



Supply Chain Sustainability in the Marine Contracting Industry

A qualitative assessment based on the Integral Conceptual Framework for a Circular Climate-Neutral Society

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A qualitative assessment based on the Integral Conceptual Framework for a Circular Climate-Neutral Society

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Van Oord Dredging and Marine Contractors heeft Wageningen Environmental Research gevraagd om een beoordeling van en een advies over hun Supply Chain Sustainability Program. Het gaat hierbij vooral om de aansluiting op internationale agenda's en om eventuele onvoorziene effecten. Voor de beoordeling is gebruikt gemaakt van het Integral Conceptual Framework for a Circular Climate-Neutral Society. De beoordeling leidt tot de conclusie dat het een adequate strategie is die goed spoort met internationale agenda's en een positief effect zal hebben op luchtvervuiling, uitstoot van broeikasgassen en gebruik van plastic. Het thema biodiversiteit krijgt echter te weinig aandacht in de strategie. Daarom wordt aanbevolen voor de korte termijn om indicatoren voor biodiversiteit op te nemen in de monitoring van de strategie, zodat hieraan op lange termijn acties kunnen worden verbonden.

Van Oord Dredging and Marine Contractors asked Wageningen Environmental Research for an assessment of their Supply Chain Sustainability Program, focused in particular on consistency with international environmental agendas and on possible, unforeseen effects. The Integral Conceptual Framework for a Circular Climate-Neutral Society has been used for the assessment. The assessment concludes that the program is adequate. It is well aligned with international agendas and will have a positive impact on air pollution, greenhouse gas emissions and plastic use. However, the issue of biodiversity receives too little attention in the program. It is therefore recommended in the short term to include biodiversity indicators in the monitoring of the program so that long-term actions can be linked to this.

Keywords: Sustainability Strategy, Dredging, Marine Contracting, Circularity, Supply Chain, Business Strategy, Butterfly Model

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Wageningen Environmental Research (WENR) values the quality of our end products greatly. A review of the reports on scientific quality by a reviewer is a standard part of our quality policy.

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Preface

This report combines two aspects of the work of Wageningen University and Research: on the one hand, the scientific contribution to the transition to a circular and climate-neutral society; on the other hand, the practical advice for companies, governments and civil society organisations.

In this project, a newly developed conceptual model for circular climate-neutral systems was used for a request for advice from Van Oord Dredging and Marine Contracting. Van Oord wants to contribute to a sustainable world and has developed a sustainable supply chain program. This program imposes requirements on suppliers regarding circularity, emissions of greenhouse gases, air pollution, plastic use and transparency. This report reports on both the conceptual model and the advice to Van Oord.

Working on this advice once again shows that science application, applied science and fundamental science need each other to contribute to a sustainable society.

Summary

The report is summarised in the following factsheet, which is also separately available.



Scope: the Van Oord sustainable supply chain program, which consists of five themes: sustainable supply chain transparency, reduce greenhouse gas emissions, reduce air pollution, reduce single-use plastics, stimulate circular business models

Ambition

In the research programme 'Towards a circular and climate-positive society', Wageningen University & Research is working, in collaboration with farmers, industry, government and other stakeholders, to make the transition towards a circular (bio) economy as concrete as possible.

Method

The WUR has developed a conceptual model for the assessment of the effects of interventions on circularity and climate neutrality (CCC model). This model has been used here to evaluate sustainable supply chain program (SSCP).

Rationale

Several (European) agendas are examined for major environmental themes. In summary, these are sustainable development, resource depletion, pollution and waste (including plastic, air pollution, noise), climate change (including GHG reduction and fossil fuel reduction), declining biodiversity and ecosystem services and unsustainable land use. Compared to the five VO themes, biodiversity and land use are noticeably missing.

The structure, synergy and trade-offs of the sustainable supply chain program (SSCP) are assessed by a checklist deduced from the CCC model. Two major findings are as follows:

- The strategy is mainly aimed at the level of individual suppliers. However, for circularity, the overall effect of entire chains is important: implementing measures for a sustainable supply chain will obviously have impacts on the entire business chain. This is especially relevant for the circularity theme.
- Some measures under the five chains can have negative indirect impacts, such as the use of more bioplastics on land use and the compensation programs on land use.

Conclusion

- Relevant themes, covered by international agendas, and worked out concretely
- A few key themes are missing, namely biodiversity and land use
- Scope is mainly on suppliers, but the question remains of how this relates to the whole chain

Recommendations

- Start with GHG, air pollution and single-use plastic.
- Work out transparency and circularity
- Include biodiversity, land use and circularity of the chain in the theme of transparency.

