Environmental Impact Assessment of event catering at university events

Working towards sustainable event catering

Life Cycle Assessment of conventional vs. sustainable events

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Foreword

This report is based on a collaboration project between the University van Amsterdam, the Amsterdam Young Academy and the Amsterdam based caterer Cirfood focusing on sustainable event catering. The ambitions of this project have resulted in a pilot event taking place in November 2020, during which the examined products were served. Unfortunately, due to the COVID pandemic the pilot event took place online, which altered the original plans of the event. Nevertheless, the event took place and the catered food & beverages where delivered to the participants in form of a “sustainable doggy bag”. A picture of the content of the doggy bag can be found on the cover page of this report.

INTRODUCTION

One of the most pressing issues of our time is climate change and its unprecedented impact. With increasing urgency scientists have appealed that a transition toward a low carbon economy is not only desirable but necessary for our planet to be habitable for life as we know it. The decision of limiting earth's warming to a maximum of 2 degrees above preindustrial levels made in the 2015 Paris Agreement is a crucial target that requires radical change throughout various industries.

Universities, as a hub for education and scientific innovation, are often looked up to when exploring the sustainable alternatives of a low carbon lifestyle. Therefore, universities should set an example on how sustainability transitions can be implemented successfully. The university space has many different aspects for which sustainability transitions are desirable (e.g. the heating and electricity of buildings or promoting low carbon mobility), however, only few aspects are quickly implementable and do not require third party involvement and consultation with various stakeholders. The aspect on which this report is focused on, and that – we believe – is one that requires small steps for a big impact is the organization of events, meetings or scientific workshops within the university space. In comparison to online alternatives, physical events are important for networking, exchanging information and for fostering new ideas. Although online events may significantly improve sustainability outcomes, on-campus, live events may also contribute to the sustainability transition by being optimized in terms of their environmental impact, for instance, via a careful selection of the food and beverages being served. Despite the opportunity of being able to shift towards sustainable event management rather quickly, little incentives exist currently for this transition to take place. As for now, little guidance is available on how to create a maximum sustainable event in the university space and how this can be done in a cost-efficient way.

With the aim to fill this gap and to provide insights into sustainable event planning, this report shows how sustainable alternatives (available in the Amsterdam region) for food and beverage catering score in terms of their environmental impact when compared to conventional events. Hence, this environmental impact assessment allows us to give recommendations on how to set new standards for event planning to make sustainable events the new norm across Amsterdam's universities.

AIM

The goal of this report is to quantitatively assess[1] the environmental impacts of the foods and beverages being offered at (university) events in Amsterdam and to explore sustainable alternatives associated with lower impacts. More precisely, we aim to investigate the following question:

> *What are sustainable alternatives for event catering and how do these perform across environmental impacts categories when compared to conventional event catering?*

For this comparison, we use the method of a Life Cycle Assessment, which allows for an environmental impact comparison between the two options throughout the life cycle of the products. Looking further into alternative, low-impact products, this report delivers recommendations for concrete "sustainable" items and lays out the costs and benefits associated with these. As a result, the findings of this report are translated into guide that offers recommendations for planning and implementing a sustainable event. By showing how it can be done effectively, we aim to set an example for future event organization and thus, push the standard for event catering to a more sustainable level.

METHOD

The method concerning this research is twofold, as the pilot event offered different products. In order to assess the environmental impacts of quite diverse products we divided them into the products for which environmental impact data was mostly available and into the products for which no data could be retrieved (or for which suppliers were unwilling to disclose these). For the former, the method of a Life Cycle Assessment (LCA) was applied. A LCA assesses the environmental impacts associated with all stages of the life-cycle of a commercial

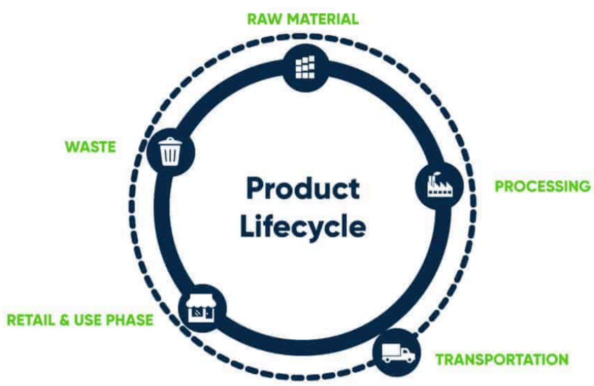

Figure 1 Life Cycle Assessment (LCA) - Complete Beginner's Guide. (2020)

[1] The limitations of this study must be considered which are further elaborated on p.19

product (see figure 1). For the latter, a literature review was preferred. This examines the products on a more holistic level and draws conclusions on the environmental impacts based on secondary literature. An overview of the products chosen for the “sustainable doggy bag” is given in appendix D. All products were delivered in a biodegradable bag. To minimize transportation emissions, the doggy bags where delivered to the participant’s houses by bicycle through an Amsterdam bicycle courier. Thus, we accounted for 0 associated emissions from “retail to event”.

Method: Life Cycle Assessment (LCA)

The life cycle assessment methodology assesses the environmental impacts associated with the life stages of a product. The LCA framework is generally broken down into four main phases which are describes by the International Organization of Standardization (ISO) for environmental management (ISO 14040). We will briefly explain each step.

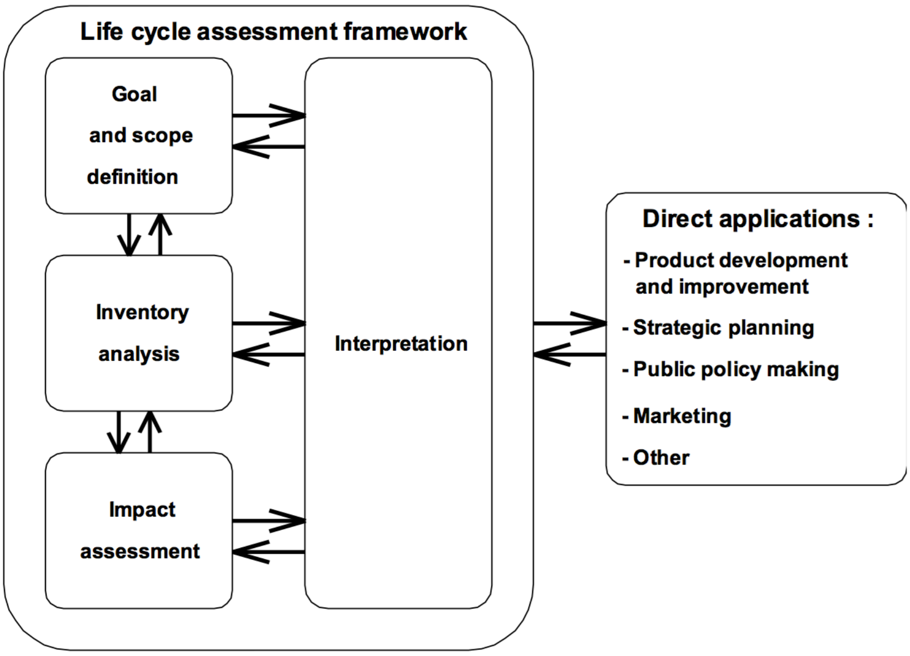

Figure 2 Components of a life cycle assessment (LCA) according to International Organization for Standardization (ISO, 2006)

1. *Defining the goal & scope*

For the first steps, the products for the LCA were selected and the goal of the research was defined. Then the scope narrowed down the impact categories (CO_2 emissions, water use, etc.) and defined what stages of the product lifecycle to include.

