

# Carbon Neutral Digestive Initiative (CANDI)

SEI report  
December 2019

Fedra Vanhuyse<sup>1</sup>

Elena Dawkins<sup>1</sup>

Ylva Ran<sup>1</sup>

Ariane van den Broek<sup>1</sup>

Aina Eriksson<sup>1</sup>

Cecilia Wirseen<sup>2</sup>

Morgan Fredriksson<sup>2</sup>

Sibel Wolff<sup>3</sup>

<sup>1</sup> Stockholm Environment Institute  
<sup>2</sup> Nagoon  
<sup>3</sup> Urban Deli

Nagoon

UD  
URBAN DELI





**Stockholm Environment Institute**

Linnégatan 87D 115 23 Stockholm, Sweden

Tel: +46 8 30 80 44 [www.sei.org](http://www.sei.org)

Author contact: Fedra Vanhuysse

[fedra.vanhuyse@sei.org](mailto:fedra.vanhuyse@sei.org)

Editor: Andrew Mash

Layout: Richard Clay

Cover photo: Helena Wahlman / Getty

This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes, without special permission from the copyright holder(s) provided acknowledgement of the source is made. No use of this publication may be made for resale or other commercial purpose, without the written permission of the copyright holder(s).

Copyright © December 2019 by Stockholm Environment Institute

Stockholm Environment Institute is an international non-profit research and policy organization that tackles environment and development challenges.

We connect science and decision-making to develop solutions for a sustainable future for all.

Our approach is highly collaborative: stakeholder involvement is at the heart of our efforts to build capacity, strengthen institutions, and equip partners for the long term.

Our work spans climate, water, air, and land-use issues, and integrates evidence and perspectives on governance, the economy, gender and human health.

Across our eight centres in Europe, Asia, Africa and the Americas, we engage with policy processes, development action and business practice throughout the world.

---

## Contents

<b>Introduction</b> .....	<b>4</b>
<b>The CANDI logic</b> .....	<b>5</b>
<b>Deliverables and method</b> .....	<b>6</b>
<b>Findings from CANDI Stage 1</b> .....	<b>8</b>
Industry .....	8
Consumers .....	8
Data.....	8
Policy and legislation.....	9
<b>Next steps</b> .....	<b>10</b>
Purpose of providing environmental footprint information...10	
Industry .....	10
Consumers .....	10
Data.....	10
Policy and legislation.....	11
<b>References</b> .....	<b>12</b>
<b>Appendices</b> .....	<b>13</b>

## Introduction

In 2017, Sweden passed legislation that legally binds it to reach net-zero emissions by 2045, five years earlier than its commitment under the EU Roadmap 2050 (Swedish Government 2017). Sweden's current emissions amount to 5.2 tonnes carbon dioxide equivalent (CO<sub>2</sub>e) per person per year (Naturvårdsverket 2018b). However, research highlights the importance of taking account of not only direct, territorial emissions, but also indirect, consumption-related emissions (Steinbach et al. 2018; Persson, Persson and Nykvist 2015; Minx et al. 2008). In 2017 Sweden's consumption-based climate footprint stood at 8.93 tonnes CO<sub>2</sub>e per person per year (SCB 2019).

Over 60% of the consumption-based emissions associated with Sweden's consumption of goods and services are generated during production in other countries. These goods and services are then imported for final consumption in Sweden (Dawkins et al. 2019). On average, in European countries, more than 50% of emissions arise from imports (European Environment Agency 2010), while Sweden's imported share of emissions is currently 64% (Naturvårdsverket 2018a).

One of the main reasons for the high level of consumption-based emissions is food consumption. A recent study carried out in the municipality of Umeå found that food consumption, at 26% of total household emissions, was the second largest contributor to household emissions of CO<sub>2</sub> after transport (Axelsson, Vanhuysse and Dawkins 2018). At the national level, Swedish household food consumption contributes 31% of total consumption-based greenhouse gas (GHG) emissions (Naturvårdsverket 2018a). Meat consumption and processed foods are the largest sources of emissions. The Swedish diet relies heavily on animal produce, resulting in one of the highest levels of food consumption-related carbon emissions in the world (NU3 2018).