KPI

- For GHG, air pollution and plastic as planned in the strategy
- In 2021, a set of indicators for biodiversity and circularity

1 Introduction

Climate change, resource depletion, global pollution and species destruction pose major challenges for society. In order to counter these problems, it is widely accepted that we need to organise the economy in a circular and climate-neutral way.

In the context of the pursuit of corporate social responsibility, Van Oord Dredging & Marine Contractors is designing a sustainability program for its supply chain with the main purpose of reducing environmental impact, which will be used in procurement procedures. In this program, five themes are distinguished: transparency; reduce greenhouse gas emissions; reduce air pollution; reduce single-use plastics; stimulate circular business models (see textbox).

Short description of the Van Oord Sustainable Supply Chain Program (draft, end of 2020)

In the Sustainable Supply Chain program, which is part of their license to operate, Van Oord expresses the mission to improve social and environmental practices throughout the supply chain by setting targets on environmental externalities created by Van Oord and suppliers. Van Oord will engage with main suppliers on the following 5 themes.

1. Sustainable supply chain transparency, with the ambition to have by 2030 full transparency on key materials procured by Van Oord and to create awareness of risks and opportunities
2. Reduce greenhouse gas emissions, with the ambition to be carbon neutral in 2050 for Scope 3 emissions
3. Reduce air pollution, with the ambition of zero SO_x and 80% NO_x reduction in 2050
4. Reduce single-use plastics, with the ambition to use only 100% reusable, recyclable or compostable plastic packaging by 2025
5. Stimulate Circular business models, with the ambition of a year-on-year reduction of waste and natural resources through innovation and circular business models

Van Oord asked WUR to conduct a qualitative assessment and validation of this draft program. During this assessment the following questions were considered:

1. Do the chosen themes reflect current (and near-future) environmental challenges? Are some themes missing?
2. Does the chosen approach fit with (international) agendas of governments and international bodies?
3. What are the potential synergies and trade-offs of the chosen themes?

General Context

Sustainability, which can be defined as our ability to exist constantly, is usually seen as consisting of three interacting domains: social, economic and environmental. These domains coincide with the People, Planet and Profit principles (PPP) of sustainable development. The present 2030 Agenda for Sustainable Development of the UN that was launched in 2015 extends those 'P's to five by including Peace and Partnership. The 17 Sustainable Development Goals (SDGs) of this agenda are accepted by all UN member states and therefore as the global context for sustainable development in the next decade. They form the basis for continental, national, sectoral and company sustainability policies and strategies, i.e., European policies, Dutch policies, business, company social responsibility and Van Oord supply chain sustainability.

The Van Oord sustainable supply chain program is aimed at the environmental component of sustainability, while the social and economic dimension are already covered by other strategies of the company. For this supply chain agenda, Van Oord wants to have more clarity and certainty over whether the program is in line with (especially European) environmental agendas and whether the chosen actions have any negative effects on other environmental topics.

Approach

The Van Oord supply chain program clearly aims to establish a framework that can be used to structure sustainability thinking and to implement activities to increase supply chain sustainability. Our approach to the assessment of this program is based on the WUR-Integrated Conceptual Framework for a Circular Climate-Neutral Society, also referred to as the Butterfly Model. In Section 2, this model and the way it can be applied to the supply chain program are described.

To maximise impact and fit, the program needs to address major, appropriate, global-to-local policy themes. The starting activity of the assessment was to scan policy documents for the major relevant themes (Section 3) and to check if the Van Oord program covers them (Section 4).

The Van Oord supply chain sustainability program addresses environmental sustainability, which is the main area of sustainability where Van Oord and its suppliers can achieve impact. Adaptations that improve environmental aspects do however have implications for, as well as have synergies and trade-offs with, economic and social sustainability. In Section 5, we will use the Butterfly Model to review the structure and completeness of the supply chain program's design and assess the possible trade-offs, risks and synergies. Finally, in Section 6 we describe our conclusions and recommendations.

2 Integrated Conceptual Model for a Circular Climate-Neutral Society

The framework for a circular climate-neutral society (Butterfly Model) is mainly intended for situations of interdisciplinary cooperation in which policy makers, business strategists, consultants, innovators and researchers of different disciplines work together. In this section, we describe this framework. After a short description of the framework including the application in general, we explain the way we will use it in the assessment of a business strategy, in this case the Van Oord sustainable supply chain program.

The Model

The model and its assumptions are described in Bos et al. 2021. Figure 1 gives an artistic impression of the model.