2. *Life cycle inventory*

The life cycle inventory is the stage at which all data is collected. This step also required the use of secondary data used from relevant academic literature. With the relevant data at hand the values were converted into the measurable unit selected in step 1. For the calculation of the emissions from transportation the *ECTA Guidelines for Measuring and Managing CO_2 Emission from Freight Transport Operations* (ECTA, 2011) were used. The following equation was used:

CO_2 emissions = Transport volume by transport mode x average transport distance by transport mode x average CO_2-emission factor per tonne-km by transport mode

[Tonnes CO_2 emissions = tonnes x km x g CO_2 per tonne-km / 1.000.000]

For retrieving the numbers on the average CO_2 emission factor per ton, the report on emissions of freight transportation modes by CE Delft was utilized. The following table represents the list of average CO_2 emission factors per ton-km for each transportation mode required for our LCA:

Table 1 CO_2 eq emission factors per ton-km (adapted from Otten, 't Hoen, & den Boer, 2016)

Transportation mode	***Load capacity (t)***	***Emission factor CO_2 eq (g/tkm) (tank-to-wheel[2])***
Small van <2t (average)	0,7t	1230
Large van >2t (average)	1,2t	1042
Truck <10t (average)	3t	493
Truck <10t (motorway)	3t	403
Diesel train medium length (heavy bulk transport)	1,914t	14
General cargo vessel 10-20 dwkt (medium-weight-bulk short-sea transport)	22,472	12
Oil tanker (heavy bulk short sea transport)	109,259t	8
Bike	*Depends on size*	0

[2] tank-to-wheel (TTW) describes the use of fuel in the vehicle and emissions during driving (excluding the emissions from production of energy source, e.g. petrol)

Note: for the road transportation modes, the emission factors were retrieved from the light bulk road transport numbers from 2014 (Otten, 't Hoen, & den Boer, 2016)

For the other indicators (water use & energy consumption) the companies offering the products where consulted and asked to share their data if available. For the products for which the data was unavailable estimates grounded in literature were utilized.

3. *Life Cycle Impact Assessment*

In step 3, the life cycle impact assessment, the data was compared and translated into common impact units. By doing so, a final impact score per indicators was disclosed. This impact score is then expressed as the percentage change of environmental impact between product A (conventional event) and product B (sustainable alternative).

4. Interpretation of results & reporting

Lastly, these impact scores were interpreted and elaborated on in the results sections of this report. The results section also provides reasoning for the impact scores found. For further explanation on the LCA method, a more detailed description on each step can be found in the following table.

Table 2 Four Steps of LCA

Steps	
1. Goal & Scope	**The goal statement** is the first component of the LCA and guides much of the subsequent analysis. *Questions explored in this phase:* • What is the intended use? • What are the reasons for doing this study? • Who is the audience? Second in this phase is the **scope** that must be defined. The scope narrows down the methodological approach and defines what will be investigated in the following steps. *Questions explored in this phase:* • What will be the system boundaries? What parts of the Life Cycle are we including (raw materials, production, transport, waste, etc.)? • What will be the impact categories? How will we assess these? • What will be the functional unit for these impact categories?

2. Life Cycle Inventory (LCI)	**The Life Cycle Inventory** stage is the data collection phase in which we collect all inputs and outputs at each stage within the LCA scope. By collecting this data, it can be modelled into the input-output flows. *Questions explored in this phase:* • How is the data for the Life Cycle Inventory collected? • Where will we retrieve the data needed? Who must be contacted to receive the data?
3. Life Cycle Impact Assessment (LCIA)	In the **Life Cycle Impact Assessment** phase, we convert the inventory data from phase 2 into environmental impact potentials. Here the impacts and resource use from all life cycle stages are grouped into environmental themes or categories. In this step, it is especially important to also convert the data into common impact units to make a feasible comparison between the two different alternatives. A common impact unit is for example global warming potential.
4. Interpretation of results & Reporting	With all the data in place we **then interpret the results** and draw conclusion about the environmental impacts of both normal and sustainable events. In this phase, a comparative analysis helps to highlight and quantify the differences between the two alternatives. Based on the results we can identify "hotspots" which are stages in the life cycle that have the highest environmental impact. The interpretation will allow us to draw recommendations that will then be disclosed in a report.

Method: Literature Review

While the Life Cycle Assessment method is specifically used for assessing and quantifying the environmental impacts of the beverages for event catering a different method is utilized for the foods and snacks being served. The LCA method is more difficult to apply to foods as many different factors are in play. For instance, when aiming to quantify the environmental impacts of a chocolate muffin it is not only interesting to know where it was baked and packaged but also where the raw materials (sugar, flour, chocolate, etc.) came from, how they were cultivated, how they were transported, if pesticides were used, whether they were produced organically, … and the list goes on and on. While the time and scope of this project is one reason why we were not able to cover this assessment for all food items served at the events, another reason for taking the research to a broader level are the general recommendations we will be able to draw. Rather than looking at individual food items and comparing these in terms of their environmental impacts, it may be more beneficial for future sustainable event planners to generally know which kind of foods they should avoid and which ones should be preferred. Therefore, a more comprehensive and broader literature review will provide insight into which foods generally show a reduced ecological footprint.

Keeping in mind the various categories and indicators that can be used to examine the environmental impact of food (e.g. carbon emissions, fertilizer use, land use, organic vs. non-organic, etc.), the literature review may show food categories that frequently score lower in terms of their impacts. As it is difficult to find food products that score low in all impact categories, the literature review can give insights into general impact patterns from which recommendations for sustainable food catering can be drawn.

RESULTS

The results of our research are divided into two main parts: the products for which the LCA was conducted and the products for which we used the method of a literature review.

Each section of the LCA highlights an exemplary product which we chose for our sustainable pilot event. In this quantitative assessment method, we find that the sustainable alternatives which we initially hypothesized to have less of an environmental impact overall did show a lower impact score throughout the three chosen categories. However, these results are limited to its scope and must therefore be interpreted accordingly. From the LCA, we further conclude that the local production and distribution of products is key for more sustainable outcomes. Additionally, the higher a product's circularity, which we define as the product's reusability and its life span, the better environmental outcomes can be observed by minimizing resource extraction and consumption.

The literature review utilized for assessing the sustainability outcomes of different catered foods provides a holistic picture of the environmental costs and benefits of different food items. From this review, we find two main results. First, a meat-based diet is generally associated with the highest environmental impacts. Therefore, meat-free options (vegan & vegetarian) have a much smaller environmental harm. Second, local and seasonal products score lower in terms of their environmental footprint due to lower transport emissions and reduced energy inputs (e.g. heating).

Life Cycle Assessment for catered beverages

Tea

Often coffee is a must have at networking events. However, research has shown that coffee might not be the best beverage when accounting for sustainability. In a Life Cycle Assessment comparing (Darjeeling) tea with coffee, Doublet & Jungbluth (2010) find that the global warming potential of one cup of tea is around 48g CO_2eq whereas it reaches 114g CO_2eq per cup of coffee. They explain that the reason for this lies in the difference in cultivation yields and processing of the coffee berries and fresh tea leaves (Doublet & Jungbluth, 2010). The difference in environmental impact being quite substantial we decided to replace coffee with a locally produced tea with the smallest possible impact. In order to examine how well our chosen tea compares to a conventional brand tea (made available by large multinationals, e.g.

Unilever, Nestlé, etc.) we conducted a LCA which results are depicted in fig. 3. The scope of this assessment was narrowed down to three indicators: transportation emissions (in CO_2 eq), energy consumption from processing (kilowatt-hours) and water use (liters). While the data on the local Dutch tea was made available to us through the company itself, the data on the conventional brand tea was retrieved based on assumptions and estimates grounded in literature. Based on our calculation and estimates we find four main results:

1. In all three indicators used, the locally-produced tea has a **significantly lower environmental impact**. Therefore, we find that the locally produced tea (in NL) **scores higher in terms of sustainability** when examining transportation emissions, energy consumption from processing and water usage.
2. **Transportation:** When selecting the local tea, we find **a 96% reduction in CO_2 emissions** associated with transportation which results from the **local proximity** of cultivation, production and distribution of the tea. Another reason for the low transportation emissions of the local tea is that the distribution from retail to event took place by bike which relates to 0 emissions. In contrast, the conventional tea has the highest emissions from the transportation by car from retail to event. It must be noted here that the 5,74kg CO2 is the total emission amount of the car ride. Keeping in mind that other products may also be carried in the same car trip the emissions per kg of tea would in reality be lower. Nevertheless, total emissions from the car will always be >0 and thus, score worse when compared to the carbon neutral bicycle. Even when excluding the transportation emissions from retail to event, there **remains a 46% reduction in co2 emissions for the local tea**.
3. **Energy consumption:** When selecting the local tea, we find a **99,59% reduction in energy consumption** of the tea processing due to **high energy efficient** methods utilized by the local tea company. Additionally, the local tea consumes 100% renewable energy, something that we cannot say for certain for the conventional tea due to unavailable data.
4. **Water use:** When selecting the local tea, we find a **99,96% reduction in water consumption** due **to high water efficient** methods utilized by the local tea option (e.g. a closed water cycle in which water is reused).

