Soil Health Index Launch Accelerator in the Netherlands

Viability assessment, market segmentation and business model developments

L C P M Stuyt and H.G.M. van den Elsen

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Een marktonderzoek wordt gerapporteerd naar de lancering van een Soil Health Index - SHI - in Nederland. In technisch/wetenschappelijk opzicht is de Amerikaanse voorganger van de SHI al goed ontwikkeld, inclusief praktijkervaring. Dit onderzoek omvat het ontwerp van waardeproposities: hoe waarde te creëren voor SHI-klanten en voor ons bedrijf in Nederland en daarbuiten. Het marketingpotentieel van de SHI en de essentiële ingrediënten van een bedrijfsmodel worden besproken en samengevat.

A marketing survey into the launch of a Soil Health Index - SHI - in The Netherlands is reported. In technical/scientific terms, the American predecessor of the SHI is well developed, including field experience. This survey is on value proposition design: how to create value for SHI customers and for our business in The Netherlands and beyond. An assessment of the marketing potential and the essential ingredients of a business model are discussed and summarized.

Keywords: soil health index, soil ecological functions, agricultural production, market segmentation, business development, valorization

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Preface

In a reconnaissance survey, held in 2017, we have made a viability assessment of a Soil Health Index (SHI) in the Netherlands. Next, we have done an exploratory market segmentation. Using the results of these steps, we have investigated all information required to support the development of a well-founded Business Plan for the SHI. This business plan must convince policy makers, the public, private investors, and other stakeholders that the SHI is a promising tool for durable soil management. After launching the SHI in the Netherlands - where we will locate our beachhead market – it is our ambition to make the SHI deployable anywhere in the EU and beyond.

For this project, Climate-KIC has granted the order for this 'single partner project', providing EIT funding of €50,000.- Furthermore, funding for the development of the SHI was developed by the province of Gelderland and Flevocampus.

Unfortunately, neither the market segmentation process nor the development of a SHI Business Model could be finalized during the term of this project.

Summary

This report describes the stepwise valorisation of the Soil Health Index (SHI) and its marketing potential in The Netherlands and beyond. Potentially, the SHI is a promising technique to assess and improve soil health, which may be defined as the capacity of a soil to function. SHI is a diagnostic and a remedial tool in one package, since it links soil health to on-farm improvement measures such as optimized fertilizer application, reduced tillage, management with cover crops, etc.

The concept of 'Soil Health' that we use as a starting point was developed by Cornell University, Ithaca, NY (USA), and operationalised as 'Comprehensive Assessment of Soil Health' (CASH). In 2016, Wageningen Environmental Research (WENR) introduced a modified version of their 'Soil Health Assessment' in The Netherlands, as the 'Soil Health Index' (SHI).

This report contains four sections: a viability assessment of the SHI, a market segmentation, a blueprint for a business model and the development of an SHI website. For each of these valorisation components, we have made considerable progress towards the desired result.

1 Introduction

Soils are the basis of our living planet and associated with nearly anything we need to survive. Indeed, soils are unique living ecosystems that provide us with many crucial services. They provide the basis of our natural and urban ecosystems, they regulate the water cycle, they store and filter water, they provide the resources to produce food and fuel, facilitate natural recycling of waste streams, and they store CO₂. The soil is, literally, the basis under our life and under our economy. During the last century, the world has lost arable land more quickly than at any other time in history. This has happened while the demand for water and food is greater than ever and continues to grow. The soil needs to be in the best possible condition to keep providing the services that are essential to meet the societal challenges of the 21st century. Healthy soils are a crucial ingredient to meet the worldwide challenges formulated in the 17 Sustainable Development Goals.

Soil health is like the weather: people talk about it, few understand it, and still fewer do anything about it. Indeed, this has been the case in the years past. New insights in the functioning of a soil provide perspectives to improve the condition of a soil, worldwide. As early as 1989, the University of Wisconsin (USA) introduced a Soil Health Report Card for farmers. The concept of a 'Soil Health Assessment' that we use as a starting point for the soil health assessment in the Dutch context, was developed by Cornell University, Ithaca, NY (USA), and operationalised as 'Comprehensive Assessment of Soil Health' (CASH)¹ (Moebius-Clune et al., 2016); see Annex 1 on page 55). In close consultation with Cornell University, Wageningen Environmental Research (WENR)² introduces a modified version of Cornell's 'Soil Health Assessment' in The Netherlands, as the 'Soil Health Index' (SHI). Design and operationalisation are not yet fully developed; this will be done in close consultation with Cornell and the intended customer groups.

In 2017, financial support was granted for further improving the concept of soil health in the USA; see Annex 2 on page 58. In the Netherlands, considering the fact that a healthy soil is an essential basis for food production, various local initiatives were taken, for a healthy soil environment that is well suited for many functions beyond the agricultural sector. The Dutch farmer's organisation LTO is very active in promoting healthy soils. They have set up a range of projects to stimulate sustainable soil management where farmers cooperate with scientists and regional policy makers. Meanwhile, the awakening of awareness among other interest groups, at regional and national scale, is remarkable.

Given the escalating problem of soil degradation in the European Union, Wageningen Environmental Research (WENR) proposes a Soil Health Index (SHI) as a tool to create awareness of soil health, and to remediate soil health issues. Especially this last feature sets our initiative apart from other initiatives in the Netherlands that deal with any form of soil health assessment. We believe that the time has come to mount a concerted effort to elucidate the relationships and interactions between soil health, plant health and human health.

1.1 Soil functions and soil health

1.1.1 Soil properties and Soil Health Assessment

The soil on which we live and develop our activities is a crucial medium. It is the source of our food, a habitat for animals and a location for nature, but also important for the entire food cycle, water filtration, air and our need for fibres. The basic functions of the soil can be summarized in six functions, as shown in Figure 1 (page 10).

¹ <https://soilhealth.cals.cornell.edu/>

² <https://www.wur.nl/en/Expertise-Services/Research-Institutes/Environmental-Research.htm>

Figure 1 Functionality of a soil, classified as 1) habitat for organisms; 2) nutrient cycle; filter and buffer; 3) medium for plant growth; 4) regulation of water and climate and storage of carbon; 5) medium for geotechniek; 6) physical and cultural heritage

Among the 'services' that the soil provides are processes like cleaning water, storing rainwater; storage of nutrients and CO_2 , and climate regulation. These types of services are known as Eco System Services (ESS). The importance of the soil and its natural resources, and the ecosystem services they provide are not always appreciated (Dominati, 2010). In recent decades, however, people are becoming increasingly aware of the importance of a well-functioning soil. We do not merely speak of a well-functioning soil if it provides the services that it is supposed to do. Rather, we focus on the extent to which a soil is capable to do so for a prolonged period, providing sustainable use. In order to realise this, it is necessary that the soil's ecosystem works well (Brussaard, 1997), so that the soil can recover sufficiently after providing its services and at the same time has sufficient resilience to resist external threats. Examples of external threats are desiccation, flooding, salinization, erosion etc.

A well-functioning soil ecosystem is important when the soil has to provide services such as the production of food, both primary (arable farming) and secondary (livestock farming). A well-functioning soil ecosystem has physical, chemical and biological properties that ensure that food production is sustainable, so with the lowest possible rate of added nutrients. It must be ensured that the output of the soil (crop yield) and the input (organic fertilizers, green manures) are in balance, and that the soil ecosystem has the opportunity to close the cycle. This means: conversion of added substances to nutrients through soil biology and soil chemistry.

In brief, the assessment of soil health may be used to (i) increase awareness of soil health, (ii) understand constraints beyond nutrient deficiencies and excesses, (iii) target management practices to alleviate soil constraints, (iv) monitor soil improvement or degradation resulting from management practices, (v) compare management practices to develop recommendations for farm and field specific soil health management planning. Furthermore, soil health assessment is very useful for land valuation purposes, i.e. facilitate the realization of equity embodied in healthier soils and to enable the assessment of farming system risk.

The term 'soil health' has a slightly different meaning than the term 'soil quality'. Soil quality is defined as the capacity of a specific type of soil to function, within natural or managed ecosystem boundaries, to maintain the production of plants and animals, to maintain and improve water and air quality and to support the health and habitation of humans (Karlen, 1997). Soil health is the continuous capacity of the soil to function as a vital living system, within the boundaries of ecosystem and land use, to maintain biological productivity, to maintain the quality of air and water environments, and to promote the health of crops, animals and humans (Doran, 2000). This definition is somewhat more 'holistic' in nature; the emphasis is more on the soil as part of a larger ecosystem and includes all soil functions. In contrast, in soil quality the emphasis is focused on 'production'. Since we like to see the soil as more than merely a production medium, we prefer to use the term soil health. For a summary of definitions of soil health, see Annex 3 on page 60).

The functioning of the soil ecosystem can be assessed from a quite a few of soil properties, expressed as parameters. These parameters can be quantified by field- and laboratory measurements. A set of critical physical, chemical and biological parameters has been identified that are representative of the functioning of the soil. The values of these parameters are associated with the functioning of the soil ecosystem. The Soil Health Index (SHI) is the system that measures these parameters, assesses their values and assigns quality indications to them in terms of 'scores'.

Which properties does a 'healthy' soil have? Here follows a list of the properties of a healthy soil related to crop production and good properties for the environment:

- retention and recycling of nutrients,
- supporting plant growth,
- capturing carbon,
- facilitate good infiltration and storage and filtration of water,
- suppression of vermin, diseases and weeds,
- detoxification of harmful chemicals,
- support the production of food, animal feed, fibre and fuel.

If the soil does not function adequately, sustainable production, environmental quality and net yields will be challenged in the long term. Deteriorated functionality may cause limitations of specific and interactive soil processes.

When we speak of a 'vital living system', all physical aspects of this system are involved in the quality of this system. In other words: all specific soil properties have an impact on soil health. Soil properties (or, rather, the 'soil ecosystem' since we consider a living system) are considered to comprise all physical, biological and chemical ('FBC') properties, cf. Figure 2. In order to determine soil health, we must assess the quality of these properties. As the comprehensive range of soil properties encompasses dozens of associated parameters, and we would like to develop a manageable and affordable system that determines soil health. Hence, we must limit ourselves to the most important and influential parameters.

For any soil, Cornell University presents soil health assessment reports as illustrated in Figure 3.