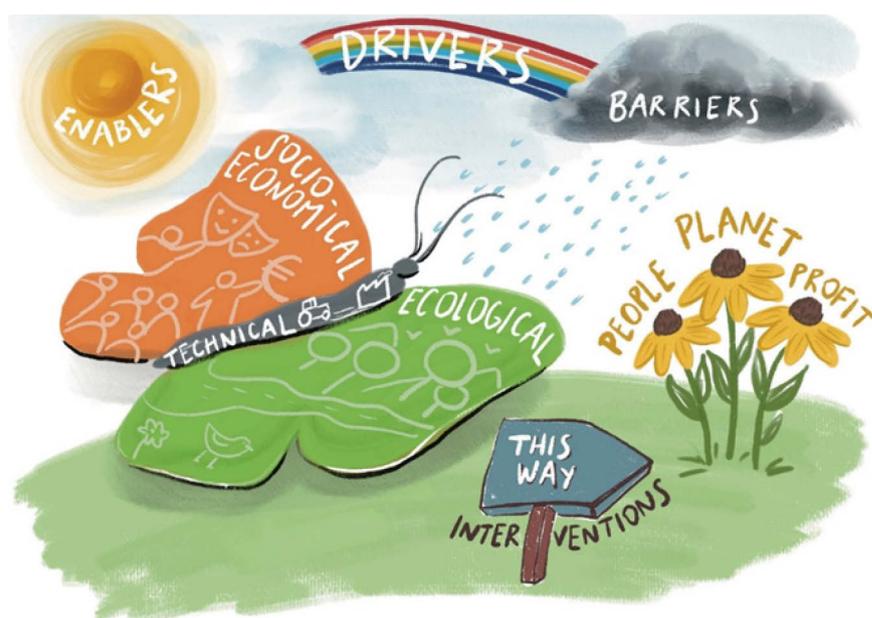


Figure 1 The framework for a circular climate-neutral society (Butterfly Model), artist's impression.

In summary, the model is built up from the following components:

- *Technical system: the bioeconomy*

The technical system includes all the processes in which people (try to) intervene in the physical world to improve their quality of life.

The technical system is part of the socio-economic system and the ecological system (see below).¹

The technical system has a 'day to day' component and a strategic component. The 'day to day' component covers the bioeconomy: the production and use of natural/biological resources, e.g., mining, agriculture, transport, bioindustry, etc.

The strategic component is aimed at improving the system. This includes the choice of the goals that the improvement tries to reach. These goals are described separately, using a flower as a metaphor

¹ In terms of system theory, the technical system is a subsystem, while the socio-economic and ecological systems are aspect systems. A subsystem is a subset of elements in the system, while all the original relationships between these elements remain unchanged. An aspect system is a subset of the relationships in the system, with all elements unchanged (In 't Veld, 1998).

(see below). The strategic component also includes the actual intervention in the system, highlighted with a remote control as a metaphor (see below).

- *Ecological system*

The ecological system is the physical manifestation of all living and non-living matter and flows of material. Part of the processes in the ecological system take place outside human influence; others include humans and their interaction with the ecological system through their physical activities. The ecological system contains several 'great cycles' in which key materials (e.g., carbon, oxygen, nitrogen) are transported through the environment. The ecological system delivers several ecosystem services.

- *Socio-economic system*

The social system includes economic, social and cultural processes from which a certain positive or negative value is attributed to ecological processes.² Economic processes include the production, consumption and distribution of scarce goods and services. Social processes relate to the dynamics in human relationships based on power, rules, habits, personal preferences etc. Cultural processes relate to shifts in values, meanings and opinions.

- *Drivers*

Drivers are powerful processes in the ecological and socio-economic system; they have such a large influence that they have been taken apart in the model. Drivers can be seen as non-influenceable processes, but exactly which processes are the drivers in a specific situation depends on the scale at which the model is applied. On a global scale, there are generally fewer processes that cannot be influenced and thus can be defined as drivers (e.g., the oil price). On a local scale, oil price can also be an important driver, but national policies, for instance, can also act as a non-influenceable driver.

- *Goals*

Goals are concretisations of social values. They determine how changes in the technical, ecological and social system are assessed. Assessing different choices for interventions against goals helps to determine the more optimal interventions/developments. Goals can be expressed in different ways and on different levels, also depending on the scale this model is applied. Values behind goals often differ fundamentally, but widely accepted and relevant for circularity and climate neutrality is the idea to integrate people, planet and profit goals.

- *Interventions*

Interventions are the strategic actions or processes that are aimed at changing the system, in this model, in particular, the technical system. In theory, there are several points of contact to change systems, which range from new techniques to new values. Here we distinguish: interventions by developing new technology, interventions by new strategies of companies, interventions through new legislation and government policies, interventions by citizens' initiatives, interventions aimed at a higher level of competences and knowledge.