Items	Indicators	Measurable Unit	Normal event	Sustainable event	Impact score
Tea			*Brand tea*	Local Dutch tea	
Description					
	Transportation	kg CO2eq/kg			
	- from production to processing		0	0	
	- from processing to distributer		0,371229 kg CO2eq/kg	0,090897kg CO2eq/kg	
	- from distributer (Kenia) to NL		0,1391 kg CO2eq/kg	/	
	- from NL dstributer to distributer (Sligro)		0,03224 kg CO2eq/kg	/	
	- from distributer (Sligro) to retail		0,0087261kg CO2eq/kg	0,16359kg CO2eq/kg	
	- from retail to event		5,74 kg CO2eq/kg	0	
	total from transportation		**6,29 kg CO2eq/kg**	**0,254 kg CO2eq/kg**	**-96,00%**
	Enegry consumption	watt/kg			
	- energy from irrigation		n.I.	n.I.	
	- energy from heating		0	0	
	- energy from processing		4,85kWh/kg	0,02kWh/kg	
	total from energy consumption		**4,85kWh/kg**	**0,02kWh/kg**	**-99,59%**
	Water use	liters			
	- Water use for production/irrigation	liters / 1kg of fresh tea leaves	3467l/kg	1,332 l/kg only once	
	- Water use for consumption	liters per cup	0,15l	0,15l	*cancelling out*
	total from water use (excl. consumption)		**3467l/kg**	**1,332 l/kg only once**	**-99,96%**

Figure 3 LCA for tea (conventional vs. sustainable)

Bottled water

For hydration purposes, serving water at events is essential. At conventional events, it is a habit to give guests a plastic water bottle which can be carried to the meetings or panel discussions. Most certainly now in times of the COVID-19 pandemic, hygienic and sealable water bottles are more important and preferable than single use cups that are refilled at a common tap. Due to convenience, ease and its low costs, plastic water bottles are a popular choice for serving water to guests. However, the environmental impacts of plastic water bottles are often overlooked, especially when factoring plastic waste creation into play. How often do event organizers find empty plastic bottles on the tables when cleaning up an event? Only few decide to reuse the plastic bottle maybe once or twice again before discarding it into the garbage bin. As a result, we wanted to highlight an alternative to the plastic bottle: a reusable, recyclable and dishwasher safe water bottle made from on sugar cane which aims to incentivize frequent reuse and durability.

Comparing our bio-based alternative to a conventional plastic water bottle, we chose a local Dutch retailer and a multinational brand water. In our LCA, we limit our scope to the transportation emissions (in $C0_2$), energy consumption (in MJ), water use (in liters) and plastic waste generation (in grams of plastic). For both products, we worked with literature grounded estimates based on the available information. When viewing the results of the LCA (in fig. 4) it must be considered that although the measurable unit is the same for both, the materials observed differ. For the plastic water bottle the numbers are based on kg of (recycled) fossil-fuel based plastic. Whereas for the alternative bio-based bottle the results are depicted in kg of green polyethylene, a plastic produced from sugar cane. The completed LCA yields four main findings:

1. **Transportation/CO_2 emissions:** The **sugar cane water bottle scores 114% lower in terms of CO_2 emission** from transportation than the plastic water bottle when accounting for its negative production emissions. The -2,15 kg of CO_2 reduction per kg of green PE through the carbon capture by the sugar cane plant substantially lowers the sugar cane bottle's emissions. As a result, we can identify **negative carbon emissions** for the sustainable alternative. However, even without accounting for the carbon capture, the associated CO_2 emissions for the sugar cane alternative are **83% lower**. Another reason for the low transportation emissions is that the distribution from retail to event took place by bike which relates to 0 emissions.
    - When considering the reusability of the green PE bottle we find that the sustainable alternative has an even lower CO_2 footprint than a one-time use of the plastic bottle (0,25695 kg $C0_2$ /0,5l). As the sugar cane-based bottle is meant as a refillable water bottle, the associated emissions **are substantially lower than the conventional bottle's emissions when reusability is high** (even without considering the carbon capture from the sugar cane plant).
2. **Energy consumption:** The **bio-based bottle scores 98% lower in terms of energy consumption** from material production. This result can mainly be explained by the energy intensive processes of recycling PET. The transportation and separation activities from recycling contribute extensively to the high-energy requirement.
3. **Water use:** The **bio-based alternative requires 419% more water** for producing 1kg of green PE when compared to the production of 1kg of conventional recycled plastic. According to Benavides et al. (2018), the main driver is the high-water consumption necessary for the bio-based route to TPA (terephthalic acid). However, they also argue that process optimization and

reducing water consumption has not been fully explored which creates opportunities to do so.

4. **Waste generation:** The sustainable alternative has a **100% reduction of plastic waste**.

Items	Indicators	Measurable Unit	Normal event	Sustainable event	Impact score
Water			plastic bottle water (0,5l)	bio-based reusable bottle (fills 0,5l)	
			based on fossil fuel	*made from green polyethylene*	
	Transportation	kg of CO2eq/kg of waterbottle			
	- from production to processing	kg of CO2eq/kg of green PE	n.l.	n.l.	
	- from processing to distributer		0,097929 kg CO2eq/ kg of bottle	0,0165 kg of CO2eq/kg of green PE	
	- from distributer (BRZ) to manufacturer (NL)		n.a.	0,000732 kg of CO2eq/kg of green PE	
	- from manufacturer(NL) to distributer		n.a.	0,0314 kg of CO2eq/kg of green PE	
	- from distributer to retail		0,0872 kg C02eq/ kg of bottle	0	
	- from retail to event		5,74/15 = 0,38266kg CO2eq/ kg of bottle	0	
			0,5678/kg CO2eq/kg	*green PE reduces 2,15kg of CO2eq/kg of green PE*	
	converting kg in number of water bottles		0,5678/2 = 0,2839 kg CO2eq/ 0,5l bottle	0,048632 - 2,15kg C02e = -2,1 CO2eq/kg of green PE	
	total from transportation		**0,2839 kg C02e/ 0,5l bottle**	**negative 2,1/ 50 = -0,042 per 0,5l**	**-114%**
	Enegry consumption	in MJ			
	- energy from production		4,1 MJ/kg	0,09 MJ/kg	
	total from energy consumption		**4,1 MJ/kg**	**0,09 MJ/kg**	**-98%**
	Water use	in liters			
	- Water use for production	liter per kg of plastic/green PE	3,1 L/kg	13L/kg	
	- Water use for consumption	per water bottle	0,5	0,5	same
	total from water use excl. consumption		**3,1 L/kg**	**13L/kg**	**419%**
	Waste generation	in grams per bottle			
	- total plastic waste		**9,9g**	**0**	**-100%**
			15kg = 30 bottles *0,5L (kg)	50= assumption that 1kg PE can produce 50 bottles	
				2,15 = carbon capture from sugar cane plant	

Figure 4 LCA for water bottles (plastic vs. bio-based[3])

Beer

For afternoon networking events and particularly for the Dutch "borrel" a bottle of beer is a popular requested beverage. Beer being a desirable drink also for our pilot event we decided to choose a locally produced beer hoping to keep the environmental impacts of the production to a minimum. The chosen beer is also produced using rescued potatoes which were discarded from Amsterdam's supermarkets and then collected for reuse. Instead of having to cultivate the raw materials with extensive energy, water and labor inputs, this alternative beer embraces the principle of circularity which reduces environmental impacts. At conventional events, brand beer is usually served which bring very complex and long supply chains and thus, more associated emissions. Our LCA looks at both, a conventional, popular brand beer and a locally produced beer from Amsterdam and compares them in terms of their environmental impacts for three categories: transportation emissions (in $C0_2$ eq.), energy consumption (in MJ) and water use (in liters). Working with data from relevant literature on

[3] Note: the calculations are based on an event catering 30 people

the environmental impacts of the beer brewing process, the following findings of the LCA are concluded:

1. **Transportation:** The sustainable beer **scores 59,89% lower in CO_2 eq emissions** from transportation. This is mainly due to its local production and short supply chain. Another major reason for the low transportation emissions is that the distribution from retail to event took place by bike which relates to 0 emissions.
2. **Energy consumption:** No clear results can be drawn from the energy consumption between the two options due to missing data. However, the energy consumption is assumed to be very similar as the brewing process most likely remains similar among the different beers.
3. **Water use:** Despite missing data on water use for the raw materials that go into conventional beer, we can conclude that **the sustainable beer has an overall lower water consumption**. The main reasoning for this is that water is being "rescued" by using wasted potatoes (0,1675L/L saved). On the contrary, the brand beer relies on water use for the cultivation of its grain which is very likely higher than 0 and thus, exceeds the water consumption of the alternative beer.