## The CANDI logic

To help achieve Sweden's vision to become a net-zero emitter, a shift is urgently needed. This will require the joint efforts of consumers, retailers and producers (Willett et al. 2019) to:

1. Consume food that leads to the emission of less CO<sub>2</sub>e per kilo, by moving away from a meat- and dairy-intensive diet towards a more locally produced, plant-based and seasonal diet; and/or
2. Produce food that leads to the emission of less CO<sub>2</sub>e per kilo consumed – either by moving away from high emissions-related produce, or by introducing innovative production processes that lead to reduced levels of CO<sub>2</sub>e emissions and increased circularity in the production chain.

To this end, the CANDI project's overarching aim is to increase the uptake of food with lower environmental impacts, targeting both consumers and actors along the product supply chain.<sup>1</sup> We aim to achieve this by working on two pathways (see appendices): first, by providing consumers with easily digestible, comprehensive information on the environmental impact of the food they purchase at the moment of decision making; and, second, by working with retailers, producers and authorities to assess the environmental impact of the food currently available on the Swedish market, the effects of moving towards a more sustainable diet and the role of schemes that could offset negative impacts. This might entail, for example, understanding whether there are any opportunities to alter production processes and increase circularity in the production chain.

The project has been designed according to the principles set out in King and He (2006) to allow proposed solutions to be supported by a wide range of stakeholders (solution consensus), to be feasible (solution acceptability) and to be accessible (solution affordability and availability). The project consists of three stages, with gateway decisions after each stage that allow opportunities to refocus the project's content and approach.

The first stage, from April to December 2019, deepened our understanding of the consumption patterns of a select group of consumers in regard to information about the environmental impact of food production. We also reviewed a number of applications that present information to consumers at the point of decision making in store or online, which provided a more detailed understanding of what such applications focus on, their strengths and what the gaps are. Furthermore, we engaged with a series of organizations (researchers, supermarkets and restaurants) to understand the aims and intentions of existing sustainability plans. By the end of stage 1, the objective was to have a clearer direction and idea of how to help Sweden become more climate neutral ("the concept"), and to have built up a committed and collaborative partnership on how to share carbon emission levels with consumers at the point of decision making.

A second stage, prior to roll-out of the concept in wider society, will entail initial testing in a relatively closed environment (a more lab-like environment), for example, in a supermarket branch or within a certain area. At the same time, assessments will be made of the impacts and trade-offs of the change in consumption patterns. We will undertake an ex-ante and ex-post analysis of consumption and behaviour, and assess which factors have the largest and most durable impact on reducing the consumption-based carbon footprint. In the third stage, the solution would be scaled-up, either through the retailer's own network or through governmental aims, whether with local collaborators and organizations such as Local Governments for Sustainability (formerly the International Council for Local Environmental Initiatives, ICLEI) (see e.g. ICLEI and C40 2018), the C40 cities that have identified a need to work on consumption-based GHG emissions (C40 2018) or national government. Through an assessment of the trade-offs for producers – such as market share and revenue – and a discussion around offsetting the negative impacts of the change in consumption patterns, new policies and/or incentive schemes could be developed that support more sustainable consumption.

<sup>1</sup> The CANDI project is funded by Vinnova through diarienummer 2019-00883

## Deliverables and method

This report contains the findings from stage 1. CANDI Stage 1 was made up of four work packages (see Figure 2):

- WP1. Stakeholder engagement
- WP2. Options appraisal
- WP3. Consumer preferences
- WP4. Concept development and agreement

Table 1 presents an overview of actual deliverables compared to the planned deliverables in the project plan.