In the figure above, these components are depicted by the metaphor of a butterfly. The wings represent the ecological and social system, and the body represents the technical system. The drivers, which are taken apart, are represented by the sun, the wind and the clouds. They can blow the butterfly towards the goals or obstruct it. The butterfly is flying to a flower, i.e., the goals, partly directed by a signpost which stands for the interventions.

Application to the Assessment of a Business Strategy (in general)

In general, the framework can be used in two ways: as a checklist or as a map.

- *As a checklist*

The use of the frame starts with a choice of the scale of the system and the system boundaries. This choice also determines the difference between uninfluenceable processes (drivers) and the influenceable processes. Then we should go through all parts of the framework and try to formulate

² The corona virus entering my body is part of the ecological aspect system, while my displeasure is part of the socio/economic/cultural aspect system.

one or more questions which could play a role in this part of the system. These questions concern the (problems in) the state of the system, goals (aimed at the preferred state of the systems), drivers, interventions, impacts on the system). This use as a checklist does not have a fixed starting point. In many cases, it is obvious to start with the problems in the system and the goals, but in other cases it can be more appropriate to start with drivers or interventions.

- *As a map*

The framework can also be used as a 'map'. For instance, in the application for the development of a knowledge agenda. To develop a knowledge agenda, one of the questions is how much research has already been done. The amount of research and the main content of this can then be 'plotted' on the butterfly to see which aspect of the system has been most extensively researched so far.

For the assessment of the Van Oord sustainability supply chain program, we use the Butterfly Model as a checklist. Table 1 describes the assessment questions which we will use in Section 5 of this report.

Table 1 *The Butterfly Model used as checklist*

Butterfly Model Components	Assessment Questions
General: System Boundaries / Scale / Scope	1 Is the scope in terms of system boundaries of the theme well defined?
Goals	2.1 Are problems / challenges clearly defined? 2.2 Are clear and ambitious targets set?
Drivers	3 Which driving forces are involved? What are positive and negative impacts of driving forces relevant to the theme?
Interventions	4.1 Are relevant stakeholders identified and engaged? 4.2 Are scenarios used to create an image of autonomous development, intended change, and one's own role in it? 4.3 Are adequate interventions defined? 4.4 What is the potential impact of these interventions?
Technical System	5 What is the role and the impact of the supply chain in the environmental impact of the whole chain (suppliers + Van Oord + customers)?
Ecological System	6.1 What is the expected impact on ecosystem components? 6.2 Are there quantifiable effects on ecosystem services?
Socio-economic System	7 Though the program is not aimed at socio-economic goals, is it nevertheless possible to identify societal impacts?

3 International Sustainability Themes

Table 1 presents an overview of the major sustainability themes reflecting or related to environmental issues. This was limited to the major global ones and the most relevant ones for Van Oord’s main operation area, Europe. Subject-wise, we concentrated our search on areas we estimated would be the most relevant considering activities in the Van Oord supply chain.

Global documents are listed before European ones. The themes are (unavoidably, somewhat arbitrarily) hierarchically ordered from general to more specific. Environmental issues are strongly related, and therefore especially the more general policy and strategy documents are present multiple times. The list is far from exhaustive, but covers the main themes and related policy documents.

Table 2 An overview of major environmental sustainability themes in international and European policy

Theme	Document	Organisation
<i>Sustainable development</i>		
	2030 Agenda For Sustainable Development	UN
	The New European Consensus on Development: 'Our World, Our Dignity, Our Future'	EC
<i>Resource depletion</i>		
Optimisation of material flows, circularity, renewable resources	New Circular Economy Action Plan: For a Cleaner and more Competitive Europe	EC
	Updated Bioeconomy Strategy 2018	EC
	The Circular Economy and the Bioeconomy. Partners in Sustainability 2016	EEA
	The "Circular Bioeconomy" – Concepts, Opportunities and Limitations. nova-Paper #9	Nova institute, commissioned by EC
	State of the Environment Report 2020	EEA
<i>Environmental pollution and waste</i>		
Plastics	Plastic Waste: A European Strategy to Protect the Planet, Defend our Citizens and Empower our Industries 2018	EC
	Single-Use Plastics: New EU Rules to Reduce Marine Litter	EC
Air pollution	Road Map for an Enhanced Global Response to the Adverse Health Effects of Air Pollution	WHO
	Ambient Air Pollution: A Global Assessment of Exposure and Burden of Disease 2016	WHO
	Clean Air Quality Package 2013	WHO
	Resolution WHA68.8. Health and the Environment: Addressing the Health Impact of Air Pollution)	EC
Noise	Environmental Noise Directive 2002	EC
<i>Climate change</i>		
General	AR5 Synthesis Report: Climate Change 2014	IPCC
	EU Adaptation Strategy 2013	EC
	2020 Climate & Energy Package	EC
	2030 Climate & Energy Framework	EC
	2050 Long-Term Strategy	EC
	The European Green Deal COM 2019	EC
	LULUCF Regulation 2018	EC