Items	Indicators	Measurable Unit	Normal event	Sustainable event	Impact score
Beer			*Brand beer*	*Locally brewed beer*	
Description			Pilsner	made from recycled potatoes	
	Transportation	kg of CO2/kg of beer			**Total**
	- from production to processing		n.l.	n.l.	
	- from processing to distributer		0,065286kg CO2eq/kg	0,0048974kg CO2eq/kg	
	- from distributer to retail		0,0110432kg CO2eq/kg	2,559/10* = 0,2559 kg CO2eq/kg	
	- from retail to event		5,74/10* = 0,574kg CO2eq/kg	0	
	total from transportation		**0,65032 kg CO2eq/kg**	**0,2607974 kg CO2eq/kg**	**-59,89%**
	Enegry consumption	MJ/L			**Total**
	- energy from brewing		3,52 MJ/L	n.l.	*missing value*
	- energy from cooling		0	0	
	total from energy consumption				
	Water use	liters water/ liter beer			**Total**
	- water use for raw materials		n.l.	0,1675 L/L saved	*missing value*
	- water use for brewing		7 L/L	assuming same: 7L/L	
	total from water use		**7 L/L**	**6,8325 L/L**	**-2,40%**
			*beer for 30 people (330ml*30) = 9,9l (ca.10)		

Figure 5 LCA for beer (brand vs. local/circular)[4]

[4] Note: the calculations are based on an event catering 30 people

Literature review on sustainable foods

Environmental benefits of a meat free diet

An article published by Clark et al. (2019), which examines both the health and environmental impacts of foods, finds that:

> *"foods associated with improved adult health also often have low environmental impacts, indicating that the same dietary transitions that would lower incidences of noncommunicable diseases would also help meet environmental sustainability targets." (p.23357)*

This finding reveals that the foods that are generally better for our health are also better for the environment. In displaying their results, Clark et al. (2019) show several food categories (fig. 5 & 6) and depict their relative environmental impact. Across all categories red meat scores statistically significantly the worst in terms of environmental impacts (fig. 5). In contrast, fruit, vegetables and grains overall have a lower relative environmental impact.

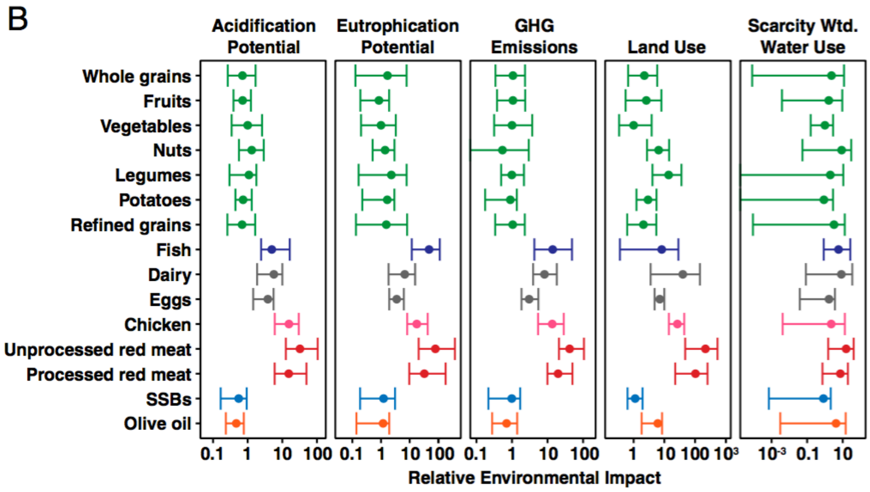

Figure 5 Summary of environmental data (Clark et al., 2018)

Dury et al. (2019) also highlight the livestock sector as a key challenge to current food systems due to its high contributions of around 14,5% of total anthropogenic greenhouse gas emissions. This includes not only carbon emissions from production but also methane emission, a very powerful greenhouse gas. With one-third of the global cereal production being fed to animals, livestock production requires vast areas of lands (Godfray et al., 2010). This suggests that more people could be supported from the same amount of land if they were vegetarians. Because meat and dairy products are among the highest contributors to environmental impacts from food consumption (Tukker et al., 2011) this leads to an increasing mitigation potential of dietary changes. For example, vegetarian or 'flexitarian' diets could substantially reduce the burden of livestock in carbon emissions (Dury et al., 2019). A study from Baumann (2013) compares two different types of meat-free diets (vegetarian and vegan) in Sweden and the related greenhouse gas emissions of each diet. This study finds that the average vegan diet caused 591kg CO2eq per year whereas the average vegetarian diet caused 761kg CO2eq. As a result, entirely plant-based food score lower than a vegetarian diet (including dairy products).

Local & seasonal food production for better environmental outcomes

It is often claimed that the ''average item of food travels 1,500 miles before it reaches your plate" (as cited in Schnell, 2013). Long and complex supply chains are the main reason for the long distances that food travels which results in increasing emissions due to transportation. The frequently used concept of food miles (e.g. the distance food travels before it reaches the end consumer) can thus be linked to climate change, with air transportation contributing significantly to CO_2 emissions (Passel, 2013). As a result, shorter food supply chains show substantial environmental benefits such as limited transport (Kawecka & Gębarowski, 2015). These benefits also include a reduction of air pollutants stemming from the refrigeration of food storage. Not only are food miles and emissions reduced in shorter and more locally oriented supply chains, but also waste and food loss is less because foods can be directly sold to the consumer (e.g. farmers markets) which also makes local supply chains more efficient (Kawecka & Gębarowski, 2015).

Another key environmental benefit of a local food system is that it reduces "specialization and intensification in agriculture through more diverse local land use" (Schönhart, Penker & Schmid, 2009, p. 177). Furthermore, local food production conserves traditional agricultural landscapes and fosters environmentally friendly production methods (organic production, protection of local biodiversity, reduced chemical inputs) (Schönhart, Penker & Schmid, 2009). Next to the listed environmental benefits, many social and economic benefits can also be observed such as providing more nutritious foods and supporting local farmers financially (Schönhart, Penker & Schmid, 2009; Kawecka & Gębarowski, 2015). However, these benefits are beyond the scope of this study and are thus not further elaborated on.

Local food consumption can help with better environmental outcomes by less transportation. Nevertheless, Weber & Matthews (2008) find that transportation as a whole represents only 11% of the food's life-cycle greenhouse gas (GHG) emissions. The larger difference in GHG emission between foods is, thus, not mainly dependent of the associated food miles but rather what type of food is chosen, e.g. red meat is around 150% more GHG-intensive than chicken or fish (Weber & Matthews, 2008). As a result, the authors suggest that a "dietary shift can be a more effective means of lowering an average household's food-related climate footprint than "buying local" "(Weber & Matthews, 2008, p.3508).

A similar conclusion can be derived when examining the sustainability potential of choosing seasonal food for consumption. The main environmental benefit of a seasonal diets is that it reduces GHG emissions because it does not require the high-energy input from artificial heating or lighting needed to produce crops out of the natural growing season (Macdiarmid, 2014). However, choosing seasonal foods may not deliver the desired impact as "it is only one small aspect of a sustainable diet and in terms of dietary change it should not overshadow some of the potentially more difficult dietary behaviors to change that are likely to have greater benefits (e.g. overeating or meat consumption)" (Macdiarmid, 2014, p. 373). As a result, a meat-free diet can substantially increase the sustainability outcome more so than local and seasonal produce.