Figure 2 Soil health may be considered an overlap of the physical, biological and chemical properties of the soil

Comprehensive Assessment of Soil Health				
From the Cornell Soil Health Laboratory, Department of Soil and Crop Sciences, School of Integrative Plant Science, Cornell University, Ithaca, NY 14853. http://soilhealth.cals.cornell.edu				
<div> <div> 1 Grower: Bob Schindelbeck 306 Tower Rd. Ithaca, NY 14853 </div> <div> Sample ID: LL8 Field ID: Caldwell Field- intensive management Date Sampled: 03/11/2015 Given Soil Type: Collamer silt loam Crops Grown: WHT/WHT/WHT Tillage: 7-9 inches </div> </div>				
Agricultural Service Provider: Mr. Bob Consulting rrs3@cornell.edu				
Measured Soil Textural Class: silt loam Sand: 2% - Silt: 83% - Clay: 15%				
Group	Indicator 2	Value 3	Rating 4	Constraints 5
physical	Available Water Capacity	0.14	37	
physical	Surface Hardness	260	12	Rooting, Water Transmission
physical	Subsurface Hardness	340	35	
physical	Aggregate Stability	15.7	19	Aeration, Infiltration, Rooting, Crusting, Sealing, Erosion, Runoff
biological	Organic Matter	2.5	28	
biological	ACE Soil Protein Index	5.1	25	
biological	Soil Respiration	0.5	40	
biological	Active Carbon	288	12	Energy Source for Soil Biota
chemical	Soil pH	6.5	100	
chemical	Extractable Phosphorus	20.0	100	
chemical	Extractable Potassium	150.6	100	
chemical	Minor Elements Mg: 131.0 / Fe: 1.2 / Mn: 12.9 / Zn: 0.3		100	
6 Overall Quality Score:			51 / Medium	

Figure 3 Sample Soil Health Assessment Report, as developed by Cornell University (NY, USA), with (1) Background info, (2) Measured indicator, (3) Indicator value, (4) Rating, (5) Constraints, and (6) Overall quality score (Source: Moebius-Clune et al., 2016)

The Cornell Soil Health Assessment determines soil health, based on 14 biological, chemical and physical parameters, which are automatically quantified as an index (0-100) for each of the parameters, making the results (both affordable for and) accessible to non-professionals. Subsequently, targeted measures can be taken by farmers or other end users to improve the least healthy soil characteristics. This simple, integrated approach gives the Cornell SHA tool a competitive edge because none of the alternative instruments or systems can do this.

1.1.2 Soil improving measures

The scores that emerge from the SHI are unambiguous and clearly indicate where (according to SHI) improvement is needed. The 'number scores' and the colour scores in an SHI report show which aspects (parameters) are eligible for improvement, and management options for improvement measures are advised. It remains the decision of the landowner to follow such advice or not.

1.2 Previous developments

In 2016, the Province of Gelderland commissioned a feasibility study for the SHI tool (see Annex 4 on page 64). The results of this study indicated that stakeholders like farmers, farmers' organizations, soil laboratories, governments, water boards, and knowledge institutes support the idea to further develop this instrument, together with potential market parties. A list of the stakeholders interviewed is also included in Annex 4.

This feasibility study includes an analysis of competing instruments, which indicates a competitive edge for the SHI tool, and therefore was used for the further validation of the SHI Business Model, during the Soil Health Index Partner Accelerator project. The initial feasibility study did not include a tailored value proposition or a final business model for bringing SHI to the market. These aspects were developed during the Soil Health Index Partner Accelerator project.

Currently, soil health is usually assessed by measuring a multitude of parameters, the outcome of which can only be interpreted by experts. Usually, only parameters from a chemical or physical nature are used. It is, however, important to use relevant biological parameters as well, thus covering the whole soil ecosystem.

1.3 Project Objectives & Outcomes

The Soil Health Index tool will be developed for use in North-Western European agricultural soils, based upon the theory and experiences provided by the developers of the American standard for Soil Health, located at Cornell University, Ithaca, NY USA. In technical/scientific terms, the American predecessor of the SHI is already well developed, including field experience. In this report we will further discuss the Business Model and value proposition design: how to create value for SHI customers and for our business in The Netherlands and beyond. The essential ingredients of a business model and its validation are discussed and in the following chapters.

1.3.1 Content perspective

The SHI tool will create an awareness among people professionally involved in soil. It shows that soil is valuable and that it is more than a substrate but is in fact a living ecosystem in which the Physical, Biological and Chemical worlds keep each other in balance and are dependent upon each other. This increased awareness will help stakeholders in the food production chain to improve their sustainability. Outside the realm of agriculture, the SHI could benefit e.g. land reclamation and regeneration projects. SHI can support and promote faster mitigation through effective soil management.

Soils have the key to the mitigation assignment. By using the SHI, the potential for C sequestration³ will increase; we assume faster than only by extension of existing management systems, because the SHI is more informative and easier to implement.

The Soil Health Index (SHI) tool is regionally specific as soils vary in different regions of the world. We will adapt the SHI for the NW European context by customizing the 'scoring functions' that calculate indices from field/lab measurements of soil parameters. A commercial Laboratory is likely to be involved in further development of the Soil Health Index, and is willing to support in the realization of a protocol and infrastructure for sampling, measurement and reporting.

Technical Background – application potential of SHI

Primarily, the SHI focuses on the soils of NW Europe. Later on, the tool can easily be made suitable for other areas within Europe. Currently, there is an established demand for a proper Soil Health Index in the Netherlands (as proven by the feasibility study). We expect that this demand will grow in the EU, especially with increasing climate pressures.

The SHI tool provides the entire soil-based food production chain with a simplified and affordable method to approach the highly complex soil system, and reach a sustainable, climate-friendly way to manage this crucial natural resource and all the ecosystem services it provides. This is at the core of Sustainable Land Use.

The system of interest is agriculture. Agriculture currently has a large impact on GHG emissions; it emits about 25% of all GHG emissions in the EU, according to IPCC. The soil compartment plays a crucial role in both agricultural production and in the global carbon cycle. To give just one example, a 2016 study in North Rhine-Westphalia (Germany) indicated that whereas soil organic matter rose until about 1990 (2.8% SOC⁴), it is in steady decline ever since and still had not reached a new equilibrium in 2015 (1.4% SOC). This is largely due to land use changes.

Mitigation

Applying the SHI tool to focus soil management on measures that lead to optimal soil functioning, can significantly improve the carbon dynamics of soils leading to both production benefits as well as higher levels of carbon retained in the soil system, thereby contributing to climate change mitigation.

Potentially, the soil can store substantially more carbon than most European agricultural soils do under their current management. Soil conditions and soil health, however, have to be optimized to balance these climate benefits with proper production goals. Achieving this with measures targeting the least healthy soil characteristics will certainly provide a concrete contribution to the 4‰ initiative⁵, and also contribute to tackling soil degradation.

Adaptation

Current European soils indirectly suffer from climate change; due to e.g. heavy rains, crust formation of the topsoil occurs, which reduces the water infiltration rate, which, in turn, results in a higher ponding risk, enhanced runoff and increased soil erosion. An impermeable topsoil further decreases soil aeration, with a negative impact on soil life. Increasing the soil health will reduce the vulnerability for crusting, and as such reduce the negative consequence of high intense rainfall.

An optimally functioning soil has an enhanced ability to provide its ecosystem services; higher uptake of CO₂ gases, increased infiltration capacity, higher water storage capacity, improved filtering and purification capability of groundwater and increased conversion of organic residues into useable nutrients for crops.

³ https://en.wikipedia.org/wiki/Carbon_sequestration - Carbon sequestration is the process involved in [carbon capture](#) and the long-term storage of [atmospheric carbon dioxide](#).^[1] Carbon sequestration involves long-term storage of [carbon dioxide](#) or other forms of [carbon](#) to [mitigate or defer global warming](#). It has been proposed as a way to slow the atmospheric and marine accumulation of [greenhouse gases](#), which are released by burning [fossil fuels](#).^[2] Carbon dioxide (CO₂) is naturally captured from the atmosphere through biological, chemical, and physical processes.^[3] Artificial processes have been devised to produce similar effects,^[4] including large-scale, artificial capture and sequestration of industrially produced CO₂ using subsurface [saline aquifers](#), reservoirs, [ocean water](#), aging [oil fields](#), or other [carbon sinks](#).

⁴ Soil organic carbon (more info at: https://en.wikipedia.org/wiki/Soil_organic_matter)

⁵ The ambition of the 4‰ initiative is to encourage stakeholders to transition towards a productive, highly resilient agriculture, based on the appropriate management of lands and soils, creating jobs and incomes hence ensuring sustainable development. For more information see link: <https://www.4p1000.org/>

1.3.2 Business perspective and validation

Within the scope of the SHI Partner Accelerator project, a first business model was developed. A tight connection with potential customers (e.g. farmers, farmer's organizations and companies and cooperatives in the food production chain, like Friesland Campina and Danone⁶) was established and validated prior to the start of this project. So far, these customer groups have no adequate tool available for assessing the soil management sustainability. Building on those insights, further validation steps for the SHI tool have been taken during the Partner Accelerator (see paragraph 4.2 on page 39). The validation will also continue by the project team members and other members of Wageningen Environmental Research (WENR). The project team also has the active support of WENR to continue pursuing European and other sources of funding to further develop the SHI tool, using the knowledge already gained from the SHI Partner Accelerator project to valorise the important knowledge created within the organization.

Being a tool that is validated from both user and business perspectives, the SHI will be highly beneficial for achieving sustainable soil management throughout the agro-production chain and beyond.

1.3.3 Business model development

The assignment of this Partner Accelerator project was to develop a business model for the Soil Health Index. This development is framed by a series of questions that were addressed when developing a business model at a training held during a Climate-KIC Boot Camp, held June 16-17, 2014 in Leusden in The Netherlands. This training was completed before start of the Soil Health Index Partner Accelerator project, but it was eventually highly beneficial for some of the SHI project team members who had the opportunity to attend, as it prepared and inspired them for their future business and entrepreneurial endeavours, in their efforts to valorise the knowledge produced by Wageningen Environmental Research (WENR). The questions used for the business model development and validation were the following:

Product/service description

Describe our SHI product/service - can we deliver a complete solution - briefly describe the state of the art - what is novel/unique about SHI - are there any underlying patents/prototypes/unique facilities supporting our product/service - which opportunity/market problem is addressed with our product/service - describe how we will produce/realize the SHI product/service.

Competitive environment of the product

What is our competitive advantage and who are our competitors - why is our SHI better than the competition - is there a blocking competition.

Market/target customers

Describe the market/target customers for our SHI product/service - are the customers well-funded - are the customers accessible to us - does the customer have a reason to buy - why will these customers buy from us, instead of others - to how many different customers are we going to sell our product - will they be the same customers each year (repeat customers), or will they be different customers every year - how will we market our product/service - when do we expect to sell our product/service for the first time.

Business model

Describe how the SHI business will make money through a business model - what is the expected level of income in the next years (e.g. till the end of 2018) - how many SHI products/services do we need to sell in a year to reach this level of income - what is the SHI selling price, and how does this compare with similar products/services of our competitors.

⁶ Companies like Friesland Campina use various indexing systems to rate the sustainability with which their suppliers produce.

Current/future business position

Describe the (legal) entity offering the SHI products/services - when was (will) our entity (be) established - if we have a successful launch of SHI, can we leverage it to enter additional segments⁷ - describe the executive team - who are the key persons for success.