Theme	Document	Organisation
GHG reduction	IPCC reports	IPCC
	Global and EU Strategies	UN, EC
	Clean Energy for all Europeans Package	EC
	Updated Bioeconomy Strategy 2018	EC
	A New Circular Economy Action Plan for a Cleaner and More Competitive Europe 2020	EC
Fossil fuel reduction / renewable energy	2030 Agenda for Sustainable Development	UN
	SDG 7 Tracking Reports	UN
	A New Circular Economy Action Plan for a Cleaner and More Competitive Europe 2020	EC
	Clean Energy for all Europeans Package	EC
	Updated Bioeconomy Strategy 2018	EC
<i>Declining biodiversity and ecosystem services</i>		
	Global Assessment Report on Biodiversity and Ecosystem Services 2019	IPBES
	Mapping and Assessment of Ecosystems and their Services	EC - MAES working group
	EC Biodiversity Strategy to 2030	EC
	Soil Thematic Strategy	EC
	Water Framework Directive	EC
	Marine Framework Directive	EC
	Habitats Directive, Birds Directive	EC
<i>Unsustainable Land use</i>		
	Towards Sustainable Land Use Aligning Biodiversity, Climate and Food Policies	OECD
	The State of the World's Land and Water Resources for Food and Agriculture (SOLAW) – Managing Systems at Risk 2011	FAO
	Sustainable Land Use for The 21st Century	UN

At the global scale, the stage is set by the UN's 2030 sustainable development agenda that is adopted by all UN member states and forms the framework to which all lower-level policies and strategies refer (or at least within which they fit).

Zooming in on environmental sustainability, a convenient overall theme in our hierarchy is the use of natural resources. The extraction or cultivation of raw materials, their use in production processes and the release of waste materials into the environment are all linked to various environmental pressures and impacts. Through the threat of resource depletion, this overall theme is tightly linked to both long-term economy and aspects of social well-being. As the reduction of raw material use and especially the reduction of waste streams has a large impact on (the reduction of) environmental pressures, policies and strategies addressing environmental threats are (at least at the EU level) mainly incorporated within a policy framework that has the prevention of resource depletion as its main driver and objective.

Circular economic policies and strategies are the main instrument to conquer resource depletion. They aim for a higher resource efficiency by reducing inputs, reducing waste streams and increasing reuse and recycling. Bioeconomy strategies address the increase of renewable (bio)feedstock. Because the reduction and reuse of rest streams of biomaterials has untapped potential for increased efficiency and reduction of environmental pressures, both strategies are increasingly combined in circular bioeconomy strategies. All main environmental sustainability themes are linked to circularity and most of them (with the exception of land use) are explicitly addressed in circularity policies and strategies. They are discussed below with their possible interactions, synergies and trade-offs:

- *Climate change*

The main policy goal is the reduction of the emission of greenhouse gases (GHG), with the reduction of fossil fuel use as a derived target. Partial solutions are increased efficiency of energy use and the use of renewable energy. There are obvious synergies with long-term economic sustainability through the reduction of resource depletion and with biodiversity protection and social sustainability

issues like health through the reduction of pollution, including GHG emissions. There are trade-offs with short-term economic interests through implementation costs and with biodiversity and social sustainability through for example negative environmental and land use impacts of renewable energy forms and the increased risk of the accumulation of disease agents and dangerous substances in circular systems. For instance, because the production of solar panels and windmills make use of many scarce natural resources (e.g., copper, iron and other metals), there is a trade-off between energy production and resource depletion.

- *Declining biodiversity and ecosystem services*

Ultimately, a sustainable economy depends on functional biodiversity providing ecosystem goods and services like food (for which e.g., functioning soil biodiversity and pollination are crucial), clean water, clean air and oxygen. Biodiversity decline is therefore a problem receiving increasing policy attention over the last decades. The EU has a separate biodiversity strategy and a host of directives directly or indirectly aimed at biodiversity protection in place. There are synergies between the reduction of pollution and waste streams and protection. Trade-offs can for instance occur between the land use effects or the disturbance caused by renewable energy sources.