DISCUSSION OF THE FINDINGS

While there is no one-size-fits-all solution for sustainable event catering and planning, we can conclude that there are certain findings which most likely will bring better environmental outcomes. Drawing from the findings of the LCA as well as the literature review, we can derive three major results that can serve as a guide for implementing low-carbon and resource efficient event catering which are each discussed in the green box on the following page.

The three key findings provide an answer to the initially posed question: *what are sustainable alternatives for event catering?* As all three points (locality, circularity and plant-based foods) jointly contribute to better sustainability outcomes, we again want to highlight the benefits of embracing all three attributes. These three key findings, as guiding principles for sustainable events, lower the environmental impact and can therefore create the best environmental outcomes.

1. **Keep it local**
   - Locally produced food & beverages score significantly lower in terms of emissions related to transportation. We find a 96% reduction in CO_2 eq emissions for the local tea and a 59% reduction for the local beer.
   - For local distribution channels, carbon neutral modes of transport can be used (e.g. bicycle) which substantially lowers transportation emissions.
   - Our LCA on the tea has also shown that the locally produced tea results in a 99% reduction of both energy and water consumption. This is due to the highly efficient cultivation techniques adopted by the Dutch tea producer.
   - Buying local products is often coupled with buying seasonal products which have also shown to have better environmental outcomes.
2. **Circularity**
   - We want to emphasize the high importance of circularity for reducing the impact on the environment.
   - The higher the reusability of the product, the lower is the associated environmental impact. For example, the reusable sugar cane bottle offered in our pilot event is intended for frequent reuse whereas the plastic water bottle has a quite low reusability rate.
   - Circularity/reusability and zero waste generation are thus the goal for sustainable events (or even going beyond this by using waste as an input stream for new products e.g. potato beer). Our pilot event showed how e.g. plastic can be 100% reduced when embracing the concept of circularity.
3. **Plant-based diets**
   - Shifting towards a plant-based catering has significant potential to reduce the environmental footprint and provide better health outcomes (win-win situation).
   - Meat does not only score high on associated $C0_2$ emissions but also on land use and methane emissions and should therefore be avoided.
   - Vegetarian foods are desirable as they require less land and resources.
   - Vegan diets (no dairy products) show the least environmental impacts.

The Notion of Trade-offs & Synergies

The implementation of the three key themes derived from the results can help in creating more sustainable event catering but may not guarantee it. The reason for this are trade-offs which occur throughout the process of selecting the different products. To make better use of the findings presented above one must therefore understand the notion of trade-offs. In simple terms, a trade-off happens when, if one thing increases, another must decrease. Similar to a scale, a tradeoff is “a situation in which you balance two opposing situations or qualities” (Trade-off, 2020). For this to happen one would accept something bad for something good to happen. More concretely, trade-offs can be found in the evaluation of environmental impacts of different foods. For example,

- when a product is low-impact but it is more costly (financial trade-off).
- when a product is plant-based but relies on pesticide use or is wrapped in plastic (ecological trade-off).

Trade-offs must be examined and taken into the decision-making process of selecting the products for event catering. As a perfectly sustainable product rarely exists, it is up to the decision makers to decide which environmental aspects are accounted for.

In the case of our sustainable pilot event, the organizers were faced with the trade-off between environmental benefits and costs. As the initially calculated costs[5] of the sustainable event exceeded the associated costs for a “normal” event, the organizers had to decide whether the environmental benefits are worth the additional costs. Here a cost-benefit analysis is an often-preferred tool which helps in the decision making. Although valuing environmental benefits can be quite complex, different tools can help for such analysis. While expressing environmental benefits in monetary terms is one way of doing such analysis, another way is an assessment of the event participant’s own perceived benefits. Having conducted a short survey with the event participants of the pilot event, the results can give insights into the effectiveness of sustainable events. These results are further elaborated on in appendix B.

Although trade-offs exist and may be inevitable, it is desirable to keep them to a minimum and instead explore synergies. In contrast to a trade-off, a synergy is an “interaction among two or more actions, which will lead to an impact greater […] than the sum of individual

[5] This cost estimates were based on the assumption that the event would take place live and in person.

effects" (Mainali et al., 2018). For our sustainable catering event, synergies are important as they help identify opportunities for products which score low on multiple environmental indicators. An example for a synergy from our pilot event is the locally grown tea. Not only does this tea perform low in terms of CO_2 emissions due to its shorter supply chain, but the tea is also produced in energy and water efficient way. As a result, this local Dutch tea can create a larger environment impact than choosing a tea which only scores high on one of the three categories.

Another example for a synergy from our pilot event is the circular beer made from discarded potatoes. Because it relies mainly on potatoes which would have otherwise been thrown away, this beer has an innovative approach to brewing beer which results in less waste as well as less required inputs (e.g. water, grain). Learning from these examples shows how it is desirable to embrace synergies whilst avoiding trade-offs to obtain the most environmental beneficial outcome for sustainable event catering. As it takes innovative approaches and out-of-the-box-thinking to reach the best sustainability outcomes, we encourage searching for products that embrace the concept of sustainability on multiple levels (e.g. locality, circularity, plant-based).

LIMITATIONS OF THESE FINDINGS & SUGGESTIONS FOR FURTHER RESEARCH

The results of this study must be used while recognizing its limitations. Due to the scope of this project, only a limited number of items could be explored in depth in the life cycle assessment. In this method, we also had to rely on assumptions and rough estimates when data was unavailable. Therefore, it may not be an accurate representation of the reality. The conducted LCA was also constrained to a few indicators only which limits the recommendations to a narrow set of environmental impacts. As a result, this may not provide a holistic picture of all environmental impacts. Moreover, it must be considered that the presented results of each product were calculated separately. This may be problematic with the transport emissions values from driving a car. The way the calculations where conducted it was assumed that each product category (e.g. tea, beer, water) was transported in a separate car ride. As this is rather unlikely to happen, the results must be used with this limitation in mind. Nevertheless, in our results each LCA stands independently which can be beneficial for comparing them with other studies.

Similar limitations must also be considered with the literature review. With much literature on the topic of food sustainability being available, the conducted literature review represents only a brief overview of some relevant scholarly work. Therefore, we suggest that future research could build upon our work by further investigating academic literature on sustainable catering. Additionally, a more extensive LCA which would also incorporate other impact categories such as pesticide use, acidification potential, sustainable land use management, etc. is suggested as it would provide a more in depth analysis on the different products. Finally, we recommend future research to explore other foods and beverages which embrace the three key findings of our research (locality, circularity and plant-based). We advise to evaluate the impacts of these items in order to provide further evidence for better environmental outcomes.

RECOMMENDATIONS

For universities

The results presented in this report are valuable for universities because they show that sustainable event catering can have lower environmental impacts. The pilot study and this environmental impact assessment may give universities an idea of what can be done and what the associated impact potentials are. Based on our findings, we urge universities to implement basic guidelines for holding events within the university space which are based the idea of increasing sustainability. For making it easier for event organizers to know what foods and beverages to choose we advise universities to create a list of (local) products from which they can choose from. Additionally, universities could restrict the catering of certain products such as meat or other livestock products. A set of specific "sustainability" guidelines for event catering at university events would support wide scale adoption of sustainable products and therefore help in transitioning to a low impact institution. An idea on how such guidelines could specifically look like is given in the two pager which can also be found in appendix D.

For catering companies

Similarly to universities, we recommend catering companies to make use of our findings by creating a sustainable catering option. In addition to their current catering plans, catering companies could offer their customers a more sustainable version which would be based on a set of sustainability guidelines. Having a plan that would be primarily plant-based, locally sourced, and low in waste would allow customers to choose a sustainable catering option. Such an alternative catering plan (which ideally would become the standard offering) would also contribute to a positive environmental image of the catering company, which can lead to new revenue streams. The gap between the growing demand for sustainable products and the low catered supply of environmentally friendly items is something catering companies could address by delivering sustainable food and beverages based on agreed upon guidelines.

