measures, like Cradle to Cradle or Industrial Ecology. And yet others are management techniques aiming to utilize ever so scarce resources most efficiently, like Resource Efficiency Management.

The selection of approaches we’re providing here is interesting to us but does not constitute a recommendation or preference of any of the presented ideas.

Circular Economy

Circular Economy can be defined as a framework for conceptualizing a new economic model that rethinks the system and supports a sustainable society. The term encompasses a shift from fossil fuels to the use of renewable energy, the role of diversity (e.g. biodiversity) as a main characteristic of resilient and productive systems, correction of price settings to include externalities, and sustainable resource management [46]. The idea is to change today’s linear way of thinking to a cyclical way of thinking, imitating nature where everything is reused and nothing ends up as waste.

Cradle to Cradle

Cradle to Cradle, or its acronym C2C, is a practical application for moving towards a Circular Economy and can be seen as one tool to achieve Zero Waste [47]. Cradle to Cradle promotes the usage of renewable energy and to continuously keep materials in the cycle. Being a biomimetic (life-imitating) approach to the design of systems, it shares a lot of principles with the Circular Economy framework [47]. Cradle to Cradle is particularly applied in companies. The developers of Cradle to Cradle, McDonough and Braungart have introduced a certification program awarding an eco-label to products that follow the Cradle to Cradle principle. Cradle to Cradle is not about minimizing growth, but improving growth by combining rich human experience of good design with environmental sustainability and thereby implementing so called eco-efficiency [48]. An example of a Cradle to Cradle project is Park2020, a fully deconstructable office building being built outside of Amsterdam. A lot of the

material used in construction is not sold but leased, and usage of not reusable materials is avoided as far as possible. In addition, human resources and creativity are valued, resulting in a lot of creative new ideas, another aim that Cradle works towards [48].

Resource Efficiency Management

Resource Efficiency Management can be understood as a strategic principle for corporate sustainable development. The principle addresses the increasing scarcity of resources, rising demand for fresh water, and the growing recognition of the economic value of the environment over and above its potential as simply a source of supplying natural resources. Like Zero Waste, C2C, and Circular Economy, Resource Efficiency Management describes the need of decoupling economic growth from resource consumption, understanding waste as an opportunity, selling services and not products, and highlighting the need to imitate nature's ability to work in cycles. Local production is a further key aspect [49]. Resource Efficiency Management is a more of a guiding and less of a practical approach that focuses on how to use resources in a sustainable manner.

Green Chemistry

There are about a 100.000 synthetic chemicals on the market today making it hard to recycle or reuse many products [13]. Green Chemistry sets out to purify the system from toxins and substitute them with less harmful, often organic, chemicals. This can be achieved in different ways but one of the most important is to identify man-made substances (refer to above mentioned EU project REACH). The Austrian research companies alchemia-nova (www.alchemia-nova.at) and Verpackungs-Zentrum Graz (www.vzg.at) are working with finding solutions for alternative, biological chemicals, and packaging materials. An example of a company making way to a Green Chemistry Production is the German paint company AURO that manufactures paints using only organic primary products. They state that nature has worked for many millions of years to develop an enormous wealth of organic products that can substitute industrially made chemicals commonly used today [50].

Industrial Symbiosis

Industrial Symbiosis (a.k.a Industrial Ecology) is a practical approach to minimize waste streams and resource use by connecting companies to each other. Industrial Symbiosis postulates that one company's surplus can meet another company's needs, thus emulating natural cycles where one species' waste becomes another species' food [51]. Practical examples can be found both on local level, e.g. at so called eco-industrial parks like in the Danish town of Kalundborg (www.symbiosis.dk) as well as at a bigger scale, e.g. the ZeroWIN project (www.zeroWIN.eu), connecting companies in Europe, or the National Industrial Symbiosis Project in the UK (www.nispnetwork.com).