Table 1. Project plan: planned and actual deliverables

Work package	Planned deliverable (as per project application)	Actual deliverable
<b>WP1. Stakeholder engagement</b>	<p>Registry and engagement with relevant stakeholders to understand willingness to collaborate and barriers to participation among supermarkets and research institutes;</p> <p>Scan of relevant legislation and policy supporting sustainable consumption and production, including understanding tax incentive systems and other incentives supporting the production and consumption of food with high associated carbon emissions.</p>	<p>Interviews and meetings with industry (ICA, MaxBurgers, AxFood, Mat.se);</p> <p>Interviews with research institutes (RISE and Chalmers University);</p> <p>Participation in conferences (Konsumentverket's Konsumenternas ställning på digitaliserade och datadrivna marknader and Hållbara val av kött – hinder och möjligheter) (“The Consumer Agency’s consumer position in digitized and data-driven markets” and “Sustainable choice of meat: obstacles and opportunities”)</p>
<b>WP2. Options Appraisal</b>	<p>Assessment of other concepts providing information on purchasing habits and footprints, cataloguing benefits and shortcomings;</p> <p>Appraisal of and agreement on required characteristics of the application.</p>	<p>Review of 24 digital applications (international and national, mainly related to food), analysing content, popularity, what works and what is missing;</p> <p>Review of environmental impact databases and calculation of the carbon footprint of five of Urban Deli’s recipes.</p>
<b>WP3. Definition of user needs</b>	<p>Identification of users and classification into groups;</p> <p>Inventory of needs and priorities of user groups</p>	<p>Survey of Urban Deli customers (563 responses) on environmental impact of food including a choice experiment, breaking down results by gender, age, level of education, income and specific food preferences (e.g. vegan, vegetarian, etc.)</p> <p>Draft paper with survey results in progress</p>
<b>WP4. Concept formulation and agreement</b>	<p>Development of concept plan, including data management and handling plan, intellectual property negotiations bringing together the findings from WP1, WP2 and WP3;</p> <p>Communication and sign-off of the concept plan</p>	<p>Development of a proposal for the Formas Digital Transformation of Food call, and successful award of the project in November 2019. Project title: CANDIES (CANDI – Enhancing Systems);</p> <p>Participation in the Vinnova start day, several tweets and LinkedIn messages related to sustainable food, and one press release.</p>

A mixed methods approach was applied throughout stage 1 of the project. Based on approaches linked to service design and behavioural theory (Lambe et al. 2020), a survey was sent to the customers of Urban Deli. The survey contained questions related to purchasing behaviour and information on the environmental impact of food, as well as questions to provide an understanding of the socio-economic status of the respondents. The consumer group is not representative of Swedish society, so general conclusions cannot be drawn. This survey was analysed by SEI, ensuring confidentiality for respondents, and the findings were triangulated with other research done on consumer preferences and the impact of food labelling and environmental awareness (Banterle, Cavaliere and Ricci 2013; Koistinen et al. 2013; Vanclay et al. 2011). In addition, interviews were carried out with a range of stakeholders in supermarkets and restaurants, research institutes and other key actors, and the team attended various events related to sustainable food and digitalization to understand the appetite of the private sector and government for supporting the uptake of food with lower environmental impacts, including how systems should support transparency and the traceability of food. The interviews were not intended to be systematic or comprehensive, but more exploratory in nature. The consumers selected for the first stage made up a relatively homogenous group with regard to the level of education and socio-economic background. The second stage will enable identification of a more heterogenous group, which will broaden the applicability of the survey results.

A one day write-shop collated our findings, jointly analysed them, shared reflections and discussed the next steps of the project.

## Findings from CANDI Stage 1

Our findings from CANDI Stage 1 can be grouped into five areas.

### Purpose of providing environmental footprint information

There is an appetite among some consumers and industry partners to reduce the environmental impacts of food consumption, and there are a number of existing initiatives and information-sharing projects on this topic. However, our study identified that information on environmental impact needs to be broken down so that it is easy for consumers to understand and clearly related to the decisions they can make on reducing their environmental impact.