1.3.4 Validate our business model with potential clients

A crucial element in the development of the business model is feedback with potential clients: would they use the tool, what are the benefits for their business?

In the validation process, a few pilots with pioneer customers should be established under an attractive offer, to determine to what extent SHI meets expectations, what improvements may be needed, and to build a record of accomplishment.

1.3.5 Marketing of the SHI

It is important to develop a marketing plan, pointing marketing in a pro-active way, choosing the right priorities, including some or all of the following: market launch, launching customer proposition, risk analysis, sales website and possibly other marketing materials. Determine the most appropriate type of entity that will market the tool. A separate report has been written by the SHI project team specifically on marketing potential of SHI.

1.3.6 Business-to-business and intellectual property

The protection of the developed Intellectual Property (IP) is another important element while developing a business model. We must determine what needs to be done in this respect. Negotiations on 'Business-to-Business' collaboration with companies like Eurofins⁸, an internationally operating laboratory organization specialized in the field of food, agro-science, and environmental analysis, including contents, financial and legal issues, must be carried out with the IP ownership in mind. Eventually, the following must be determined: who does the SHI measurements, who will calculate the SHI and who does the reporting? Being a scientific, experimental laboratory, the facilities of Wageningen Environmental Research (WENR) are not suited. Thus, finding a party for this job would be more cost effective. If Eurofins does SHI measurements, we generate business for them, but that does not mean that they have to be co-owners of the SHI. Alternatively, Wageningen Environmental Research (WENR) may hire them, simply outsourcing this workload and expertise. Assumingly, however, merely taking measurements without being allowed build a dedicated database is not very attractive; any party would be interested to expand their database(s). WENR is one of the developing partners of the Dutch 'Basisregistratie Ondergrond' (BRO)⁹, where intellectual property of soil data is an important issue. See www.basisregistratieondergrond.nl (in Dutch).

1.3.6.1 Positioning of other companies as developing partner

First of all, we can take the example of the 'Late Blight' app housed in Akkerweb¹⁰; see Annex 5 on page 76). This is an app jointly developed by Wageningen University and Research and Agrifirm – a cooperative in which some 17,000 Dutch livestock farmers and growers have combined their purchasing power -

⁷ [https://en.wikipedia.org/wiki/Leverage_\(finance\)](https://en.wikipedia.org/wiki/Leverage_(finance)): In *finance*, leverage is any technique involving the use of borrowed funds in the purchase of an asset, with the expectation that the after tax income from the asset and asset price appreciation will exceed the borrowing cost. Normally, the finance provider would set a limit on how much risk it is prepared to take and will set a limit on how much leverage it will permit, and would require the acquired asset to be provided as collateral *security* for the loan.

⁸ www.eurofins.nl/nl/milieu/analyses/bodem/

⁹ Information about the subsoil in the Netherlands is managed by various organizations. As a result, the data has not been digitized, standardized and harmonized in the same way. The 'Basisregistratie Ondergrond' (BRO) collects all data in one place and makes them available through one counter. Thanks to the BRO, governmental bodies can operate more efficiently. Information exchange between governments improves, data is reused and duplication in research is prevented.

¹⁰ <https://www.wur.nl/nl/nieuws/New-App-available-for-the-control-of-Phytophthora-in-potato.htm> Information on 'Akkerweb' platform: This platform compiles data and information associated with farming (fields and crops) - that is usually registered and recorded by various trading and other partners - in one central geo-platform. Within Akkerweb the use of geo-data, forms the foundation for all the functionalities that provide an added value for farm operations, such as fertilisation and crop protection. All the information is securely managed in a free user account and may be supplemented with input, for example, from satellites, sampling bodies, parties in the chain, farm management systems, Netherlands Enterprise Agency (RVO), and sensors. Website: <https://akkerweb.eu/en-gb/>

which has largely been developed with government money. Even a company like Agrifirm only gets temporary (2 years) exclusivity for the use of the app, as there is a licensing agreement model around it. Taking this into account, we can also 'license' the SHI 'engine' (the calculation rules / algorithms) to others. We should follow a comparable procedure with developing partners, with regard to the SHI (app). The SHI is being developed with (government) subsidies: provinces, EZ, TKI funds, Climate-KIC (EU). So we have to deal with government subsidy rules: any interested Dutch party must be able to use the knowledge that has been developed, otherwise it is unlawful state aid for only one or a few companies.

Interested parties like Eurofins may make a request for exclusivity. Wageningen Environmental Research (WENR) may agree, but a market-based fee is required. That means that things like revenue sharing and royalty payment come into play.

Future partners will have to negotiate: together, they make this project possible. On a piece of exclusivity, limitations will be imposed, concerning region and duration. A party may receive the exclusive right to put SHI 'on the market' for two years. Next, the SHI may also be licensed to others. The 'first' party will have a lead in time; sufficient to acquire a solid position in this market. Parties which operate worldwide may not easily accept such restrictions.

In any case, Wageningen Environmental Research (WENR) must keep the option open to offer the SHI on an Akkerweb-like platform after that two-year period, whereby they may itself be able to collect revenues directly. Possibly with revenue sharing with a partner like Eurofins, in case they have co-financed the development.

1.3.6.2 Comparing 'Eurofins' and 'Soil Cares' companies

Several soil parameters can only be determined in the field. 'Soil Cares'¹¹, a company which provides farmers with data-based precision farming tools, has set up a data acquisition system which facilitates this kind of data acquisition without needing a soil laboratory. In close cooperation with Soil Cares, Wageningen Environmental Research (WENR) has developed a 'Soil Fertility Tool'.

Collecting / scanning soil data with a smartphone and uploading it to a server which returns the SHI, including suggestions for remediation measures, would be quite a step forward. The larger the database in the cloud, the more accurate such a procedure will be. Eurofins has a larger soil data base than Soil Cares. Soil Cares nor Eurofins share their 'spectro-library' database with third parties, for reasons of privacy or otherwise.

1.3.7 Project Work Plan

Under the scope of this Partner Accelerator, the project team worked on the development of a business model for the soil health index tool which gives users an insight in soil health and measures to improve the least healthy characteristics. The tool provides the soil-based food production chain with a simplified and affordable method to reach a sustainable climate-friendly way to manage this natural resource. To realize that the team used the following work plan steps:

- Development of SHI Product / service description
- Analysis of the competitive environment
- Analysis of market / target customers
- Description of all elements of the business model and Validation of the business model for end users
- Analysis of Current / future business position potential.

As a next step after the completion of the Partner Accelerator project, the SHI for Dutch soils will be launched; awareness/introduction meetings will be organized, as well as specific meetings for interested food companies (potential customers/partners). Going forward the funding from other potential partners – as well as the own resources of Wageningen Environmental Research (WENR) – will be sought and used for further technical development, the realization of the SHI tool, and the infrastructure needed for it to function.

¹¹ The SoilCares agronomists and scientists put their knowledge in a self-learning database and give farmers access to it using in-house developed monitoring tools so they can obtain on-the-spot, fast and reliable data and custom-made fertility management recommendations. Their 'World Soil Database' is operational in more than 10 countries on 3 continents. Website: <http://www.soilcares.com/en/>

2 Viability assessment of the Soil Health Index

A thorough investigation, made in the Netherlands by WENR (Gerritsen, 2017) confirms ample support for a tool with the functionality of the SHI. It provides a comprehensive list of available 'soil health classification tools' that are proposed and (incidentally) applied in this country, with their specific characteristics. Yet the (dis)advantages of these tools, as compared with the SHI, are not discussed, nor is it argued if - and why - the SHI would be superior to existing Dutch instruments. Concrete options for application of the SHI in the Netherlands are not proposed. Gerritsen (2017) does not provide a comprehensive, comparative survey, which made us decide to assess the viability of the SHI in the Dutch context (and beyond). We describe our findings in this chapter. Meanwhile, scientific research into soil health is emerging at Wageningen University and Research. In a current project named SQUASH (=Soil Quality Universally Applicable Soil Health assessment system)¹², Soil Quality Indicators (SQIs) are being developed that can be applied in a soil quality assessment system (SQUASH) to predict the status of ecosystem services related to land-use. This project is supported by NWO-Green (Bunemann et al., 2018).

2.1 Why the SHI is currently the best tool available

The Soil Health Index is, in the range of soil tools currently available in the Netherlands (see Annex 6 on page 77), the most universal tool that is best understood by a broad group of users. This is partly due to the 'index' mechanism that ensures that the scores of the various parameters are understandable for everyone, including soil experts. No other tool has this property. The SHI is also the only tool that, based on field measurements, provides advice for soil improvement. Because of this, and because of arguments that are presented in the rest of this memorandum, we think that SHI is currently the best soil health tool, and we advocate continuing the development for the Netherlands.

2.2 The SHI in a nutshell

The SHI is a tool that qualifies soil health by means of an index between 0 and 100, where zero is very bad and 100 is optimal. This index is built up by measuring 12 soil parameters. These parameters cover three subareas: physical, biological and chemical. By measuring in each of these three sub-areas, we ensure that the most important characteristics regarding the soil health of the Ecosystem soil are quantified. With these 12 parameters, we can map the overall health status of the soil. For each of these 12 parameters, a score between 0 and 100 is also determined from the relevant measurement. The SHI is calculated from the 12 separate scores. Each of the 12 individual scores indicates how 'healthy' a soil is considering the parameter involved. If one (or more) parameters score low, this means that soil health should be improved in terms of this parameter.

For each of the 12 parameters, the SHI provides short-term and long-term improvement measures. The SHI can also be used as a diagnostic tool to assess if measures are already catching on. The SHI is therefore not only a tool for measuring soil health status, but also provides measures to improve it, and enables us to determine whether these measures have indeed improved soil health.

Due to the limited number of parameters (12), the provision is relatively inexpensive and therefore accessible to many parties. The Cornell Soil Health Assessment (SHA) forms the basis of the SHI. The SHA will have to be adapted for the Dutch context. Adaptation of the SHA to Dutch SHI is in a preparatory stage.

¹² <http://topsectoragrifood.nl/project/squash-a-soil-quality-universally-applicable-soil-health-assessment-system/>

2.3 How does the SHI relate to other tools?

Currently, in the Netherlands work is done on the development of a number of tools that deal with soil health. Gerritsen (2017) includes a table that provides a complete overview of the most important Dutch tools currently in the Netherlands that have provided information on soil health. However, this table was not intended to draw a conclusion about the benefit of the SHI, compared to these tools. The SHI is the only tool that proposes targeted measures to improve soil health.

Other tools have been designed with a financial objective, for instance lease price assessment support by the 'Soil Passport', or the Label 'Sustainable Soil Management', designed to keep the value of the land of a landowner up to standard.

With the use of key figures, use and cultivation history, the Soil Passport clearly differs from the SHI, based on current measurement data. In addition, the Soil Passport is not yet fully developed and it is not yet clear how its assessments are made, and whether the Soil Passport is a suitable consultancy tool. The Soil Passport has clearly opted for land evaluation functionality, to support (e.g.) property leasing contracts.