Other Concepts

Other similar concepts worth mentioning that can help transition to a Zero Waste society are:

Blue Economy, www.blueeconomy.eu

Natural Capitalism, www.natcap.org

Bio-cascading, e.g. www.alchemia-nova.net/english/bio-cascading.html

The Ecological Footprint, www.footprintnetwork.org

Common Ground

All of these approaches aim to achieve a solution to the waste and resource problem, rendering the notion of "there is no alternative" meaningless. Though each approach applies its own set of principles, they share a set of specific values, ideas and notions. They:

- view waste as a valuable resource;
- approach a need to imitate the way nature works in cycles;
- critically review and rethink the contemporary interpretation of values of modern society, like consumption, the idea of a good life, and what factors contribute to lasting happiness;
- recognize the complexity and systemic character of the situation, hence arguing that a solution can only take place on a systemic level and requires cooperation across cultural, professional, social, educational, institutional, and geographical boundaries;
- emphasize inclusion and responsibility of everyone in society;
- recognize that nature and culture are intertwined, and that a cultural approach in terms of technological innovation to manage nature without taking care of this very same nature leads to a dead end, for without maintaining biodiversity the very basis of life is going to be irreversibly damaged and eventually destroyed. In short: social innovation is as important as technological innovation.

Barriers to achieve Zero Waste

Even though there are many actors striving towards Zero Waste and other principles that support the idea of minimized waste streams and a circular economy, there are also barriers to achieve Zero Waste. As Zero Waste promotes a transition from linear to circular economy it includes great change. And with change, naturally, come reluctance and opposition, because both organizations and individuals usually do not want to give up long practiced knowledge, beliefs, and behaviors. Hence, establishing a Zero Waste world requires a change of mind by overcoming the inertia of

common viewpoints and practices. Common wisdom needs to be challenged [52].

Like the Zero Waste pioneer grocery store ingredients in the U.S state of Texas that offers local groceries with minimized environmental impact and less packaging describe their mission; “package-free and zero-waste are new frontiers in the grocery industry, so we’re pioneers in relatively uncharted territory. Because of this [Zero Waste] can’t be fully reflected by our business model, since local regulations, consumer demand, public perception, and the norms of the food industry are not aligned in pursuit of a common goal or always interested in sustainability” [53]. The needs to overcome frontiers and to discover uncharted territory are aspects that can be applied to sectors outside the grocery industry as well.

Economic barriers

As of today competition between social, environmental, and economic goals seems to be counter-productive. Ellis describes the situation as the old-school paradigm of “either/or” fighting to be outdated by the new-school paradigm of “both/and”. In other words, the notion of either a company makes profit or it engages in social/environmental activities is being replaced by an understanding that profit and social and environmental aspects are not mutually exclusive but actually go together [54]. Greyson corroborates this notion when he describes the need to overcome conventional understanding that social and environmental needs cannot be met simultaneously with doing business. However, this means challenging the notion of profit maximization, which has been heavily promoted by the dominating economic school of thought throughout the last forty or so years [59,60,61], and move towards a maximization of common benefit – including making profits, but also achieving social and environmental impact [17].

Somewhat related to challenging this kind of economic paradigm is another huge leap to be undertaken in eliminating waste. It concerns moving away from managing symptoms that can only gradually reduce the negative effects, to implementing a scheme for problem prevention in the first place. Hence a leap to address systemic problems rather than symptomatic effects [17]. One of the reasons for the end-of-pipe solutions being in focus today are the governmental subsidies that since the 18th century support mining, logging, and waste disposal industries in many countries around the world. As extracting virgin materials causes serious impact on environmental and social sustainability authorities are increasingly addressing these effects. Often triggered by public pressure, regulations that are intended to deal with these negative environmental and social consequences are issued. However, since the waste management subsidies benefit a certain competitive advantage to enterprises operating in the disposal industry rather side-effects of are dealt with, instead of the source of the problems. Hence, the

transition towards Zero Waste would require authorities to cancel these subsidies, making it profitable to conserve resources instead of wasting them [53]. In order to do this, another barrier appears. Changing from extracting virgin materials to recovering resources from waste would cut into lucrative tax revenues from fossil fuel dependence, resulting in heavy lobbying of beneficial interest groups to not change prevailing rules [17].