### Industry

The food industry is making efforts to calculate the environmental impact of its food products, but there needs to be more transparency on the methods used, the assumptions that are being made, and which indicators and data should be used. Currently, there are a number of methods being applied in different initiatives but there is no standardized way of calculating, for example, carbon footprints of food. For this reason, and the additional lack of transparency in the applied methods, differing carbon footprint results for the same food product may be presented to consumers without any further explanation of why there could be differences. This results in increased confusion among consumers and undermines the trust in the carbon footprint calculations. Max Burgers, which was interviewed as part of the project, noted that:

The research project CANDI shows that there is a need for a common and standardized calculation model regarding CO<sub>2</sub> emissions for food, in order to make consumers confident that the information they receive is calculated in the exact same way, no matter who is the sender. Such a scientifically proven standard for CO<sub>2</sub> emissions will also be a prerequisite for nudging behavioural change among consumers, that is, to move sustainable consumption patterns from a niche group to include the vast majority. For us at MAX, this research area will provide crucial insights about the role of information in driving behavioural change among our customers, at the moment of purchase, as well as for developing our own operations.

Systems are also not currently tailored to tracing ingredients throughout the supply chain, which means that footprints cannot be presented for a specific brand but only calculated as averages.

### Consumers

Our research with Urban Deli consumers found that when provided with information on the environmental impacts of food choices, consumers indicated they would alter their choices. However, the information needs to be easily digestible, and provided in the right format and at the right point in time, for example at the point of decision making but also at other times to contribute to consumer learning over time, which should lead to more effective and long-lasting behavioural change.

### Data

Customer data on food purchases is currently being collected by many retailers and restaurants, including through apps, but it is unclear what data is being collected and whether consumers understand how such data is being used and for what purposes. The purposes of/motives for retailers collecting data vary. They could be collecting data to understand which products to advertise or how to adapt to consumer trends. Data might not be collected by retailers with the purpose of understanding behavioural change towards more sustainable food choices. Our



survey identified that consumers prefer to receive information in store, often accompanied by information online/in a phone app.

### **Policy and legislation**

It is unclear what the current trade-offs of moving to more sustainable diets would be for industry and for consumers. A sustainable diet such as the one advocated in the EAT-Lancet Commission (Willet et al. 2019) could, for example, be unaffordable for lower income groups and have “unjust” effects on industry (Wood et al. 2019).

There could be a role for government in supporting a dietary shift, through social programmes for example in schools and workplaces, as well as through procurement legislation and supporting the food industry to purchase more sustainable products.

## Next steps

Following on from CANDI Stage 1, we aim to move our work forward by exploring the preferences of wider consumer groups, building different profiles and working to increase transparency and the traceability of food in the supply chain. We have received funding from Formas under its digital transformation of food call (CANDIES – diarienummer 2019-02274) and intend to submit an application to Vinnova’s Challenge Driven Innovation 2. Our future focus can be grouped in similar categories as our findings.

## Purpose of providing environmental footprint information

In stage 2, we aim to enhance communication of the importance of the environmental impacts associated with food production and consumption, branching out to harder to reach consumers and industry. We will develop communication materials and a communication strategy, among other things, on how to bring on board different perspectives and ensure that we reach a “critical mass”, moving beyond early adopters and Urban Deli’s consumer base to more diverse consumer groups. We might also test various methods of in-store communication, to test “what works”.

## Industry

Stage 2 will map how industry’s systems of procurement, and supplier and environmental information are integrated, and how they could communicate with each other. This would identify areas where systems could be improved by including information about the food supply chain and environmental pressures, showing industry where there are options to improve the environmental impact of food. Dan Jacobson, CEO Urban Deli, acknowledges this:

For a smaller player like Urban Deli, it is crucial that the entire production and supply chain work together to get the right information about the end product’s climate impact.