- *Pollution and waste*

The reduction of pollution and waste has synergies between social sustainability (health and well-being), environmental sustainability (effects on biodiversity) and economic sustainability (resource efficiency and reduction of waste streams). Issues are climate change, loss of crucial minerals in effluents, health issues, biodiversity decline, air, soil and water pollution.

- *Unsustainable land use*

Land use is specifically addressed in climate policy but is also a sustainability theme in a wider sense due to issues like the tension between functions (living, natural habitats / food / renewable feedstock) and between environmental pressures and productivity. Possible issues are soil degradation and pollution, space taken up, quality loss due to noise, etc.

4 Relationship With the Supply Chain Program

The themes from the various agendas are divided in pressure factors and impacts. Continuing on this path, the next table indicates which themes are well covered by the sustainable supply chain program (hereafter called SSCP), and which require some more attention.

Table 3 Are the major environmental themes covered by the SSCP?

Major environmental policy themes	Sustainable supply chain transparency	Reduce GHG emissions	Reduce Air pollution	Reduce Single-use plastics	Stimulate Circular business models
Pressures					
<i>Resource depletion</i>					
• Optimisation of material flows, circularity	+				++
• Renewable resources	+				++
<i>Environmental pollution and waste</i>					
• Noise	-	-	-	-	-
• Plastics	+			++	
• Air pollution	+		++		
Impacts					
<i>Climate change</i>					
• GHG reduction	+	++		+	
• Fossil fuel reduction / renewable energy	+	++		+	+
<i>Declining biodiversity and ecosystem services</i>					
• Biodiversity	-	-	-	-	-
• Ecosystem services	-	-	-	-	-
<i>Declining soil quality and land use potentials</i>					
• Degradation / quality loss, erosion, fragmentation, area loss	-	-	-	-	-

Pressures

A first major theme in the agendas discussed in the previous chapter (Table 3) is *resource depletion*. This is mainly covered by the actions under the 'circularity' theme of the SSCP. It also plays a role in the transparency theme.

The second major theme is *pollution and waste*. Air pollution is covered by a theme in the SSCP, plastics too, but the plastic theme focuses on single-use plastics. Several agendas also address non-single-use plastics. Several agendas also mention the noise level in the sea as an important theme. For a long time, this topic received little attention. This theme is also relevant for the theme of transparency of the SSCP.

Impacts

The impact on climate change is well covered by the SSCP themes GHG reduction, air pollution and (indirect) single-use plastics.

However, the impact on *biodiversity* and *ecosystem services*, which are becoming increasingly important in the various agendas, is hardly reflected in the SSCP themes. Indirectly, biodiversity will benefit from less GHS, less air pollution, less single-use plastic and more circularity, which are all SSCP themes. However, biodiversity decline has more causes, like habitat loss and disturbance of

populations. Information on these can be included in the transparency theme, and the relationship can be covered in the general program.

The third impact theme is *soil quality and land use*. Van Oord mainly works offshore, so this does not seem to apply. However, the activities of suppliers can possibly contribute indirectly to low land use potentials in the form of degradation, erosion, fragmentation or area loss, for instance by the substitution of fossil fuel by certain types of biofuel. These impacts are also important for the SSCP theme of transparency.

5 Completeness, Synergies and Trade-offs

WUR has developed a conceptual model for the assessment of the effects of interventions on circularity and climate neutrality which is described in Chapter 2. This model has been used here to evaluate whether the SSCP addresses all important points and to assess the possible trade-offs and synergies of measures taken under the program. Table 4 shows the conclusions. The first column describes the steps from the model. The following columns show to what extent these are included in the SSCP.

Table 4 Results of check of the SSCP using the Butterfly Model. (Green cells indicate the BM component is well covered, orange cells indicate partly covered, and red cells indicate points of attention.)