Not to forget, managing waste is a huge business also without subsidies and in many countries incineration of waste for heating and electricity is needed. In Sweden for instance incineration is widely spread, and 50% of all municipal waste is incinerated. In order to keep the high demand for electricity and heat generated by the incinerators waste is imported. This has created a system that “gets rid” of the waste but needs the generation of waste in order to function. The question is how a society can succeed in the goal of reducing waste if the infrastructure demands the production of it [2:38-40].

Out of Sight, Out of Mind

Waste burning is linked to another barrier. In countries that are burning or burying waste, the ordinary citizen does not recognize waste a problem. Crocker calls that effect *out of sight, out of mind* [7]. Drawing from Princen’s theory of conceptual distancing he argues that in our Western consumption culture individuals have lost the ability to draw a comprehensive picture of the life-cycle of any particular product or service, being “able to focus only on the consumption phase. [...] Everything else becomes somebody else’s problem. [...] The *stuff* we use and enjoy appears in our lives almost magically.” We do not think about the real costs or impact of production, transport, processing, or disposal of this *stuff*, because the production system works in a way that “skillfully airbrushes the real origin, life cycle, [and] the end-of-life destination of products and services out of the picture” [7:12]. Hagberg reckons this the possibly biggest threat to our environment. The impact of green house gas emissions and toxins into our environment is still not evident to most of us and the burning and burying of waste makes us unable to see how much waste we are creating [2].

The real costs of a product are not visible since not all costs are included in its price. Goods sold carry a misleading price tag. This, together with the thousands of advertisements we see every day triggers the excessive consumption observable in many parts of the world [14]. Often, we don’t actually *need* a new kitchen or another pair of shoes, but we *want* it. Consumption is not only connected to company profits but it is also tightly linked to status. People consume for a social purpose and not only to satisfy basic needs [2:125-128]. In order to get a grip on the kind of impact our consumption patterns have we have to *pay for what we buy* [16]. The scarcity of resources will eventually have to have an impact on prices, but the global chains of mass production have reached a level

“The impact of green house gas emissions and toxins into our environment is still not evident to most of us and the burning and burying of waste makes us unable to see how much waste we are creating.”

Mattias Hagberg

of complexity, which simply hinders the single consumer to comprehend the impact of their choice. Even if we as consumers wanted to do something about the negative effects of this system, we cannot due to insufficient information making it impossible for us to act with any degree of certainty [6,7].

Misunderstanding - Recycling Is Enough

While globally only 20% of waste is being recycled, in Austria, for example, this rate has increased over the last 15 years from 55% in 1998 to 63% in 2009 [55]. In Austria, the amount of residuals going to landfill or being incinerated have remained stable, seemingly letting Austria appear to have somewhat already reached the goal of waste reduction. Some EU member countries have achieved a quote of up to 80% of some recycling materials and an average of 40% [6].

However, as important these figures may be, there is still a long way to go in order to become Zero Waste. Because the same data showing the improvement in recycling also show that efforts for waste prevention must be considered failed, as the total amount of waste has continuously increased and is expected to further increase in the future. For instance the amount of domestic waste in Austria has grown from 3.1 million tons in 1998 to 3.85 million tons in 2009, which translates to a rise of more than 24%. Not only domestic waste is expected to increase. Other types of waste like building materials, waste from logging and mining operations, industrial waste, ashes and sludge, and other residuals are expected to further grow by more than 10% until 2016, as compared to data from 2009 [55].

One approach to tackle the waste problem is introducing technological innovation. This, however, might lead to an unwanted consequence, the so called Jevons paradox, also known as rebound effect. Lehmann and Crocker provide a description of the paradox and illustrate it with an example; “[...] an increase in the efficiency of using a resource frequently leads to an increased use of that resource rather than to the desired reduction. [...] for example, doubling the efficiency of food production per hectare over the last fifty years [...] did not solve the problem of hunger. Instead, this increase in efficiency increased production and, paradoxically, worsened hunger because of the resulting increase in population” [18:5]. Also Hagberg illustrates this

by taking a look at the recycling process. It has been seen that recycling itself does not necessarily change consumption patterns. Let the action of recycling a milk carton illustrate this; one feels acting environmentally friendly, but does not per se let one switch to other perhaps more environmentally sustainable packaging. Thus, recycling needs to be more than a demonstration of morality, and the basic issues of overconsumption should be addressed in order for the waste stream to stop growing [2:58].