We would also aim to explore linking environmental data with social impact estimates (carbon emissions as well as other indicators such as equality and labour conditions) for some of the Urban Deli’s products.

## Consumers

In stage 2, further work on assessing consumer demand for more environmentally friendly products will be undertaken. In addition, behaviour change techniques and choice experiments will be identified and used to better understand how behaviour change among consumers could be brought about by provision of information on the environmental impact of food. The research will identify, for example, how the information should be communicated and what information is needed. We will target our work to a more diverse group of consumers, which will feed into more robust results.

## Data

Calculations of carbon emissions from food should be more streamlined, including work on improving the granularity of the indicators and branching out into labelled and branded foods (e.g. in a standard that is supported by the whole of the food industry). Government should assess its role in protecting ethical boundaries when it comes to sharing information. This might be beyond the scope of stage 2, but we will gauge the interest of other parties in this work, and interface with other projects on calculating the environmental footprint of food.

## Policy and legislation

In stage 2, following on from our engagement with industry and consumers, we will analyse how a more environmentally sustainable food system would affect various stakeholders. This would allow us to assess the societal impacts of moving to a more sustainable food system and whether there are conflicting incentives for industry and consumers.

The debate will involve stakeholders along the whole supply chain, within Sweden and elsewhere. As Sivan Kartha, SEI Senior Scientist, noted at COP25 in Madrid:

The only way that we can make emissions go to zero among the whole world is if the world's more privileged inhabitants — those who have benefited as their societies have developed and become prosperous, and burned lots and lots of fossil fuel – eliminate their emissions and if they also extend their support to the rest of the world, to those who are less privileged and who consume less and who emit less, to enable them to do the same.

In addition, we would aim to assess how procurement legislation and other legislation could enable a more sustainable system of food production and consumption.