CONCLUSIONS

The need for sustainable catering options in the university space is ever more relevant in the transition towards a low impact institution. Offering an example for sustainable event catering, this report gives insights into alternatives of food and beverages catering which score lower in terms of environmental impacts. The Life Cycle Assessment of the three selected items, tea, water bottle and beer, as well as the literature review on food sustainability have resulted in the three key findings. First, we show that locally produced food and beverages score significantly lower in terms of emissions related to transportation. The principle of locality is therefore one we strongly advise future sustainable events. Second, we highlight the importance of circularity and reusability of products being offered. Through extending the product's life cycle and minimizing waste generation the environmental impact decreases, thus contributing to more sustainable outcomes. Third, we find that plant-based diets are most desirable for sustainable event catering because they have less impact on the environment when compared to meat based diets. By leaving out meats and other dairy products, the foods served would contribute to a low impact event. We therefore strongly suggest restricting (or completely avoiding) meat-based products at sustainable events.

The recommendations of this report must be viewed as incremental steps towards sustainable event planning. Having focused on catering exclusively, other aspects of events such as heating and electricity use must not be ignored. Nevertheless, the implementation of a catering option which serves better environmental outcomes is a necessary step to take in the desired sustainability transition. Universities as hubs for education and innovation can and should set an example of how it can be done.

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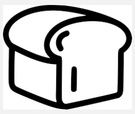
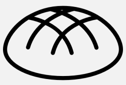
APPENDIX A. Overview of products

Products included in the "sustainable doggy bag" offered at the pilot event

Product	Details on product	Method for analysis
Tea 	An organic tea cultivated and processed in the Netherlands.	LCA
Water 	A sugar cane-based, reusable water bottle bought from a local store in Amsterdam.	LCA
Beer 	A locally brewed beer made from discarded potatoes (from e.g. supermarkets). The brewery is in Amsterdam.	LCA
Vegan banana bread 	A slice of vegan banana bread from a bakery in Amsterdam.	Literature Review
Tomato-olive bread 	A tomato-olive bread also made from a bakery in Amsterdam.	Literature Review
Confetti bomb 	A confetti bomb was requested by the event organizers. As a sustainable alternative to conventional confetti, this confetti bomb is made from leaves and is thus 100% biodegradable.	Excluded from this research
Cutlery 	The bag included a paper-based plate, a paper cup and biodegradable cutlery.	Excluded from this research

APPENDIX B. LCA calculations

Water bottle

Sustainable event

Transportation	Total tons of CO2e	Kg CO2/kg[6]	Mode	Route
from processing (factory) to distribution	1,914t*1180 km*14g/tkm/1000000= 0,0316t CO2e	0,0316t CO2e*1000 = 31,6kg CO2e /1914 = **0,0165 kg CO2e/kg**	by rail (diesel train)	Braskem, Triunfo - Rio Grande do Sul, Brazil - Porto of Santos (Sao Paolo)
from distribution in Brazil to NL	109,259t*10.000km*8g/tkm /1000000= 8,74tCO2e	8,74t C02e*1000 = 8740kg CO2e/ 109259 = **0,000732 kg CO2e/kg**	by ship (oil tanker)	Sao Paolo-Rotterdam (5430 nautical miles at 10 knots speed = ca. 10.000km)
from Rotterdam to Amsterdam	3t*78km*403g/tkm/1000000= 0,0943t C02e	0,0943 CO2e*1000 = 94,3kg CO2e/3000 = **0,0314 kg CO2e/kg**	by <10t truck (motorway)	Rotterdam - Distribution center in Amsterdam
from distributor to retail	0 emissions	-	by bicycle	Distribution center - Cirfood
from retail to event	0 emissions	-	by bicycle	Cirfood - event

Energy consumption	MJ/kg	Academic source
energy from producing Green PE	**0,09 MJ/kg**	Benavides et al., 2018 (supplementary information)

Water use	L/kg	Academic source
water use for processing Green PE	**13L/kg**	Benavides et al., 2018 (supplementary information)
Water use for consumption	0,5l (for 1 bottle)	-

Regular event

Distribution	Total tons of CO2e	Kg CO2e/kg	Mode	Route
from processing to distribution	3t*243km*403g/tkm/1000000 = 0,293787t CO2e	0,293787t CO2e*1000= 293,787kg CO2e /3000 = **0,097929 kg CO2e/kg**	by <10t truck (motorway)	Processing facility-Distribution center

[6] *These calculations assume that the mode of transportation is always loaded with its maximum capacity. In reality, this is most likely not the case which would result in a higher number of kg of CO2/kg of load.*

from distributor to retail	3t *17,7km* 493g/tkm/1000000 = 0,02617t CO2e	0,02617t CO2e*1000= 261,7kg CO2e/10.000= **0,0872 kg CO2e/kg**	by <10t truck (average)	Distribution center - Cirfood
from retail to event	114.24 g CO2e/km * (25,1km*2) = 5.74 kg	**5,74kg of CO2e/trip made** (one way: 25,1km – roundtrip needs to be accounted for) 5,74/15kg (30*0,5L) = **0,38266kg CO2eq/ kg of bottle**	by car (Skoda Fabia Petrol using 4,8L/100km; this translates into an emission factor of 114,24 g CO2e/km[7])	Cirfood - UvA

Energy consumption	MJ/kg	Academic source
Energy from sorting and processing rPET (100% recycled plastic)	**4,1 MJ/kg**	Benavides et al., 2018

Water use	L/kg	Academic source
water use for processing rPET	**3,1 l/kg**	Benavides et al., 2018
Water use for consumption	0,5l (for 1 bottle)	

Waste generation	in grams per bottle	Academic source
Total plastic waste	**9,9 g**	PET Resin Association, 2015

Tea

Sustainable event

Transportation	Total tons of CO2e	Kg CO2e/kg	Mode	Route
from cultivation to processing facility	-	-	-	*Tea plants are cultivated and processed at the same facility*
from processing to distribution	0,7t * 73,9km * 1230g/tkm /1000000 = 0,0636279t of CO2e	0,0636279t CO2e*1000 =63,6279kg CO2e/ 700= **0,090897kg CO2e/kg**	by small van (<2t; average)	Processing facility (NL) to distribution center

[7] *Emission factor was retrieved from CO2-Rechner für Autos - den CO2-Ausstoß Ihres Pkw berechnen, 2020.*

from distribution to retail	0,7t*133km*1230tg/tkm/1000000 = 0,114513t CO2e	0,114513t CO2e*1000 = 114,513kg CO2e/700 = **0,16359kg CO2e/kg**	by <10t truck (average)	Distribution center to Cirfood
from retail to event	0 emissions	-	by bicycle	Cirfood to UvA

Energy consumption	kWh/kg	Source
Energy use from tea processing	1kWh/50kg = **0,02kWh/kg**	*Data from tea company*
Energy from heating	0 *(The greenhouse in which the tea plants grow is not heated)*	*Data from tea company*

Water use	Liters	Academic source
Water use for irrigation	666L/ha/ 10.000= 0,0666 l/m^2 0,666 l/m^2 * 2= **1,332 L/kg**	*Data from tea company: the water is used in a closed circular system, therefore the 666L/ha are only required once.* *Own assumption*: yield of fresh tea leaves= 0,5 kg/m^2 (based on own calculation from Chapagain & Hoekstra, 2007 using the estimates average of yield of fresh tea leaves of 13 countries)
Water use for consumption	0,15L per cup	Suggested serving

Regular event

Transportation	Total tons of CO2e	Kg CO2e/kg	Mode	Route
from production to processing	0 (*Assuming production and processing takes place at the same facility)*	-	-	-
from processing to distributer	3t *753km* 493g/tkm/1000000 = 1,113687t CO2e	1,113687t CO2e*1000 = 1113,687/3000= **0,371229 kg CO2e/kg**	by <10t truck (average)	from tea estate - port in Kenia
from distributer (Kenia) to NL	22,472t*11599*12g/tkm/1000000 = 3,127t CO2e	3,127t CO2e*1000 = 3127 /200.000.000= **0,1391 kg CO2e/kg**	By General cargo vessel (load capacity 22,472t)	from harbor Kenia to NL (6263 nautical miles VIA Suez Canal at 10 knots speed = 11599km)
from NL port to distributer	3t*80km*403g/tkm/1000000= 0,09672t CO2e	0,09672t CO2e*1000= 96,72/3000=	by <10t truck (motorway)	From Rotterdam to