The so-called 'Minimal Dataset' is similar to the SHI but lacks an 'index' mechanism and does not suggest soil-improving measures. It is also more expensive than the SHI because more parameters have to be determined.

The 'Soil Condition Score' is based on visual observations and therefore much less consistent, has no 'index' mechanism and no soil-improving measures. In a direct comparison with regard to possibilities and applicability, SHI appears to be the best choice.

In the following, the SHI will be compared in detail with the most familiar tools; the Minimal Dataset, the Soil Passport, the Label Sustainable Soil Management (or the 'Soil Label') and the Soil Condition Score.

2.3.1 The Minimal Dataset

The Minimal Dataset is a project of Wageningen Plant Research and others, within the PPS Soil of the Top Sector Agri & Food¹³. In a draft version of a report on the MD, entitled 'Soil parameters for the determination of soil quality', the aim of the project is described as follows: This report describes parameters that have been identified by the researchers involved within the Wageningen Plant Research as important properties to characterize the soil quality. In most cases, these parameters are measured (or should be measured) in long-term soil tests. Next, these soil parameters are arranged in importance for (characterization) the soil quality. The Minimal Dataset is therefore a list of parameters for '... important properties to characterize the soil quality ...'. The complete list given in the report contains 45 parameters, arranged by priority. The number of 'priority 1' parameters is 23.

How does the SHI relate to MD? With the SHI, 12 parameters are measured that are considered representative of the soil quality. In the development of the Cornell SHA, a similar method was chosen as in the creation of the Minimum Data Set. Originally, a comprehensive list was drawn up, consisting of 42 parameters. From this extensive list, a limited list of 12 was selected, based - among other things - on the following criteria: sufficiently sensitive to soil-improving measures, consistent and reproducible, measurable on disturbed soil samples, relatively inexpensive determination, representing agronomic and environmentally important soil processes.

Indeed, the 12 parameters of the SHI also appear in the list parameters of the Minimal Dataset. This means that the Minimal Dataset data can be used for application and testing of the SHI, and that the SHI can support refining the prioritisation in the Minimum Data set. In addition, SHI adds two more elements: i) an indexing between 0 and 100, and ii) depending on the score of the various parameters, measures to improve the soil. Due to its more limited set of indicators, the SHI offers the possibility of quick assessment and advice.

¹³ <http://topsectoragrifood.nl/en/kennis-en-innovatie-tki/>

2.3.2 The Label Sustainable Soil Management (Soil Label)

The Soil Label has been developed from an assignment from *ASR Landelijk Vastgoed* landowners to the Centre for Agriculture and the Environment (CLM). In the CLM report 'Design Label Sustainable Soil Management', it is stated that ASR asks *CLM Onderzoek en Advies BV*, in collaboration with other experts, to develop a system that encourages farmers to adopt sustainable soil management measures. This system is monitored using indicators for sustainable soil management. The assignment therefore concerns both the formulation of measures that positively influence soil quality, and indicators checking the effectiveness of the measures.

In brief, in the framework of the Soil label, farmers that are leasing land from ASR are encouraged to take sustainable soil management measures. Taking such measures, a farmer will be rewarded financially, depending on the ultimate effectiveness of the measures he takes. The Sustainable Soil Management Label (and the financial reward) is awarded in classes A-D.

After a period of five years, the effectiveness of the measures is evaluated, based on a number of measurements. The farmer's commitment to apply measures is rewarded, regardless of the effect of these measures. However, if it appears that they have hardly any effect, the Soil label may encourage implementing measures that may be relevant for a subsequent lease contract. In order to be able to assess soil quality improvement, a so-called 'Baseline measurement' is made. The commitment of the farmer and the effectiveness of any measures taken depend on the type of farm (arable, grassland) and soil type, among other things.

The Soil Label is strongly focused on the application of management measures that are good for the soil quality and the rewards for such measures. In first instance, the commitment of the tenant is rewarded, in second instance the effectiveness of the management. This effectiveness is measured on the basis of 14 parameters, associated with physics (4), biology (7) and chemistry (3).

The Soil Label works with a fundamentally different approach compared to SHI. SHI examines soil health, after which measures are taken to improve of low-scoring parameter(s). In the Soil Label protocol, standard measures are taken, assuming that these contribute to soil health, regardless of whether these measures are necessary. Next, the effectiveness of the measures taken is examined.

The Soil Label is strongly focused on commitment, control and reward. One may wonder if a farmer is – at all – capable of taking the required measures; assumingly it would be more efficient to take only measures that are essential, like is prescribed in the SHI protocol.

2.3.3 The Soil Condition Score

The Soil Condition Score is a tool developed by Wageningen University & Research Centre, Boerenverstand BV, the Louis Bolk Institute and a few other parties¹⁴. The Soil Condition Score is currently being marketed by the Louis Bolk Institute. The Soil Condition Score comprises 11 visual soil assessments, to be made in the field. A final score is a weighed sum of all observations. With 10 'Tips for optimal soil condition', a farmer can improve his soil score (Klaasse Bos, R., 2017).

The advantage of the Soil Condition Score is that each farmer can draw up a score for his lands himself and take appropriate measures, yet the disadvantage is that some of the provisions are indirect ones, that all provisions are merely visual, subjective observations. As a result, the reliability and repetition accuracy of the provisions is strongly influenced. The accuracy of the calculated 'score' is low, compared to e.g. the parameters of the SHI that are determined in the laboratory, following standardized methods. In general, the Soil Condition Score is considered a dedicated awareness instrument.

2.3.4 Conclusion

Given the above analysis, we conclude that the SHI is the best choice as an affordable, universal soil health tool.

¹⁴ <http://www.louisbolk.org/sustainable-agriculture/soils/soil-condition-score>

The **Minimal Dataset** is too elaborate for the functionality that the SHI aims to provide. As far as measurements is concerned, cooperation with the SHI is worth investigating because the indicators of the SHI and the Minimal Dataset are largely similar.

In principle, the SHI is superior to the **Soil Passport** in that it has a scientific foundation. The Soil Passport may trigger awareness of soil health and fulfil specific objective of supporting lease contracts. The Soil Passport may be combined with the SHI to facilitate the assessment of long term effects.

The **Soil Label** is the mirror image of the SHI and can lead to more interest in soil health. If you really want to know how the soil is and how specific soil problems can be solved, you need a tool like the SHI.

Being designed for visual assessment, the **Soil Condition Score** is primarily an awareness tool that ensures that farmers can see which problems there are with soil health. To get an insight in what is going on in the soil, and how to act, the SHI comes into play.

The **Soil Health Assessment** of Cornell University, the tool on which the SHI is based, has completed a 10-year development, experience and adaptation process. It is still being adapted to new techniques and insights. Because of the contacts with Cornell, Wageningen Environmental Research (WENR) can draw on Cornell's experience; reversely, Cornell supports the development of SHI Netherlands. Obviously, SHI has added value compared to existing systems and may significantly promote their application.

2.4 Applicability of the SHI

Originally, the Soil Health Index (or the Cornell Soil Health Assessment) was developed as a tool for improving soil health in agricultural lands. Because the 'score' component is built into the tool (converting the measured values of the parameters to a score between 0 and 100) the term 'soil health' has become accessible to non-soil experts, i.e. for farmers, managers and policy makers. The limited number of parameters, combined with the type of parameters ensures that the provision is affordable for every user category. This is in contrast to e.g. the Minimal Dataset, which encompasses substantially more parameters and more specific, costly measuring methods. We can distinguish the following categories of users and applications:

- **Farmers** can use SHI to measure soil health on their agricultural lands. The SHI also contains a series of suggestions for applied measures to improve soil health where necessary. This is likely to be an incentive for them to choose the SHI: not only note that a piece of their lands falls short, yet improve it with appropriate measures, just as well.
- **Policy makers** (at municipal, provincial and national level) can use the SHI on a different scale as a tool to measure the health status of a soil, but also (after the use of policy measures) as a monitoring tool to check whether implemented measures are effective. The SHI may also reveal whether policies aimed at improving specific parameters do not have an adverse effect on others.
- **Tenants and lessees** can use the SHI as a dedicated tool to measure, maintain and improve the quality of land. As dedicated efforts are specified for specific parcels, the associated measures are effective, in contrast to generic measures taken through the Soil Label protocol.
- **Water Boards** and **Drinking Water Supply Companies** can use SHI measurements and targeted measures to improve the water retention, infiltration and reduction of surface runoff in their area. With regular SHI measurements, it can be verified whether soil quality with respect to water management functionality is optimal.
- **Landowners** can use the SHI as a sound instrument for determining the state of health of the soil, e.g. for lease purposes.
- **Industry** can use the SHI as an aid to achieve sustainability objectives by demonstrating that the land use of their suppliers is sustainable and that agricultural products are grown on sustainable, healthy soil.

Sustainable land use is an important starting point in the green economy. The SHI can be used to determine the state of soil health of the soils that are used to grow crops and feed animals for the relevant chains and products.

3 Market Segmentation

3.1 Market Segmentation stepwise

The skills, required to initiate and proceed with market segmentation were developed at a Boot Camp, organized and financially supported by EIT Climate-KIC in June 2014 in The Netherlands; see Figure 4.

Figure 4 Climate Adaptation Business Challenge Boot Camp, financially supported by EIT, June 2014

During this two-day event, we familiarized ourselves with the process of stepwise customer identification, focusing on the first step, which is Market Segmentation; see Figure 5.

This training was completed before start of the Soil Health Index Partner Accelerator project, but it was eventually highly beneficial for some of the SHI project team members who had the opportunity to attend, as it prepared and inspired them for their future business and entrepreneurial endeavours, in their efforts to valorise the knowledge produced in Wageningen Environmental Research (WENR). This bootcamp may have been earlier than the SHI Partner Accelerator project, but it provided us with great knowledge in business models, value propositions, market segmentation and customer identification. Eventually this knowledge was key to our decision to progress with an EIT Climate-KIC Partner Accelerator project and developing the business around the SHI tool. This is a great example of Knowledge Triangle Integration, where Business meets, Research & Technology, and Higher Education.

Figure 5 The process of stepwise customer identification; step #1 is Market Segmentation

During the Partner Accelerator project, the Market Segmentation process for the SHI tool was supported by two publications, namely 'Value Proposition Design' and 'Disciplined Entrepreneurship'; see Figure 17.

Figure 6 Two publications that we have consulted for the Market Segmentation process

In our primary market research for the SHI, our goal was to get an accurate assessment of the market opportunities, enabling us to move on to the next step. Our ambition was not to just search the internet. Also, we did not want to be stuck in 'analysis paralysis'. Information searches may turn out to be a never-ending process.

Starting point for our market segmentation is the mere fact that the single necessary condition for a business is a paying customer. Hence, it is crucial to assess the potential market for the SHI by exploring it in two ways; see Figure 7.