## References

- Axelsson, K., Vanhuyse, F. and Dawkins, E. (2018). Konsumtionsbaserade Utsläpp i Umeå Kommun. Resultat Av Konsumtionsvaneundersökningen 2018. Stockholm Environment Institute, Stockholm.
- Banterle, A., Cavaliere, A. and Ricci, E. C. (2013). Food labelled information: An empirical analysis of consumer preferences. *International Journal on Food System Dynamics*, 3. 156-170. DOI: 10.18461/ijfsd.v3i2.325.
- C40. (2018). Consumption-based GHG emissions of C40 cities. <https://www.c40.org/researches/consumption-based-emissions>.
- Dawkins, E., Moran, D., Palm, V., Wood, R. and Björk, I. (2019). The Swedish footprint: A multi-model comparison. *Journal of Cleaner Production*, 209. 1578–92. DOI: 10.1016/j.jclepro.2018.11.023.
- European Environment Agency. (2010). The European Environment: State and Outlook, 2010 – Consumption and the Environment.
- ICLEI and C40. (2018). *Data Speaks Louder than Words: Findings from an Initial Stocktake of Climate Change Adaptation and Urban Resilience Efforts*. <https://resilientcities2019.iclei.org/wp-content/uploads/Data-speak-report-web-final.pdf>.
- King, W. R. and Jun He. (2006). A meta-analysis of the technology acceptance model. *Information & Management*, 43(6). 740–55. DOI: 10.1016/j.im.2006.05.003.
- Koistinen, L., Pouta, E., Heikkilä, J., Forsman-Hugg, S., Kotro, J., Mäkelä, J. and Niva, M. (2013). The impact of fat content, production methods and carbon footprint information on consumer preferences for minced meat. *Food Quality and Preference*, 29(2). 126–136. DOI: 10.1016/j.foodqual.2013.03.007.
- Lambe, F., Ran, Y., Jürisoo, M., Holmlid, S., Muhoza, C., Johnson, O. and Osborne, M. (2020). Embracing complexity: a transdisciplinary conceptual framework for understanding behavior change in the context of development-focused interventions. *World Development*, 126. 104703. DOI: 10.1016/j.worlddev.2019.104703.
- Minx, J., Scott, K., Peters, G. and Barrett, J. (2008). *WWF 2008: An Analysis of Sweden's Carbon Footprint*. Stockholm Environment Institute, University of York.
- Naturvårdsverket. (2018a). Konsumtionsbaserade Utsläpp Av Växthusgaser per Område. Stockholm: Naturvårdsverket. <https://www.naturvardsverket.se/Sa-mar-miljon/Statistik-A-O/Vaxthusgaser-konsumtionsbaserade-utslapp-per-omrade/>.
- . (2018b). *Territoriella Utsläpp Och Upptag Av Växthusgaser*. Stockholm, Naturvårdsverket. <https://www.naturvardsverket.se/Sa-mar-miljon/Statistik-A-O/Vaxthusgaser-territoriella-utslapp-och-upptag/>.
- NU3. (2018). *Empreinte Carbone Alimentaire Indice, 2018*. <https://www.nu3.fr/c/empreinte-carbone-alimentaire-indice-2018/>.
- Persson, L., Persson, Å. and Nykvist, B. (2015). *Styrmedel Och Andra Insatser För Att Minska Svensk Konsumtions Påverkan På Hälsa Och Miljö i Andra Länder*. Stockholm Environment Institute, Stockholm.
- SCB. (2019). Miljöpåverkan från konsumtion: Ny officiell statistik. Stockholm. <https://www.scb.se/hitta-statistik/statistik-efter-amne/miljo/miljoekonomi-och-hallbar-utveckling/miljorakenskaper/pong/statistiknyhet/miljorakenskaper---miljopaverkan-fran-konsumtion-2017/>.
- Steinbach, N., Palm, V., Cederberg, C., Finnveden, G., Persson, L., Persson, M., Berglund, M., Björk, I., Faure, E. and Trimmer, C. (2018). *Miljöpåverkan Från Svensk Konsumtion: Nya Indikatorer För Uppföljning. Slutrapport För Forskningsprojektet PRINCE*. Rapport 6842. Naturvårdsverket, Stockholm.
- Swedish government. (2017). The Climate Policy Framework. <https://www.government.se/articles/2017/06/the-climate-policy-framework/>.
- Vanclay, J. K., Shortiss, J., Aulsebrook, S., Gillespie, A. M., Howell, B. C., Johanni, R., Maher, M. J., Mitchell, K. M., Stewart, M. D. and Yates, J. (2011). Customer response to carbon labelling of groceries. *Journal of Consumer Policy*, 34(1). 153–60. DOI: 10.1007/s10603-010-9140-7.
- Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S. and Garnett, T. et al. (2019). Food in the Anthropocene: The EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems. *The Lancet*, 393 (10170). 447–92. DOI: 10.1016/S0140-6736(18)31788-4.
- Wood, A., Gordon, L. J., Röös, E., Karlsson, J. O., Häyhä, T., Bignet, V., Rydenstam, T., Hård af Segerstad, L. and Bruckner, M. (2019). *Nordic Food Systems for Improved Health and Sustainability: Baseline Assessment to Inform Transformation*. Stockholm Resilience Centre, Stockholm. [https://www.stockholmresilience.org/download/18.8620dc61698d96b1904a2/1554132043883/SRC\\_Report%20Nordic%20Food%20Systems.pdf](https://www.stockholmresilience.org/download/18.8620dc61698d96b1904a2/1554132043883/SRC_Report%20Nordic%20Food%20Systems.pdf).