Butterfly Model Checklist questions	Sustainable supply chain program				Stimulate Circular Business models
	Sustainable supply chain transparency	Reduce greenhouse gas emission	Reduce air pollution	Reduce single-use plastics	
1. Is the scope in terms of system boundaries of the theme well defined?	Although LCAs cover the full life cycle of procured products, the scope is limited to the suppliers and not the full chain.	A clear scope for three emissions	Clear choice	Clear choice--the goal is 100% reusable, recyclable or compostable	Circular business models can apply to different levels, e.g., to individual suppliers or to the whole chain; the SSCP focuses on the suppliers, and therefore does not cover whole chain ambitions.
2.1 Are problems / challenges clearly defined?	The general transparency challenges are clearly defined, but especially biodiversity and land use effects are missing.	Adequate problem description, well thought about where in the chain potentials are highest	Adequate problem description	Adequate problem description	Overall challenges are defined, text is work in progress
2.2. Are clear and ambitious targets set?	Full transparency is a clear target, but how awareness of risks and opportunities is created is not addressed.	Clear	Clear	Clear	Clear demand for year-on-year reduction of natural resource use and waste, but why not also ask for increased reuse and recycling? Innovation would be better placed under this method.
3. What are positive and negative impacts of driving forces relevant to the theme?	Requirement for more transparency from governments, public etc. is mentioned, as well as the need of information to be able to define actions.	Not mentioned but basically implicit in overall aim	Not mentioned but basically implicit in overall aim	EU and UN policies mentioned	Not mentioned; in this case, it would be worthwhile to refer to circular economy strategies.
4.1 Are relevant stakeholders identified and engaged?	Stakeholder meetings organised for all themes				
4.2 Use scenarios to create an image of autonomous development, intended change, and own role in it.	Autonomous change scenario is more or less implicit (left behind, possible future non-compliance and/or reputation damage) and theme scenarios are partly present, but an overall scenario addressing time horizon, intended change and the position of Van Oort in the larger system would be helpful.				
4.3 Are adequate interventions defined?	One LCA for first year is realistic, but there may be a tension between the actions (LCA's) and the overall goal of this theme; although perfectly suited for a first phase, LCAs may need to be supported by other methods (e.g., risk assessment) at consecutive stages.	Clear, adequate first action and two intervention methods identified	Clear, adequate first action and general intervention method (reduction) identified	The first action is a minor step in relation to the ambition. Why for instance not also ask suppliers to come up with possible alternatives? Intervention methods 'eliminate', 'innovate' and 'circulate' are identified.	Broad and unspecific; this theme could be linked to transparency and for instance identify innovation as a way to achieve reduction of resources and waste and increase circularity.

Butterfly Model Checklist questions	Sustainable supply chain program				Stimulate Circular Business models
	Sustainable supply chain transparency	Reduce greenhouse gas emission	Reduce air pollution	Reduce single-use plastics	
4.4 What is the potential impact of these interventions?	The effect of / follow-up on the LCAs is properly addressed.	Impact is not explicitly mentioned but follows from ambition	Impact is not explicitly mentioned but follows from ambition.	Impact is not explicitly mentioned but follows from goal	Pursued impact follows from goal
5. What is the role and the impact of the supply chain in the environmental impact of the whole chain (suppliers + Van Oord + customers)?	In a very general sense, this could be part of a general explanation of the motivation for and the expected impacts of the program; for the separate themes it is probably only useful in specific cases, where supply chain practices interfere with specific aspects of the natural system; identification of such cases could be part of transparency.				
6.1 The impacts on the different ecosystem components (only physical)	It could be useful to mention that identification and description of possible effects will be facilitated by transparency.	If general impacts are covered in overall description	If general impacts are covered in overall description	Possible impact (positive or negative) of changes in production methods and reuse or recycle procedures could be a point of attention; microplastics could be mentioned. If general impacts are covered in overall description	If general impacts are covered in overall description
- Sea (including marine life and sea use effect)					
- Land (including freshwater, terrestrial and soil life and land use effects)	KPI's now quantify the reduction of pressures, and those can be seen as proxies for the positive impact on biodiversity and ES; future methods may allow a more direct calculation of ES impacts; more inclusive types of accounting are becoming common.				
6.2 Are there quantifiable effects on ecosystem services?	Environmental sustainability interacts with economic, social and cultural sustainability. Environmental measures will therefore often have impact in these domains as well. Circularity is for instance a main instrument to address long-term economic sustainability, and environmental measures resulting in the reduction of resource use, pollution and waste will contribute to this goal as well. Environmental measures can burden short-term company economics, but may be necessary for a future licence to operate. Many environmental measures can have synergies with social aspects, like health, but they may also be trade-offs when measures for instance cost jobs, or when for instance reuse of materials leads to higher risks. Interactions with the cultural domain are less obvious and probably less important in the Western world, but can play a role in third-world countries, for instance when area demand for activities like biofuel crops conflicts with spiritual values of indigenous people.				
7. Impacts on the social - economical - cultural aspect system	In a general sense, these possible impacts deserve attention. The goal to take them into consideration could be taken up in the general aims of the SSCP. In a more specific sense, awareness and identification of possible problems and opportunities could be part of the transparency theme.				

The table indicates that the aims, targets and boundaries of the SSCP themes are in general well defined and described. The interventions are mostly in line with the objectives and will have a positive impact on many components of the environment. The first actions defined under the program are logical, form a good starting point and set baselines. More detailed remarks are mentioned in the cells of the table.