Figure 7 In order to assess the marketing potential of the SHI, we must be aware that there are two equally important ways to explore the associated business challenge

We started our reconnaissance survey of the marketing potential of the Soil Health Index by trying to see the world through the eyes of our intended, paying customers. We asked ourselves quite a few questions, most of which are adequately summarized in Figure 8.

Figure 8 Essential 'kick-off'-questions that have been discussed thoroughly by WENR scientific staff, involved in developing the Soil Health Index

Not everyone is our customer (Figure 9); it is therefore crucial to get in touch with so-called Innovators and Early adopters. The best guidelines on how to approach potential customers are available in the so-called 'Mom-test' (Figure 10); see <https://www.slideshare.net/xamde/summary-of-the-mom-test>.

Figure 9 Only a minority of our 'targeted customers' will eventually turn out to be one

Figure 10 The Mom-test teaches you good and bad questions for potential customers

The Mom-test teaches us which are good and bad questions for potential customers.

To start with, it is a good idea to listen, don't talk too much.

Next, **good** and **bad** questions for potential customers are the following:

1. Do you think it's a good idea?
2. Would you buy a product, which solved this problem?
3. How do you currently deal with this problem?
4. Talk me through the last time you had this problem
5. How much would you pay for this?
6. How much money does this problem currently cost you?
7. Is there a budget for it?
8. Who else should I talk to?

It is also a good idea to ask questions about:

- Things **they care about**
- Frequency & Details
- Current solutions
- Past behaviour.

Our discussions may be summarized as follows. We are looking for market segments, i.e. users and buyers; not for applications. We are reasoning in terms of: who needs the Soil Health Index? Who is willing to pay for it?

In a feasibility study of the SHI tool, commissioned in 2016 by the Province of Gelderland (see Annex 4 on page 64), we had already explored before the start of the SHI Partner Accelerator, whether and how it is feasible to introduce a system for the measurement of soil health, focusing on the Netherlands to start with, yet with the obvious ambition to expand business beyond our National borders, in the long term.

Determining the feasibility implies that we focused particularly on support among parties that assumingly have an interest in in soil health. We have investigated their expertise and vision regarding what sort of information is welcome (i.e. 'nice to know'), and what is absolutely required (i.e. 'need to know'). We also wanted to determine feasible options for introducing the SHI.

We have focused on perceptions of feasibility and an assessment of whether there is sufficient support for the SHI by market parties, government, knowledge and society. We tried cross-linking with other systems relating to soil health, government policy, farmers' needs and social organizations.

Our survey did not aim to recommend which indicators, scoring functions and measures can best be included in the SHI and how it can best be measured. This action can be carried out in a separate assignment after a positive decision on feasibility and support from the current partners, involved in this project, i.e. the province of Gelderland, Wageningen Environmental Research (WENR) and The Netherlands Institute for Ecology (NIOO-KNAW) and perhaps others. The preliminary study will also bring the SHI to the attention of relevant actors and thereby strengthen the social capital where a follow-up project, in which the SHI will be developed, can benefit from it.

The market segmentation work had already started in 2016 – under the scope of the feasibility study – with a series of interviews, with the aim to eventually validate the SHI business model among different stakeholders. To support this process, a 6-minute video was made to inform the respondents about our plans and potentials for the SHI. This video has been further edited and is now publicly available at <https://vimeo.com/182450088>. Interviews were held with 33 respondents, of which 17 in two group discussions, with in addition to the direct contact also 5 arable farmers (De Peel) and 10 dairy farmers (Achterhoek). The following questions were central to the conversations:

- Is there a need for collecting and using more measurement data on agricultural soil health?
- How could this best be designed?
- Is the SHI a tool with perspective for this?
- Which requirements should an SHI have to meet in order to be acceptable to stakeholders?
- With which initiatives and processes can the SHI be linked, and how?
- Are the conditions for using the SHI as a tool for learning and changing around agricultural soil health?

The interviews had a semi-structured character, in which the interviewer structured the interview and emphasized which questions needed to be answered, but also gave the interviewee room to contribute his own ideas. An interview guideline was drawn up for this purpose.

Finally, a workshop was held where the findings were shared, and a discussion was organized about the development process and the desirability of starting the implementation. In addition to these activities, a limited desk study was also carried out into existing soil tools that are relevant to SHI.

Both the interviews and the workshop were important steps towards the validation of the SHI tool and Business Idea. For the Partner Accelerator project, the team built on those results and used this knowledge to construct the value proposition and the business model for SHI. Moreover, based on those inputs and the further market research, the project team also produced a project flyer, (see Annex 7 on page 79) and developed the first version of the SHI website design (see Chapter 5 on page 46). A synopsis of market segmentation questions is contained in Annex 8 on page 81.

3.2 Recommendations

The results of the study lead to a positive advice, as the SHI seems to be able to play a useful role in what 'the field' aspires as well. This is why it is advised to start with the development of the SHI for the Netherlands. In addition, there is a number of issues to be mentioned for which it is advisable to address this when implementing the SHI.

1. **Set up an SHI user group.** Do not only include parties with expertise on soils and comparable instruments, but also parties that are committed to the theme of soil health. Of particular importance is the relationship with the wider research agenda of Wageningen University & Research and R & D of commercial parties, so that the SHI can relate to these, and methods and data can be easily shared and connected. In this group, parties that support agriculture in general and soil health in particular, committed to make an SHI operational, should also be represented.
2. In addition to this group or as part of it, also **use existing operational networks of farmers** for a practical validation, and to embed and communicate the benefits of the SHI in practice. Also consider the EIP Agri operational groups, set up in 2017, that have been given a privileged status by the European Commission, provided that action is taken at European level. It is advisable to inform a number of these groups via the experimental farms such as Vredepeel, Valthermond and De Marke, and via advisors in the user group during the follow-up project, and to request feedback and to actively try to set up pilots.
3. Make a clear and well-considered **choice for the intended use of the SHI** and investigate how such a step would affect its specifications. In this context, include the following: the degree of concreteness of measures, the intended users and the relationship with other instruments and processes.
4. Set up a **project group for developing and implementing the SHI**, after a having decided whether or not other organizations are required to join, besides Wageningen Environmental Research (WENR) and NIOO-KNAW.
5. Set up a **support group** with investors and other essential parties (e.g. local governments, water boards, farmers' unions, policy makers, users of soil for agriculture and other commercial land uses, or for natural preservation).
6. Connect the SHI and its support group to a project-transcending agenda, or join an existing one, e.g. in the framework of TKI Agri & Food, or as dedicated cooperation between the Dutch provinces (IPO=InterProvinciaal Overleg). This allows the SHI to become part of the learning processes of various parties that are involved in soil health. One can also think of a Green Deal, and European Innovation Deals. Sustainability programs of chain companies are a relevant anchor point in this respect, e.g. CSA Booster, Flevocampus.
7. Any wider follow-up agenda also concerns the organization of relevant research, the support of working on soil health by farmers and the valorisation of knowledge through inheritors and other companies. Such a wider agenda can be established in the process.

3.3 Market Segmentation Table

Using all information that we have gathered concerning SHI marketing, we have assembled the following Market Segmentation Table; see Table 1. It contains ten different categories of information and eleven market segments. In order to fill in the table we tried to obtain information for each market segment on:

- End User: who will be using your product?
- Application: What is the functionality of the SHI?
- Benefits: what pain is alleviated, or value created?
- Lead customers: who are the most influential?
- Market characteristics: which are typical market features?
- Partners/players: who do I need to partner with?
- Size of the Market: can we give a rough estimation?
- Competition: who is our competition?
- Are any complementary assets required?
- Are we aware that we should not be overdelivering? A modest yet effective/attractive SHI is best.

Table 1 SHI Market Segmentation Table

	WAGeningen UNIVERSITY & RESEARCH			Soil Health Index							
MARKET SEGMENT <i>Describe the market segment</i>	1 Arable Farmers	2 Livestock Farmers (grassland)	3 Nature (organisations) SBB etc.	4 Provinces	5 Water Boards	6 Municipalities	7 Ministries	8 Rijkswaterstaat	9 Comparable systems: Soil Passport	10 Farmers' Unions (LTO etc.)	11 Soil data systems (BRO)
USER <i>Who will use your product or service?</i>	Individual farmers	Individual farmers	SBB Staatsbosbeheer	Rural Development Projects (POPS) ¹	Climate change and sustainable soil management, depending on water storage in the soil	Public green areas, green space	LIV: policy development: 'Deelbaar, S&G&G, Waterbeheer'	Sustainable Development Goal 15.3 ²	Landowners, individual farmers	Policy file 'Kennis en Innovatie' ³	Users of BRO data and -information
APPLICATION <i>For which activities does the end user need the SHI?</i>	Periodic monitoring of soil quality in conjunction with crop yield	Periodic monitoring of soil quality in conjunction with crop yield	Testing soil on suitability for nature + improvement actions	Policy development green space management (is this a provincial task?)	Periodic monitoring of soil quality ⁴	Periodic monitoring of soil quality	Periodic monitoring of soil quality	Periodic monitoring of soil quality	Periodic monitoring of soil quality	Policy development periodic monitoring soil quality in conjunction with crop yield	Draw attention of all categories of BRO users to (added value of the) SHI
ADVANTAGES <i>What are the advantages of SHI as a solution for (an) existing problem(s)?</i>	1-rating, 2-time signalling of unwanted trends; 3 suggestions for improvement actions.	1-rating, 2-time signalling of unwanted trends; 3 suggestions for improvement actions.	1-rating, 2-time signalling of unwanted trends; 3 suggestions for improvement actions.	1-rating, 2-time signalling of unwanted trends; 3 suggestions for improvement actions.	1-rating, 2-time signalling of unwanted trends; 3 suggestions for improvement actions.	1-rating, 2-time signalling of unwanted trends; 3 suggestions for improvement actions.	1-rating, 2-time signalling of unwanted trends; 3 suggestions for improvement actions.	1-rating, 2-time signalling of unwanted trends; 3 suggestions for improvement actions.	1-rating, 2-time signalling of unwanted trends; 3 suggestions for improvement actions.	1-rating, 2-time signalling of unwanted trends; 3 suggestions for improvement actions.	1-rating, 2-time signalling of unwanted trends; 3 suggestions for improvement actions.
MARKET CHARACTERISTICS <i>What specific characteristics does this market have?</i>	Young generation is curious and sensitive to innovation	Young generation is curious and sensitive to innovation	Many soils must be made suitable for nature development, while expertise is lacking	Little dynamic; strongly dependent on network	Little dynamic; strongly dependent on network	Little dynamic; strongly dependent on network	Little dynamic; strongly dependent on network	Little dynamic; strongly dependent on network	Information, contained in report Alwin Gerritsen (2016)	Little dynamic; strongly dependent on network	Developing rapidly
MARKET SIZE <i>How big is this market?</i>	+++	+++	+++	+	+	+++	+	+	+	++	++
MAIN CUSTOMER <i>Who could be the main customer(s) in this market segment?</i>	Individual farmers	Individual farmers	Policy advisors, project leaders	Policy advisors (putting SHI on the agenda is crucial)	Policy advisors (putting SHI on the agenda is crucial)	Policy advisors (putting SHI on the agenda is crucial)	Policy advisors (putting SHI on the agenda is crucial)	Policy advisors (putting SHI on the agenda is crucial)	Developers and users	Unclear; LTO; LTO-Noord	