How can Zero Waste be possible?

Two very important questions remain now:

- How can we change to Zero Waste in such a consumer-driven, economic growth-focused society?
- How do we tackle the complexity of the subject since it demands so many different skills and so much knowledge across conventional boundaries? [56]

According to Greyson Zero Waste is frequently “misinterpreted as unrealistic since it cannot be achieved with today’s economic approach” [17], which conceives material flow as a linear stream. We need to step outside the box and start thinking of a closed loop economy. Even if this is great change there is knowledge and information available that can guide towards closed loop economic thinking like Blue Economy and Natural Capitalism, both mentioned above. The question remains if it is possible to change the linear economy to a circular one and if eliminating waste is possible. This should not be seen as the issue though. As Bill Sheehan of the Grass Roots Recycling Network says, “Zero Waste is a design principle. If we plan for eliminating waste, whether we reach 100% elimination is not the point. The point is to start planning for the elimination of waste rather than managing waste” because we are heading towards a future where resources are depleted, our environment damaged and the waste stream is continuously growing.

Community involvement key to overcome barriers of Zero Waste

When looking into both scientific knowledge and practical advice, a lot of ideas and approaches are presented to achieve a Zero Waste society. It seems that many of the actors providing information how to approach Zero Waste agree on one particular and apparently most important advice: involving the community [7,9,17,18] In the introduction to their latest book *Designing for Zero Waste* Lehmann and Crocker state that “the most successful [...] projects related to sustainability and behavior change are probably those in which the community is involved and those that enable participants to identify with the outcomes of their activities” [18:5].

“Engagement thus requires three parallel approaches; taking responsibility on governmental, business, and individual levels.”

Paul Connett & Robert Crocker

A great example of people’s involvement is the community of Halifax where the building of a new incinerator in the 1990’s made citizens heavily disapprove. In the wake of the protests public administration gave citizens responsibility to come up with alternatives and provided experts the community could consult with. Community citizens adopted a plan for source separation and collection of waste into recyclables, organics, and residuals, allowing for improved processing of the waste stream. After five years Halifax had achieved a 50% diversion rate, created 1000 new jobs directly through collection and residual treatment, and a further 2000 jobs indirectly in industries reusing the collected material, keeping most of revenues and tax money in the community [5]. A very similar story is the one of Capannori in Italy, mentioned already as an example above. Also here a planned incinerator made people protest. Local politicians accepted the protest and in turn challenged the citizens to provide an alternative for waste management. They did and today, Capannori has reached a 92 % recycling and reusing quote and is working actively towards Zero Waste [25].

Information and education are key in involving people and overcoming barriers. However, it is most important to provide information and education about Zero Waste in a way that makes it simple to understand and easy to apply. One of the main challenges is the awareness building process on different levels of society. Often, the majority of terms used when talking about this area are rather academic, thus excluding a huge amount of people that do not have the same access to higher education. To be able to engage the broad mass of people, the movement and its intentions need to be easy to communicate, conveying both a clear message and goals [27]. However, there are also critical voices claiming that providing information and education and raising awareness are only a first step. For instance, Greyson remarks that providing information does not equal dialogue, and raising awareness does not equal changing behavior. On the other hand he states that the need for change is growing with the worsening impacts our behavior has on the planet. Good news though is that the inventiveness of human beings seems to be infinite. Creativity only needs to be directed in sustainable direction and the will for change has to be there [17].