The table contains two points of attention. First, the theme of biodiversity receives little attention, which was also mentioned in the previous chapter.

A second point of attention concerns the scope of the SSCP (checklist point #5). The program is focused on the supply chain, for which relevant, concrete and practical proposals are made. These will probably lead to improved supply practices, especially for the GHG, air pollution and plastics themes. Although they are probably intended, possible sustainability improvements at the chain level are currently not explicitly included. For instance, is it conceivable that a new product will increase the environmental impact of the Van Oord suppliers, but will decrease overall environmental impact of the whole chain, from suppliers to consumers?

6 Conclusions and Recommendations

We compared the SSCP to the themes mentioned in various national and international sustainability agendas and used the WUR 'Butterfly Model' as a checklist for completeness and the identification of possible synergies and trade-offs.

General Conclusion

Overall, the program covers what it needs to. The selected themes cover the major policy themes. Some themes receive little attention, biodiversity most important among them.

Rationale: Why is This Program Important?

The present draft of the program starts with a clear goal: improving social and environmental practices throughout the supply chain. Although it is implicitly clear what the motivation for the program is, a brief description of this background could help readers better understand where this program comes from and why it is both necessary and smart to have. We recommend adding a short explanatory paragraph between the goal-setting. This paragraph could explain that the nature of the activities of Van Oord makes it logical that a sustainability program should concentrate on environmental aspects. The same paragraph could also explain in which way the social goal is taken up.

Boundaries: What Should the Program Address?

The program relates to the supply chain and sets goals for Van Oord that are to be achieved in cooperation with its suppliers. We see this as a good and practical ambition that will certainly lead to fewer emissions and less plastic. However, using the steps in the Butterfly Model as a checklist, we noticed that there are still some unclear areas in terms of extent and boundaries. We recommend defining the strategies boundaries. The now-defined actions clearly aim to measure, visualise and reduce the impact of the presently procured products, but a future outlook of the program could include innovation in the entire chain, including Van Oord's core activities and Van Oord products and services customers.

Priorities and Timeframe

We conclude that the five themes of the program are an evident choice, contain all necessary elements and cover all important aspects. Nevertheless, we see a difference between the themes of circularity and transparency on the one hand and greenhouse gases, air pollution and single-use plastics on the other hand. Circularity and transparency have a more overall character and can be worked out as such.

Although development over time is implicit in the SSCP, especially in terms of the ambitions of the themes, the time perspective is currently not explicitly addressed. The three themes--reduction of GHG, air pollution and single-use plastics--form a perfect starting point for a new cooperation with suppliers. They will deliver the easily obtainable first results of the SSCP: the 'low-hanging fruit'.

This would lead to a timeframe in which the themes greenhouse gases, air pollution and single-use plastics are taken up as soon as possible, but some additional time is taken to further elaborate upon the themes of circularity and transparency. Circularity could be aimed at the overall impact, and transparency could be aimed at monitoring the overall impact.

Circularity as an overall aim

As indicated in Section 2, the transition to a (more) circular economy is a main instrument chosen in international sustainability policies. Circularity is therefore is a logical theme to include in any sustainability program. Circularity policy includes important environmental targets, and all sustainability measures taken within the SSCP can be guided by it and will contribute to it.

This would mean that circularity is not only worked out as a requirement for suppliers, but that requirements for suppliers are seen as part of the circularity of the entire business chain.

Include biodiversity and ecosystem services in the transparency theme

The SSCP has a motto--Measure, Visualise and Reduce together--and the transparency theme serves the first and most urgent requirement to support these aims: information. As such, information is an evident second overall theme. The transparency theme's goals currently include the awareness of risks and opportunities, but method and rationale concentrate on material flows and do not further address those two aspects.

The overall impact of reducing emissions (GHG, pollution, plastic) will not only depend on their direct impact, but also on their possible positive or negative side effects: their synergies and trade-offs with other pressures and with economic and social aspects. For instance, a supplier can reduce GHG but increase the production area with possible consequences for biodiversity through habitat destruction and pollution.

We would therefore recommend to (in time) include an assessment of the possible risks and opportunities in the transparency theme. We would specifically recommend including possible interactions with biodiversity and ecosystem services because these policy themes are not yet mentioned in the program.

Biodiversity systems are complex, and effects can sometimes be difficult to forecast. For an appropriate and useful monitor, it is advisable to measure the actual impact on targeted biodiversity as well as general biodiversity by monitoring species numbers and densities during and following activities. This will have the added value that positive effects are actually documented and that action can be taken in case of unexpected negative effects.

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