		0,03224 kg CO2e/kg		distribution center (NL)
from distributer to retail	3t *17,7km* 493g/tkm/1000000 = 0,0261783t CO2e	0,0261783t CO2e*1000= 26,1783kg CO2e/ 3000 =**0,0087261 kg CO2e/kg**	by <10t truck (average)	From distribution center (NL) to Cirfood
from retail to event	114.24 g CO2e/km * (25,1km*2) = 5.74 kg	**5,74kg of CO2e/trip made** (one way: 25,1km – roundtrip needs to be accounted for)	by car (Skoda Fabia Petrol using 4,8L/100km; this translates into an emission factor of 114,24 g CO2e/km)	Cirfood - UvA

Beer

Sustainable event

Transportation	Total tons/kg of CO2e	Kg CO2e/kg	Mode	Route
from processing to distributer	1.2t*4,7km*1042tg/tkm/ 1000000 = 0,00587688t CO2e	0,00587688*1000= 5,87688kg CO2e /1200=**0,0048974kg CO2e/kg**	by large van > 2t (average)	Brewery to distribution center in Amsterdam
from distributer to retail	114,24 g CO2e/km *22,4km= 2558,976g; 2558,976g/1000= 2,559 kg CO2e	2,559kg CO2e/ 10L (the liters of beer transported = **0,2559 kg CO2e/kg of beer**	by car (Skoda Fabia Petrol using 4,8L/100km; this translates into an emission factor of 114,24 g CO2e/km)	From distribution center in Amsterdam to Cirfood (22,4km by car)
from retail to event	0 emissions	-	by bicycle	Cirfood to UvA

Energy consumption	MJ/L	Source
Energy from brewing	No available information	*Missing data from beer brewery*

Water use	liters water/ liter beer	Source
Water use for raw materials	670L / 4000 L = **0,1675 L/L saved**	*Data from beer company: "For the first production of 4000 liters of our beer 600 kilos of potatoes were used. The production of this amount of saved potatoes translates into 670 litres of water")*

Water use for brewing process	Assuming it is about the same as other beers (= 7L/L)	*Missing data from beer brewery*

Regular event

Transportation	Total tons/kg of CO2e	Kg CO2e/kg	Mode	Route
from processing to distributer	3t*162km*403g/tkm/1000000= 0,195858t C02e	0,195858*1000 = 195,858kg C02 /3000 = **0,065286 kg C02/kg**	by 10t truck (motorway))	Brewery to distribution center (162km)
from distributer to retail	3t **22,4km** 493g/tkm/1000000 = 0,0331296t C02e	0,0331296t *1000 = 33,1296kg C02 /3000 = **0,0110432kg C02/kg**	By 10t truck (average)	From distribution center to Cirfood (22,4km)
from retail to event	114.24 g CO2e/km * (25,1km*2) = 5.74 kg	5,74 of CO2e/ 10L (the liters of beer transported) = **0,574kg of CO2/kg of beer**	by car (Skoda Fabia Petrol using 4,8L/100km; this translates into an emission factor of 114,24 g CO2e/km)	Cirfood – UvA

Energy consumption	MJ/L	Source
Energy from brewing	3,52 MJ/L	*Cordella et al., 2008*

Water use	liters water/ liter beer	Source
Water use for raw materials	- (however, likely to be >0L/L)	*Missing data*
Water use for brewing process	0,7 m^3/hl beer produced; 0,7*1000 = 700L/hl; 700L /100 = 7L/L of beer	*Average taken from Olajire, 2020*

APPENDIX C. Participant survey

Overview of survey

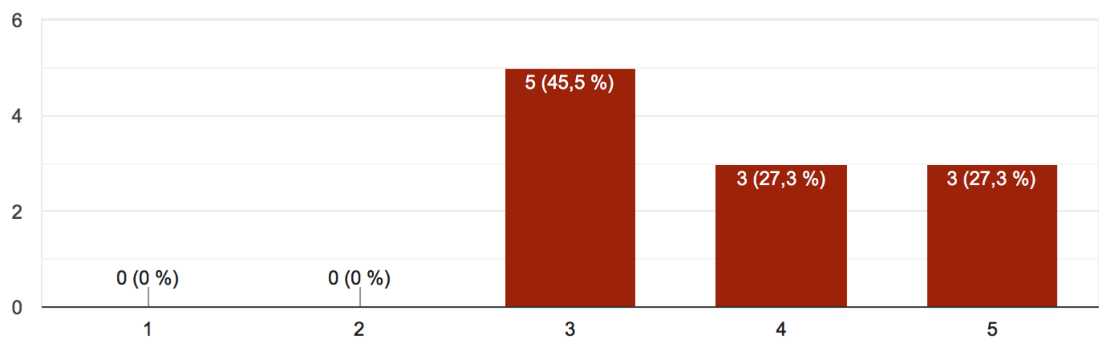
The conducted survey was filled out by participants of the online pilot event. The sustainable doggy bag which as delivered to them contained a QR code with the following questions. In total 14 participants filled out the survey.

Results

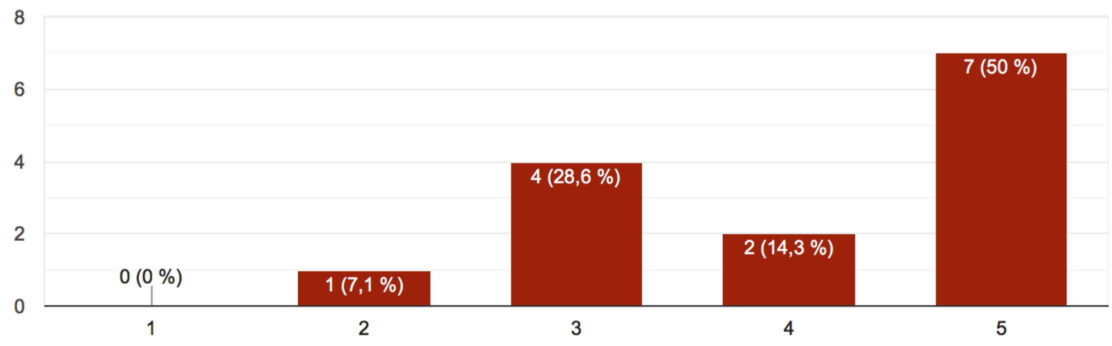
Overall, the sustainable doggy bag was greatly appreciated as can be seen from the positive responses. Most participants rated the sustainable tea break (tea and sweet snack) higher than the conventional ones. Also, when asked to strike a balance between sustainability and effectiveness of the tea break 91% chose the sustainable option. For the borrel, we also found that most participants rated the sustainable (circular) beer better than regular beer. However, when asked to rate the savory product for the borrel most participants preferred the conventional option (bitterballen, chips) over the savory sustainable roll. Nonetheless, 77% of the participants chose the sustainable option when asked to strike a balance between sustainability and effectiveness. Lastly, when disclosing the overall estimated costs of the event to the participants only half of the respondents would opt for the low impact arrangement.

Coffee/tea break

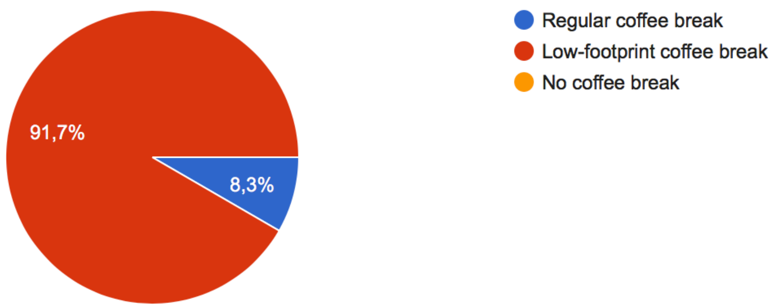
How would you rate the locally-grown tea, compared to regular tea?



How would you rate the sweet products which accompany the tea?