The Three Pillars of Responsibility

Both Crocker and Connett also describe that there is more to be done than improving communication and information about Zero Waste. It is only one out of three pillars that are needed to establish a Zero Waste society. Engagement thus

requires three parallel approaches; taking responsibility on governmental, business, and individual levels [5,7]. The Grassroots Recycling Network strengthens this argument, claiming that “Zero Waste requires the need for dual responsibility. First, the community has to maximize reuse, repair, recycling and composting, and secondly industry has to redesign the objects the community cannot reuse, repair, recycle or compost. And, of course, both industry and the community need to reduce wasteful practices like [excessive] packaging and overconsumption” [22]. As of today the larger part of the responsibility is put on the individual. Little investment needs to be directed towards telling people to save energy and make educated consumer choices. However, individuals soon reach systemic boundaries, because they only are offered limited choices from both governments and businesses. For instance, if there is no public transport available, it cannot be chosen, though it often would be the better option compared to taking the car. If there is no washing machine available, which has a life cycle of a hundred years and is affordable to be repaired, it cannot be bought. There needs to be engagement from all parts of the society [5].

A social, environmental, and economic approach in the municipality of Castelbuono, Italy, has shown for some time now that outside of the box thinking can overcome barriers. A win-win-win situation for people, environment, and business was created introducing a true Triple Bottom Line project. The recovery of a traditional donkey-breed from Sicily was linked with the challenges of the waste collection in narrow streets and social work to reintegrate people into society. The donkeys are used in the collection of domestic waste, and they are handled by socially excluded people, who have or have had addiction or mental problems. Not only is this a way of helping the socially excluded by providing them a special kind of therapy that involves contact with animals, it also has become a tourist attraction bringing revenues for local businesses and tax income for the city. Overall, the municipality has achieved balanced accounts in waste collection and treatment, has fewer expenses in subsidies to socially excluded people and has very high rates of integration to society, and is recovering an important part of its culture and even creating a tourist attraction at zero cost [58].

Behavioral change

One approach to avoid the *out of sight out of mind* problem stated above is to make waste visible. Clearer price signals are possible by integrating more aspects of the lifecycle of a product into the price. Some information, like lifecycle analysis and production facts, is already popping up on some consumer goods. Research has shown that consumer patterns can change if information is given on lifecycle costs and costs of resource use in a product [6].

“Making waste what it is – a “verb and not a noun” is possible because “bearing in mind the needs of the future generations, how much waste do you think is acceptable?”

Paul Connett

The behavior of making waste is further linked to design. Many products are not designed for reuse [8]. Hence designers have a key role in the change process to a Zero Waste society – we need to design waste out of the system. For that it might be useful to recall a design principle formulated in the 1960s. It was called the “three L’s concept” and would, if applied today, have far reaching consequences for the way designers think. The three L’s stand for “long life, loose fit, and low energy” [56]. Linking the three R’s and the three L’s may provide a key approach to accomplishing a Zero Waste society.

Behavioral change might already be happening. Greyson states that it seems like we have moved past the “bigger is better era” and as the swapping and sharing movements are showing, times for wanting ownership of things might be over [44].

Heading the Right Way

Not only people working for Zero Waste or Cradle to Cradle see the need to be wise with waste but also bigger organizations and corporations are heading in this direction. An example is the EU, which has set as a goal to cut the connection between economic growth and waste production by making waste reduction a first priority. The European Environmental Agency’s report states that “new technologies and business models that generate less waste or waste with less hazardous properties need to be developed and applied” [3].

There are many ways and more and more voices are raised to achieve a Zero Waste society. The European Unions vision is “turning waste into a resource by 2020” and recycling quotes (even the higher ones) in all countries can be improved. A high recycling and reuse quote in a country does not have to mean that enough is done but can represent the will of people to be a part of a sustainable waste management system. Precycling and upcycling methods can be used to improve recycling even more. Cities like San Francisco and companies like Fuji Xerox have implemented a Zero Waste agenda [6,10:20]. All the examples stated in this report, like the people of Halifax or Castelbuono’s mayor are best proof that Zero Waste is not a utopian principle but actually applicable. Making waste what it is – a “verb and not a noun” is possible because “bearing in mind the needs of the future generations, how much waste do you think is acceptable?” [5]

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