## Appendices

Figure 1: impact pathways

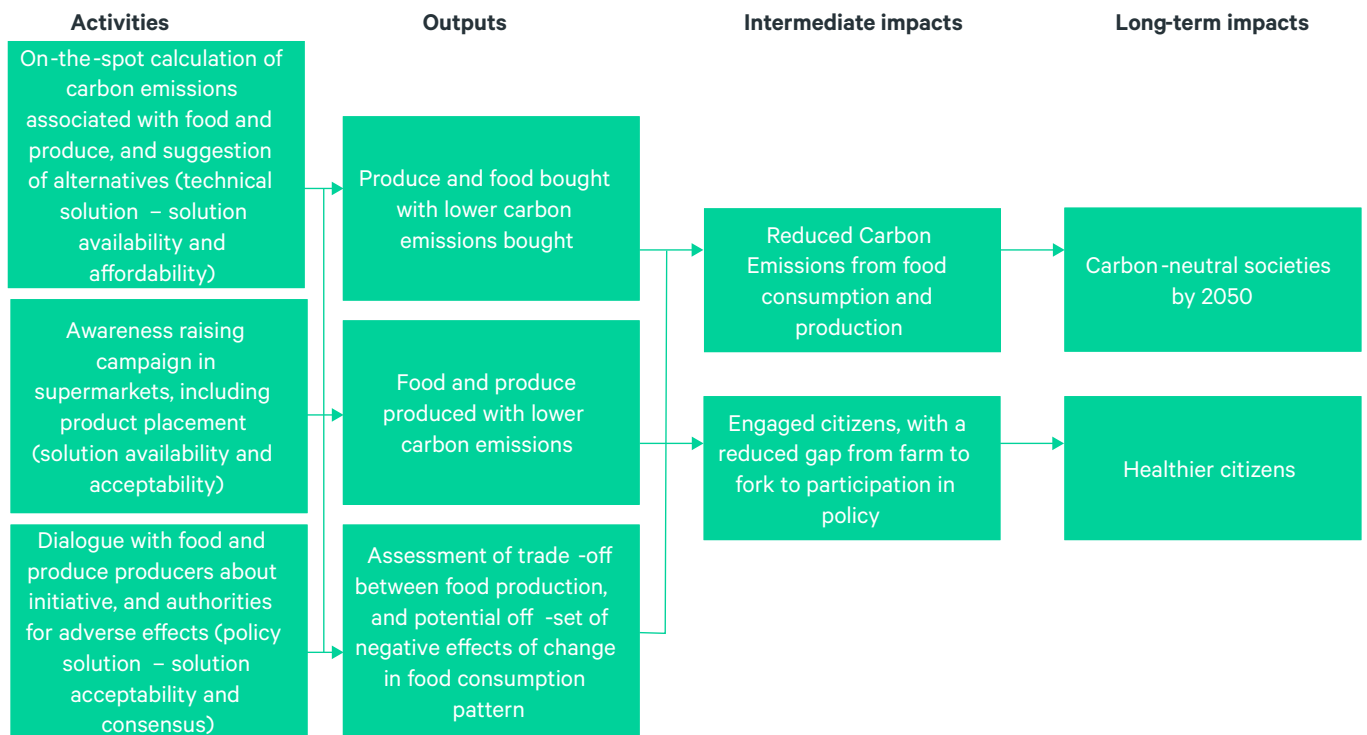
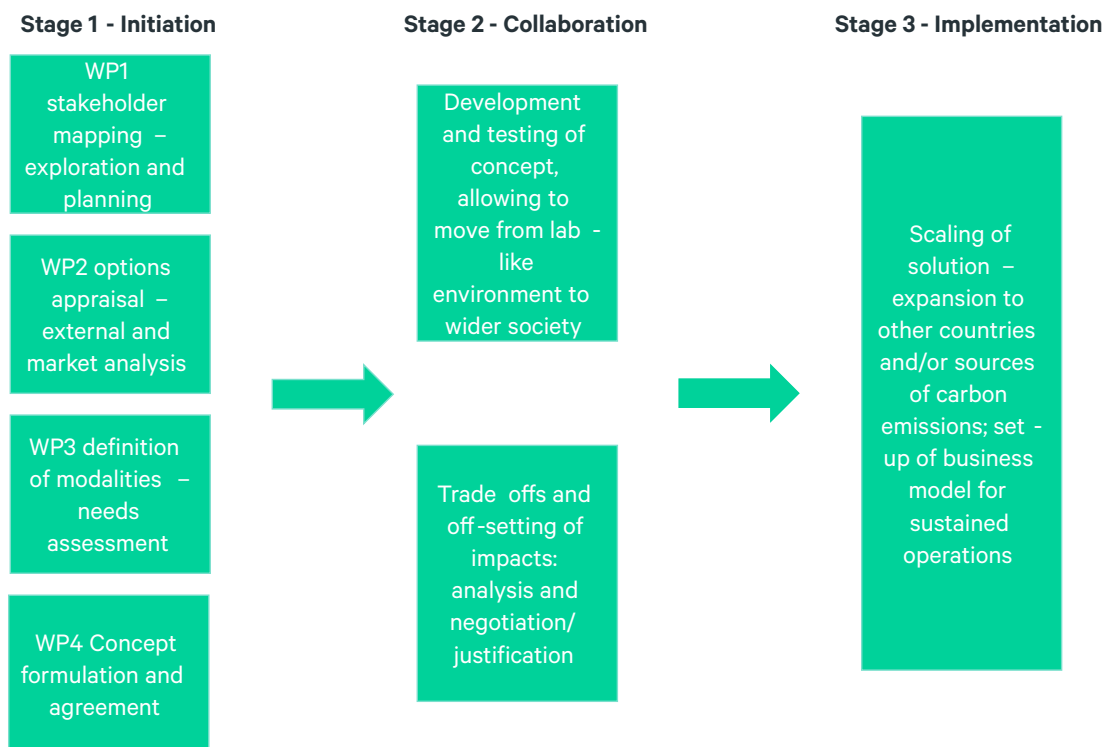