¹ <https://www.feyland.nl/dossiers/plattelandontwikkeling-pop3/>
² <https://sustainabledevelopment.un.org/sdg15>
³ <http://www.kennis-en-innovatie.nl/>

	WAGeningen UNIVERSITY & RESEARCH			Soil Health Index							
MARKET SEGMENT <i>Describe the market segment</i>	1 Arable Farmers	2 Livestock Farmers (grassland)	3 Nature (organisations) SBB etc.	4 Provinces	5 Water Boards	6 Municipalities	7 Ministries	8 Rijkswaterstaat	9 Comparable systems: Soil Passport	10 Farmers' Unions (LTO etc.)	11 Soil data systems (BRO)
PAIN OF THE CUSTOMER <i>Which urgency (s) could the customer solve with / thanks to the SHI?</i>	Suboptimal harvests (or worse)	Difficulties with grazing; reduced grass yield	We do not know whether soil is suitable for use and how far away you are from it	Does not have unambiguous information regarding soil quality	Does not have unambiguous information regarding soil quality in relation to water management	Does not have unambiguous information regarding soil quality in the city and beyond	Does not have unambiguous information regarding soil quality	Does not have unambiguous information regarding soil quality	SHI has added value with respect to soil passport	Monitoring interests of members	
PARTNERS <i>Which partners do you need to roll out the SHI in this market segment?</i>	Open-minded farmer who proactively welcomes pilot	Open-minded farmer who proactively welcomes pilot	Existing networks / contacts ESG; program leaders	Existing networks / contacts ESG; program leaders	Existing networks / contacts ESG; program leaders	Existing networks / contacts ESG; program leaders	Existing networks / contacts ESG; program leaders	Existing networks / contacts ESG; program leaders			
OBSERVED COMPETITION <i>Which competitive services / solutions are available?</i>	None / unknown	None / unknown	None / unknown	None / unknown	None / unknown	None / unknown	None / unknown	None / unknown		None / unknown	None / unknown
REQUIRED ASSETS ⁴ <i>What else do you need from elsewhere to be able to offer a comprehensive solution?</i>	Determine in consultation with the intended customer (group)	Determine in consultation with the intended customer (group)	Determine in consultation with the intended customer (group)	Determine in consultation with the intended customer (group)	Determine in consultation with the intended customer (group)	Determine in consultation with the intended customer (group)	Determine in consultation with the intended customer (group)	Determine in consultation with the intended customer (group)	Determine in consultation with the intended customer (group)		
CONTACT	...	...	...	...	...	...	...	...	...	...	...

⁴ <https://nl.wikipedia.org/wiki/Actus> In de kosten- en winstbeoordeling, een deelgebied van de bedrijfseconomie, wordt met de **acties** van een onderneming de in **geld** uitgedrukte **waarde** bedoeld die het geheel aan **beslissingen** van de **onderneming** versagenwoordigt. Tegenover de acties staan de **passies**, de som van het eigen en het vreemde vermogen. Op de **passies** van een onderneming zijn de acties en de passies altijd elkaar gelijk.

Setting up our SHI Market Segment Table is input to the next step in our SHI marketing process: the selection of our beachhead market; see Figure 11. The table is also available in Annex 9 on page 84.

Figure 11 The process of beachhead market selection from a market segmentation table

3.4 Beachhead Market / SHI pilot

The project team will continue developing and using the Market Segmentation Table (see Table 1) even beyond the scope of the SHI Partner Accelerator project, as it is an important guideline in the selection of the beachhead market. A beachhead Market is a clearly specified and bounded market segment; see, for example, Figure 12.

Figure 12 Example of a beachhead market

A beachhead market is a targeted strategic/priority market which gives us a learning opportunity before entering a priority market (for a company's international activities in a given part of the world). For us to be successful internationally in the long term, we need to understand our beachhead market, and how to take advantage of it. Therefore, a beachhead market becomes our main entry point for our marketing of the Soil Health Index. We determine our beachhead market from our Market Segmentation Table (Table 1), in the following steps: (i) analyse our market segmentation table; (ii) reduce the brainstorm tree to 6-12 market segments; (iii) address markets, not applications; (iv) do some primary market research; (v) select a beachhead market; (vi) calculate the TAM (=Total Addressable Market).

An ideal beachhead is a market segment with low economic and political barriers, and which subsequently facilitates easy migration to targeted markets. In our search for a beachhead market, we narrow down our options using criteria like:

Is our target customer well-funded?

If the customer does not have money, the market is not attractive because it will not be sustainable and provide positive cash flow for the new venture to grow.

Is the target customer readily accessible to our sales force?

We want to deal directly with customers when starting out instead of relying on third parties to market and sell the SHI, because it will gradually go through iterations of improvement, and direct customer feedback is an essential part of that process. Also, since our product is relatively new, third parties may not know how to be effective at creating demand for the SHI.

Does the target customer have a compelling reason to buy?

Would the customer buy the SHI instead of another similar option? Or, is the customer content with whatever solution is already being used? Remember, on many occasions, our primary competition will be the customer doing nothing!

Can we today, with the help of partners, deliver the whole product?

Our customer usually wants to buy a completely functional solution, not one they have to assemble themselves. We will likely have to work with other vendors to deliver a solution that incorporates the SHI, which means that we will need to convince other manufacturers and distributors that the SHI is worth integrating into their workflows.

Is there entrenched competition that could block us?

It is rare to enter a market with no other competitor. How strong are these competitors, from the customer's viewpoint (not our viewpoint or from a technical standpoint)? Can the competition block us from starting a business relationship with a customer? How do we stand out from what our customer perceives as alternatives?

Quite a few more questions that we have asked ourselves during our market exploration for the SHI are summarized (in Dutch) in Annex 10 on page 87.

After we have defined and refined our beachhead market and its associated target customer, we can calculate the Total Addressable Market, TAM ($\text{TAM} = \text{\#End Users} \times \text{Revenue per End User}$), in three steps, as follows:

1. Determine the total number of End Users in your beachhead market
2. Estimate the revenue per End User
3. Calculate Total Addressable Market (TAM)

The calculation of TAM should reveal to what extent we are headed in the right direction; see Figure 13.

Figure 13 Heading for our beachhead market should be refined and unambiguous, leading to a plausible TAM calculation

An essential part of the calculation of the Total Addressable Market, TAM is the assessment of revenues; see Figure 14. In this Figure, two examples of margin calculations are given; the worksheet is extremely simple, self-explanatory and well suited to support market segmentation brainstorm sessions.

Unfortunately, the SHI market segmentation process that we have outlined in the preceding paragraphs, stops here. The next - and essential - segmentation step which includes a series of decisions, based upon this protocol, has been delayed but has the highest priority as soon as this project is continued.

Figure 14 Two examples of a revenue assessment, given very elemental data. Source of Excel Worksheet: EIT-Climate-KIC

3.5 Value proposition Canvas

As a next step, in order to make the SHI an even more attractive product/service, we must further polish our set of value proposition benefits to attract customers. At the same time, our awareness of customers requires us to assume, observe and verify customer characteristics; see Figure 15.

Figure 15 In order to make the SHI an attractive product/service, we must design a set of value proposition benefits to attract customers (left), and our awareness of customers requires us to assume, observe and verify customer characteristics (right)

In order to facilitate this crucial business-developing task, the Value Map in which our SHI Value Proposition breaks down into products and services, pain relievers and gain creators (left), and our Customer Profile, in which his jobs, pains and gains are described in detail, see Figure 21.

Figure 16 The Value proposition Canvas, consisting of our so-called Value Map, in which our SHI Value Proposition breaks down into products and services, pain relievers and gain creators (left), and our Customer Profile, in which his jobs, pains and gains are described in detail. The Strategyzer help & Templates are illustrated in Annex 11 on page 88

It is worth mentioning that as the project team we had already developed several value propositions, but with the use of the value proposition canvas we were able to go one step further in tailoring and polishing our potential offerings to our identified customer segments. This will be crucial going forward as we progress with marketing the tool and seeking to establish our first potential customers.

The important work implemented during the project, as well as its innovation and market potential, was acknowledged by Wageningen Environmental Research (WENR). This was an important validation step for the value proposition of SHI. As a result, the Business Model for SHI is considered to be validated since the SHI tool is very likely to attract other sources of funding. In addition, WENR can use it as a part of its value offerings.

3.6 Conclusions

As an extra validation step during the Partner Accelerator project, our team conducted an additional series of interviews of vital stakeholders and potential customers, e.g. the Province of Gelderland, Boerennatuur.nl and the Municipality of Ede, who again expressed their interest in the further development and use of the tool. The key findings of these interviews support our findings and are, indeed, conclusive.

- Momentum is developing to implement the SHI. For different objectives, but all in relation to soil health and in relation to public and commercial payments for soil measures by farmers, there is a need to be aware what measures should be taken and how effective they are. The more so with regards to unexpected issues such as the energy transition, scheduled in The Netherlands in the years ahead.
- Policy stakeholders are discussing the need to have one, generally accepted, protocol that can function as the shared point for reference for improving soil health by farmers. This needs to be organised at the national level.
- The wide and integrated approach to assess soil quality is strongly appreciated. A crucial factor will be if the application of the SHI will offer concrete perspectives to act for farmers and other actors.
- It is great if farmers can use the information that comes from the SHI, yet there is a clear need for public authorities and chain companies as well. Stakeholders are dependent on these public and private actors for developing valorisation models for soils. Therefore, the SHI needs to be able to assist public authorities and chain businesses in their initiatives and activities in relation to soil health.
- The SHI also has potential for soils in nature areas. 'Nature managers' (e.g. municipalities) need to know what they can do to battle soil quality issues, like acidification.

The summaries of the interviews are available in Annex 12 on page 90.

4 Soil Health Index Business Model

4.1 Value Proposition Canvas

In the developing process of the SHI Business Model, two publications have been leading, namely 'Value Proposition Design' and 'Disciplined Entrepreneurship'; see Figure 17.

Figure 17 Two publications that we have consulted during the development of the SHI Business Model

In our project, starting point for the development of the SHI Business model was a protocol proposed by Osterwalder et al. (2014); see Figure 18. This protocol includes a tool that we use to describe how the company that will develop and market the SHI (including the EIT Climate-KIC Partner organization and SHI project lead, Stichting Wageningen Environmental Research (WENR) creates, supplies and captures value; both for the intended SHI customers as well as for the members of the company itself.