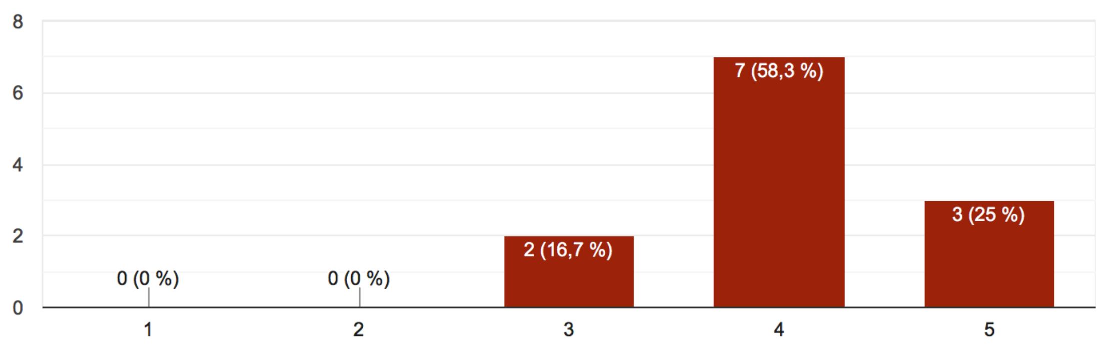


If you had to strike a balance between sustainability and effectiveness of a coffee break, which of the following options would you choose?

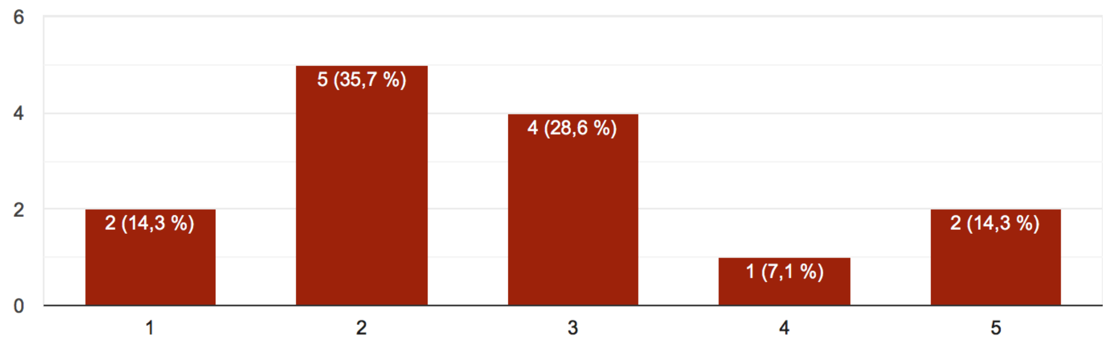


Borrel

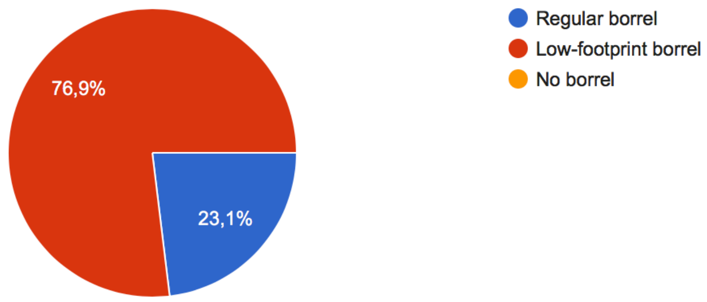
How would you rate the "circular" beer, compared to a regular beer offered in borrels (e.g. Heineken)?



How would you rate the snack offering, compared to a standard offering (e.g. bitterballen, chips)?

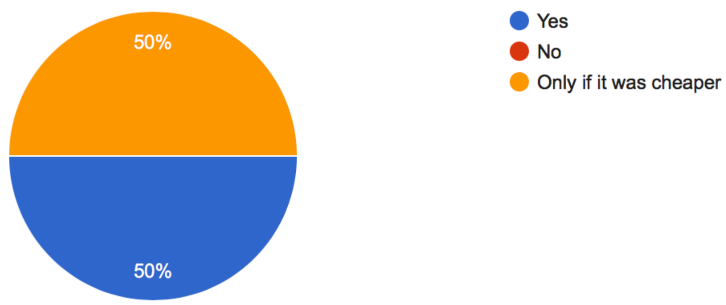


If you had to strike a balance between sustainability and effectiveness of a borrel, which of the following options would you choose?



Overall

The low-footprint catering arrangement is more expensive than a regular one (we expect that this will cost about 50€ per person compared to 20€ per person for a standard option). Would you be willing to select this low-footprint arrangement if it became available at UvA or VU?



APPENDIX D. Leaflet (executive summary)

A joint project between

A guide for sustainable event catering

Prepared by N. Friedman & U. Olcese

This guide is intended to deliver recommendations on how to organise a sustainable event within the Amsterdam region. We primarily focus on events such as workshops, meetings and conferences.

- Locally produced foods & beverages score significantly lower in terms of their emissions related to transportation. We find a 96% reduction in CO2eq emissions for a locally produced tea and a 60% reduction for a locally produced beer.
- For local distribution channels, carbon neutral modes of transport can be used (e.g. bicycle) which substantially lower transportation emissions.
- Buying local products is often coupled with buying seasonal products which have shown to have better environmental outcomes.

- The higher the reusability of a product, the lower the associated environmental impact. For example, the reusable sugar cane bottle offered in our pilot event is intended for frequent reuse whereas the plastic water bottle has a relatively low reusability rate.
- Circularity/reusability and zero waste generation are a goal for sustainable events (e.g. by using waste as an input stream for new products).
- We find that up to a 99% reduction in water usage can be obtained with a circular approach in the production of tea.

- Shifting towards plant-based catering has significant potential to reduce the environmental footprint.
- The livestock sector contributes around 14,5 % to total anthropogenic greenhouse gas emissions. Meat does not only score high on associated C02 emissions but also on land use and methane emissions and should therefore be avoided.
- Vegetarian foods are desirable as they generally require less land and resources for production than meat products.
- Vegan diets (no dairy products) show the lowest environmental impacts.

Envisioning sustainable events within the university space and beyond.

We aim to set new standards for event planning to make sustainable events the new norm across Amsterdam's universities and beyond.

WHAT FOODS AND DRINKS TO CHOOSE?

Example products that realize the three key sustainability principles: local, circular/reusable and plant-based

This list shows the products which we identified as sustainable and suitable for low impact events in the Amsterdam region. A more detailed elaboration of the products and their impacts is given in our environmental impact assessment report. However, we would like to stress that many other alternative products are becoming increasingly available. The products should therefore be selected according to the event's objectives.

Instock's Pieper Beer

- A locally brewed beer made from "rescued" potatoes (which were discarded from supermarkets)
- This beer offers an innovative approach to food waste and therefore has a much smaller environmental impact when compared to conventional beers.
- We find that the Pieper beer scores about 60% lower in C02eq emissions from transportation. The beer also requires less input resources such as water and land as the ingredients do not have to be cultivated.

JOAN tea

- This sustainable tea alternative is locally grown and processed in the Netherlands. It is an organic tea that relies on sustainable production methods such as renewable energy and water efficiency.
- We find a 46-96% reduction in CO2 emissions associated with transportation when compared to multinational tea brands.
- Additionally, we find that JOAN tea requires approx. 99% less water and energy when compared to conventional brand tea.

Join the pipe - water bottle

- A sugar cane-based, reusable water bottle bought from a local organisation in Amsterdam.
- According to our assessment, this water bottle is carbon negative as the carbon captured by the sugar cane plant exceeds the carbon emissions released from transportation. Even without accounting for the carbon capture, the associated CO2 emissions for the sugar cane alternative are 83% lower when compared to a normal plastic bottle.
- Although this bio-based bottle scores significantly lower in energy consumption (98%), the production requires approx. 400% more water (trade-off).

Vegan banana bread from 'De laatste kruimel' bakery

- This vegan banana bread was locally baked in Amsterdam.
- Our findings reveal that plant-based foods are armong the most sustainable food options. We find that vegan foods score even better in terms of their environmental footprint than vegetarian foods.
- We advise to exclude meat/animal based products from the catering menu as they have the highest environmental impacts.

Tomato-olive roll from 'Hartog Volkoren'

- This savory snack is also locally produced by a bakery located in Amsterdam.
- This vegetarian food item follows our recommendation of focussing mainly on plant-based food products.
- We again, recommend to choose a meat-free alternative due to its better sustainability outcomes.

All products can be delivered in a carbon neutral way.

*We selected the Amsterdam based bicycle courier **Tring-Tring** to deliver our sustainable doggy bag to the event participant's homes.*

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The environmental impact assessment report can be retrieved at