Figure 2: Steps per stage for the Challenge driven innovation call



---

## Visit us

---

### SEI Headquarters

Linnégatan 87D Box 24218  
104 51 Stockholm Sweden  
Tel: +46 8 30 80 44  
info@sei.org

---

#### Måns Nilsson

Executive Director

---

### SEI Africa

World Agroforestry Centre  
United Nations Avenue  
Gigiri P.O. Box 30677  
Nairobi 00100 Kenya  
Tel: +254 20 722 4886  
info-Africa@sei.org

---

#### Philip Osano

Centre Director

---

### SEI Asia

10th Floor, Kasem Uttayanin Building,  
254 Chulalongkorn University,  
Henri Dunant Road, Pathumwan, Bangkok,  
10330 Thailand  
Tel: +66 2 251 4415  
info-Asia@sei.org

---

#### Niall O'Connor

Centre Director

---

### SEI Tallinn

Arsenal Centre  
Erika 14, 10416  
Tallinn, Estonia  
info-Tallinn@sei.org

---

#### Lauri Tammiste

Centre Director

---

### SEI Oxford

Florence House 29 Grove Street  
Summertown Oxford  
OX2 7JT UK  
Tel: +44 1865 42 6316  
info-Oxford@sei.org

---

#### Ruth Butterfield

Centre Director

---

### SEI US

#### Main Office

11 Curtis Avenue  
Somerville MA 02144-1224 USA  
Tel: +1 617 627 3786  
info-US@sei.org

---

#### Michael Lazarus

Centre Director

---

### SEI US

#### Davis Office

400 F Street  
Davis CA 95616 USA  
Tel: +1 530 753 3035

---

### SEI US

#### Seattle Office

1402 Third Avenue Suite 900  
Seattle WA 98101 USA  
Tel: +1 206 547 4000

---

### SEI York

University of York  
Heslington York  
YO10 5DD UK  
Tel: +44 1904 32 2897  
info-York@sei.org

---

#### Chris West

Acting Centre Director

---

### SEI Latin America

Calle 71 # 11-10  
Oficina 801  
Bogota Colombia  
Tel: +57 1 6355319  
info-LatinAmerica@sei.org

---

#### David Purkey

Centre Director