The protocol, depicted in Figure 18, proved to be a perfect guide for our SHI developing team to recruit SHI customers based on customer profiles, and to learn how to come up with value propositions for these customers. Zooming out - the upper section of Figure 18 - suggests actions that realise this goal which are expressed in general terms; for instance 'Imitate and 'import' a pioneering model from another sector or industry' (which, coincidentally, happens to be the case with our SHI). Zooming in, in the lower part of Figure 18, suggests actions that are much more detailed, like: 'Focus on your customers' most unrealized gain'.

Where to Start

Contrary to popular belief, great new value propositions don't always have to start with the customer. They do, however, always have to end with addressing jobs, pains, or gains that customers care about.

Could you...

Written by Alex Osterwalder, Yves Pigneur, Greg Bernards, Alan Smith. Designed by Trish Papadakis • Copyright Strategyzer A.G., the makers of Business Model Generation and Strategyzer

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Figure 18 Protocol, used for value proposition embedded in the Business Model Canvas (see text)

Figure 19 The Business Model Canvas, including our value proposition and customer segments for the Soil Health Index (SHI)

This Business Model Canvas (Figure 19) facilitates sketching out our business ideas regarding the SHI. Simultaneously, we develop our value proposition, which describes the benefits that our intended customers can expect from products and services, provided by the SHI. In order to make the SHI an attractive product/service, we must design a set of value proposition benefits to attract customers. At the same time, our awareness of customers requires us to assume, observe and verify customer characteristics; see Figure 20.

Figure 20 In order to make the SHI an attractive product/service, we must design a set of value proposition benefits to attract customers (left), and our awareness of customers requires us to assume, observe and verify customer characteristics (right)

In order to facilitate this crucial business-developing task, an essential component of the Business Model Canvas, the so-called Value Proposition Canvas, is depicted in blue colour in Figure 19. It contains the Value Map in which our SHI Value Proposition breaks down into products and services, pain relievers and gain creators (left), and our Customer Profile, in which his jobs, pains and gains are described in detail, see Figure 21.

Figure 21 The Value Proposition Canvas, consisting of our so-called Value Map, in which our SHI Value Proposition breaks down into products and services, pain relievers and gain creators (left), and our Customer Profile, in which his jobs, pains and gains are described in detail

In summary: the Business Model Canvas (Figure 19; page 37) and the Value Proposition Canvas (Figure 21; page 38) are a perfect 'team': the latter 'plugs in' to the former, allowing us to zoom into the details of how the values that we create value and our intended customer groups can come to a perfect fit.

Wageningen Environmental Research (WENR) is an institution for scientific research. As such, our awareness of the importance to convert to a more business-minded environment is comparatively limited. This project was an opportunity to move forward into this direction. We have used it to support exchange of views with early adopters among our staff. We have organised internal discussions about various configurations of the Canvas Business Model (see Figure 22; page 39), and how to implement this model for the development and marketing of the Soil Health Index. Our project team gained awareness on the importance of entrepreneurial skills and ventures at WENR. We contribute our lessons learned to efforts of WENR in valorising expertise, thus creating and enhancing business opportunities through our innovative research.

Figure 22 Various configurations of the Canvas Business Model, discussed with early adopters at Wageningen Environmental Research (WENR)

4.2 Stepwise Business Model Development

The assignment of this project was to develop a business model for the Soil Health Index. This development is framed by a series of questions, listed as follows.

Product/service description

1. Describe our SHI product/service.
2. Can we deliver a complete solution?
3. Briefly describe the state of the art. What is novel/ unique about SHI? Are there any underlying patents/prototypes/unique facilities supporting our product/service?
4. Which opportunity/market problem is addressed with our product/service?
5. Describe how we will produce/realize the SHI product/service.

Competitive environment of the product

6. What is our competitive advantage and who are our competitors?
7. Why is our SHI better than the competition?
8. Is there a blocking competition?

Market/target customers

9. Describe the market/target customers for our SHI product/service
10. Are the customers well-funded?
11. Are the customers accessible to us?
12. Does the customer have a reason to buy?
13. Why will these customers buy from us, instead of others?
14. To how many different customers are we going to sell our product? Will they be the same customers each year (repeat customers), or will they be different customers every year?
15. How will we market our product/service?
16. When do we expect to sell our product/service for the first time?

Business model

17. Describe how the SHI business will make money through a business model.
18. What is the expected level of income in the next years (e.g. till the end of 2018)?
19. How many SHI products/services do we need to sell in a year to reach this level of income?
20. What is the SHI selling price, and how does this compare with similar products/services of our competitors?

Current/future business position

21. Describe the (legal) entity offering the SHI products/services.
22. When was (will) our entity (be) established?
23. If we have a successful launch of SHI, can we leverage it to enter additional segments?¹⁵
24. Describe the executive team.
25. Who are the key persons for success?

Combining all newly acquired knowledge, we have assembled the first *desk-'n-talk*-version of the SHI Canvas Business Model; see Figure 23 on page 41.

4.2.1 Validation of model

In 2016, prior to the official start of the EIT Climate-KIC Partner Accelerator for the Soil Health Index Partner Accelerator, the project team has carried out a feasibility study for the SHI tool, commissioned by the Province of Gelderland in the Netherlands (see Annex 4 on page 64). The results of this study indicated that stakeholders such as farmers, farmers' organizations, soil laboratories, governments, water boards, and knowledge institutes support the idea to develop this instrument further together with potential market parties (a list of the stakeholders interviewed is also included in Annex 4). This was a first critical step towards the validation of the Business Idea for the SHI tool. For the Partner Accelerator project, the team built on those results and used this knowledge to construct the business model for SHI.

WENR acknowledges the important work implemented during the project, as well as its innovation and market potential. This was also another important step for the validation of the SHI model. Therefore, further financing of the project, outside of the EIT framework, is scheduled in 2018, including actual implementation of the SHI Business model as developed in 2017. As a result, the Business Model for SHI is to be validated, since the SHI tool is likely to attract other sources of funding, so Wageningen Environmental Research (WENR) can use it as a part of its value offerings.

¹⁵ [https://en.wikipedia.org/wiki/Leverage_\(finance\)](https://en.wikipedia.org/wiki/Leverage_(finance)): In *finance*, leverage is any technique involving the use of borrowed funds in the purchase of an asset, with the expectation that the after tax income from the asset and asset price appreciation will exceed the borrowing cost. Normally, the finance provider would set a limit on how much risk it is prepared to take and will set a limit on how much leverage it will permit, and would require the acquired asset to be provided as collateral *security* for the loan.

Key partners	Key Activities	Value Proposition	Customer Relationships	Customer Segments
Partners supplying technology: <ul style="list-style-type: none"> • Eurofins • ... Scientific partners: <ul style="list-style-type: none"> • WUR-WenR, team BWL • CSE-NIOO Wageningen (biology) • ... Partner-developer-customer integrated: <ul style="list-style-type: none"> • LTO (Dutch Farmers' Union) • Farmer (beeshead market-pilot?) • ... Partners that can market the SHI: <ul style="list-style-type: none"> • Eurofins • SoilCares • WUR-WenR • Dutch technology supplier/developer (Eijkelkamp, Dacom etc.) • External Startup • Existing yet unknown company 	K.A. required to realise the SHI <ul style="list-style-type: none"> • Reporting and advice <ul style="list-style-type: none"> - sampling - measurements on samples - analyses, interpretations • ... K.A. concerning distribution channels <ul style="list-style-type: none"> • ... K.A. concerning customer relations <ul style="list-style-type: none"> • Helpdesk • Promotion • Information supply (FAQ) • ... K.A. concerning revenues <ul style="list-style-type: none"> • Investments by partners • ... 	What is the benefit of the SHI? <ul style="list-style-type: none"> • SHI soil health assessment report • Soil health improvement recommendations • Customer support on soil management • ... What is the user-specific 'pain of the customer'? <ul style="list-style-type: none"> • Suboptimal harvests • Unknown 'soil status' • ... Which are our concrete products and services? <ul style="list-style-type: none"> • SHI-assessment(report) at field scale • Soil management advice at regional scale • Development of soil health indicators supporting land lease contracts • ... Which needs of customer groups do we anticipate? <ul style="list-style-type: none"> • SHI-assessment(report) at field scale • Soil management advice at regional scale • Development of soil health indicators supporting land lease contracts • ... 	What kind of relationship do our customers expect to have with us? <ul style="list-style-type: none"> • ... How do we maintain interaction with our customers / customer groups? <ul style="list-style-type: none"> • ... How expensive are customer relationships and what does this depend on? <ul style="list-style-type: none"> • ... 	For whom does the SHI create added value? <ul style="list-style-type: none"> • Arable farmers • Cattle breeding • Provinces • Water boards ('soil as water storage reservoir') • Municipalities • Ministries • Rijkswaterstaat → SDG 15.3 Sustainable land use • Existing qualification systems, like the Dutch 'Soil Passport' • Unions and Interest Groups (LTO etc.) • Education (colleges, Gerard van Os?) • Soil data management (BRO) • ... Who are our most important customers? <ul style="list-style-type: none"> • Arable farmers • Cattle breeding • Provinces • Water boards ('soil as water storage reservoir') • Municipalities • ...
Key resources of our partners: Technology: <ul style="list-style-type: none"> • Eurofins: sampling, measuring, logistics, website (?) • ... Scientific: <ul style="list-style-type: none"> • Soil Expertise (WenR-BWL) • CSE-NIOO Wageningen (biology) • ... Future customers: <ul style="list-style-type: none"> • ... 	What resources do we need to realise the SHI? <ul style="list-style-type: none"> • ... Which distribution channels? <ul style="list-style-type: none"> • ... Which sources of revenue? <ul style="list-style-type: none"> • ... 	Which channels are to be preferred? <ul style="list-style-type: none"> • Trending: web-based exclusively. • Conventional information service (privatized). • Public Service? Which channels are most cost-effective? <ul style="list-style-type: none"> • Linking to existing digital tools, protocols etc. How do we integrate the channels with existing customer routines? <ul style="list-style-type: none"> • Negotiate • ... 	Through which channels are we going to maintain contact with our customer groups? <ul style="list-style-type: none"> • Assignment: WhatsApp, facebook page, (mail, telephone) → cheap • Report: download via link • Information supply: YouTube videos (what kind of information? What does the customer expect?) → reasonable costs • Concentrate everything in the 'Akkerweb' app? 	
Core activities of our partners: Technology: <ul style="list-style-type: none"> • ... Scientific: <ul style="list-style-type: none"> • ... Future customers: <ul style="list-style-type: none"> • ... 				
Cost Structure		Revenue Streams		
What are the most important costs inherent to our business model? <ul style="list-style-type: none"> • Determination of SHI by means of sampling and measurements (capacity, material, logistics) • We still have to develop a lot and, hence, invest before we can supply • ... Which 'key resources' are the most expensive? <ul style="list-style-type: none"> • ... Which essential activities are the most expensive? <ul style="list-style-type: none"> • Sampling • Laboratory analyses • Reporting • Sales, content marketing 		For which added value do our customers really want to pay? <ul style="list-style-type: none"> • For information that solves their urgencies ('pain') • ... What are they paying for now - how do they pay - how would they want to pay? <ul style="list-style-type: none"> • Not, as far as known (surely for the 'Soil Passport') • ... Which income streams can we distinguish, and how much do they contribute (%)? <ul style="list-style-type: none"> • (Regional) governments (50%) • Farmers (25%) • Interest organizations (15%) • Soil data management (BRO) (5%) • Ministries (5%) • ... 		

Figure 23 First 'desk'-version of the SHI Canvas Business Model. This version has been assembled on the basis of our knowledge concerning Value Proposition Design. For the complete version, see Annex 13 on page 93.

4.3 Branding and marketing of the SHI

In this paragraph, the expertise and recommendations concerning branding and marketing of the SHI that was acquired in this project, is summarized.

'Branding' is very important: a brand or concept must be known in the market. We must underline that Wageningen University and Research (WUR) is the basis of a development: 'WUR inside'. In a second shell, the reader/potential user should be able to conclude easily that 'this is WUR'.

The advantage of the name 'Soil Health Index' is that the user understands immediately that this is about 'soil health', which is a crucial observation. The term 'Soil Health Index' can be used in (scientific) publications just as well. Yet in order to create more opportunities for ourselves in 'the market' we must consider a more appealing name. It is not so much about the underlying technology, but about a unique name of this service/product.

Eventually, we may come up with a name other than 'SHI': we must dare to brainstorm out of the box. 'I will launch the SHI with a sexy name, where everyone initially asks: what does that actually mean? We are scientific researchers, hence people who are trained in marketing should advise us on this. We can add value to a concept, a model, a business case, a product. Listen to other ideas. Think out of box.

A word mark is the strongest, but 'Soil Health Index' cannot be protected as a word mark. There are countless brands whose value increases once the product gets name recognition, simply because it is recognized. Do register the brand name: © or ®.

We can register brand names. For example, biobased economy WUR: 'Greenhouse as a pharmacy'. They have made a nice logo, and have registered it; see Figure 24. Example 2: Everyone knows the apple 'Elstar'. The developers at Wageningen Environmental Research (WENR) designated this very successful apple with internal code 'PRI107'. Unfortunately, the name, Elstar, was not registered; a lost opportunity because the brand name of a successful product has value as well: branding and marketing.

Figure 24 Examples of successful branding by Wageningen University & Research

Based on those inputs and the further market research, the project team produced a project flyer with the project logo, and developed the first version of the SHI website design; see Chapter 5 on page 46).

4.4 Elements of creating a Business plan

The project team worked together in a dedicated session with a business expert at Wageningen Environmental Research (WENR). Based on recommendations emerging from this session, the project team came up with the following potential elements and options of creating a business case for the SHI tool. In Annex 10 page 87) the considerations provided by the business expert Ruud van den Bulk are given (the text is in Dutch, but all comments were taken into account for developing the elements of the Business plan). Inputs of the above-mentioned session were used to develop a Business-to-Business proposition for SHI (see section 4.5), the Marketing partner selection criteria (see section 4.6), and a few budgeting considerations (see section 4.7).

4.4.1 License model

We can choose the license model for the SHI tool, which would then have an established owner who would have all the rights on the tool (excluding other development partners) and could apply for a patent. This way, we would run less risk: if a joint initiative 'fails' eventually the owner will still own the intellectual property rights and can look for new options.

Other option: If you are going to create value, you have to look at what you could combine in a clever way. If an existing company offers services that already generate money and you can use the SHI as a useful option here, your market share may grow.

And then, at a certain point, we may conclude: 'unfortunately, we appear to have failed, because ...', which is unfortunate yet acceptable. Such a kind of conclusion was not yet on our agenda at the time that this project had come to an end, including the issue of who is/are to decide on this issue.

4.4.2 Choose for a Startup

An alternative to the license model would be the founding of a startup. In this case, a connection with the Wageningen incubator and EIT Climate-KIC partner 'Startlife' will be sought. Engagement with the incubator would mean that SHI will receive coaching and access to 'soft loans'. Via Startlife, SHI would also get access to a network of startup experts and coaches, entrepreneurs, and potential investors (e.g. venture capitalists¹⁶ from Innovation Industries), who could all help SHI grow, and support it – as well as the team around it – in its first steps into the market.

4.5 SHI Company, Business-to-Business

4.5.1 Starting point for WUR-Environmental Sciences Group

Ten years ago, Cornell University (Ithaca NY, USA) developed the concept of SHA (= Soil Health Assessment). Emerging questions in this respect are summarized as follows.

1. Has Cornell patented anything? Is there a patent portfolio?
2. What agreements did WENR make with Cornell? Is there a MoU; is there anything on paper?
3. Is Cornell a partner who shares experiences / improvements with WENR?
4. Has Cornell developed software that WENR may use?
5. Are any SHA source codes, DLLs and the like, available for WENR?
6. Does WENR have the right to operate any SHI software / functionality / web application and the like? What is allowed, what is not?
7. Couldn't better WENR and Cornell bundle activities from now on, than operate separately?

4.5.2 What intentions does WENR have with the SHI (positioning)?

Has WENR already given sufficient thought to the pros and cons of the SHI, and what they want? E.g.:

- Increasing sustainability, contribute to solving the world food problem, and/or preventing soil degradation by innovative means?
- Licensing SHI as a package; offering support?
- Merely job creating, thus making money?

What do answers, given to the above three questions mean for the partner choice of WENR?

In what respect do the answers, given to the above three questions limit WENR's freedom to operate?

4.5.3 Which partner(s) do we select, and why

The choice of partner(s) means exploring options: which partner is the most suitable? Why?

A company may already offer/market comparable services, to which the SHI can be added, e.g. Eurofins. This may be risky, because such a company may not give the SHI the attention it deserves. An SME or Startup is likely be more committed if their right to exist depends on the SHI.

Do not merely choose a partner because he invests money. By doing so, such a partner 'buys' co-financer rights, which limits your freedom of movement in the project. Further developing the SHI with another, perhaps more interesting or otherwise more attractive SME at a later stage will then become very difficult if not impossible.

¹⁶ <http://www.investopedia.com/terms/v/venturecapitalist.asp>: What is a 'Venture Capitalist'? A venture capitalist is an investor who either provides capital to startup ventures or supports small companies that wish to expand but do not have access to equities markets. Venture capitalists are willing to invest in such companies because they can earn a massive return on their investments if these companies are a success. Venture capitalists also experience major losses when their picks fail, but these investors are typically wealthy enough that they can afford to take the risks associated with funding young, unproven companies that appear to have a great idea and a great management team.

4.5.4 Dilemmas, associated with partner selection

Do not get along with a company with cash flow problems: it poses a risk, regardless how interesting and attractive it may seem.

WUR tends not to search for partners beyond the circle of familiar, 'self-evident' partners. There are more opportunities; look further.

4.6 SHI Marketing partner selection criteria

4.6.1 Who will market the SHI

Wageningen Environmental Research (WENR) will not market the SHI itself because it is not equipped for this, lacking the expertise and the right people. It therefore suggests outsourcing commercialization activities to an existing company or startup.

In order to investigate the pros and cons of marketing the SHI by various companies - in an exploring a subjective manner - we have established a Suitability Assessment Matrix; see Figure 25.

Suitability Assessment Matrix SHI Marketing Company														
1 = yes; 0 = unknown, -1 = no	weighing factor	ASSESSMENT						weighing factor	SCORE (= Assessment times weighing factor)					
		Eurofins	SoilCares	WUR (WENr)	External existing company	External Startup	Technology Developer		Eurofins	SoilCares	WUR (WENr)	Extern bestaand bedrijf	External Startup	Technology Developer
1 Can measure (NIRS)	1	1	-1	-1	0	0	1	1	1	-1	-1	0	0	1
2 Has its own infrastructure for sampling	1	1	1	1	0	0	0	1	1	1	1	0	0	0
3 Strong brand with (regional) governments	3	1	0	1	-1	-1	-1	3	3	0	3	-3	-3	-3
4 Strong brand among intended customers, including farmers	3	0	0	1	-1	-1	-1	3	0	0	3	-3	-3	-3
5 Strong brand at nature organizations (SBB etc.)	3	0	0	1	-1	-1	-1	3	0	0	3	-3	-3	-3
6 Strong brand in 'the soil world' (i.e. which customer?)	0	1	1	1	-1	-1	-1	0	0	0	0	0	0	0
7 Has a field service for measuring	1	1	-1	1	0	0	0	1	1	-1	1	0	0	0
8 Young, compact company with innovative power	3	0	1	0	1	1	1	3	0	3	0	3	3	3
9 Is running fast for the SHI	3	0	1	1	1	1	1	3	0	3	3	3	3	3
10 Can roll out the SHI as an activity	4	1	1	0	1	1	0	4	4	4	0	4	4	0
11 Has experience with such activity	4	1	1	0	1	0	1	4	4	4	0	4	0	4
12 Can draw up and publish SHI report	2	1	1	1	1	1	1	2	2	2	2	2	2	2
13 Is not focused on technology	2	-1	-1	1	0	0	-1	2	-2	-2	2	0	0	-2
14 Is a service provider (instead of seller of devices)	3	1	1	-1	1	1	-1	3	3	3	-3	3	3	-3
15 SHI = Core business	2	-1	1	-1	0	1	0	2	-2	2	-2	0	2	0
16 Affinity with the product SHI	3	0	1	0	0	1	0	3	0	3	0	0	3	0
17 A lot of knowledge about soil	2	1	1	1	0	1	1	2	2	2	2	0	2	2
18 Simple financial / business construction	3	-1	0	-1	0	1	0	3	-3	0	-3	0	3	0
19 Financially robust-reliable	4	1	-1	0	0	0	1	4	4	-4	0	0	0	4
		18	19	11					18	19	11	10	16	5
A marketer does not necessarily have to be the partner who takes samples and does the measurements. Marketing, sampling and measuring are separate activities.														

Figure 25 Assessment matrix to establish the suitability of various companies for marketing the SHI (see also Annex 14 on page 95)

This matrix is self-explanatory, and was used by the authors of this report. The result is that two companies, Eurofins and Soil Cares would be most appropriate companies to market the SHI. Indeed, an external startup would also be a good option. This matrix appears to be a suitable instrument for making provisional choices.

4.7 Budgeting considerations

4.7.1 Sharing of revenues

There are several options identified for the revenue streams for SHI, especially for sharing revenues with other partners. For example, as soon as revenue is created and a company/party like Eurofins has co-financed the SHI in a risk-bearing manner (e.g. investment or co-development of the tool), part of this revenue will flow to Eurofins. This fits perfectly with our business model (see Deliverable... 'SHI Business Model Canvas'). Another example is hosting an SHI app on the 'Akkerweb' platform of WUR, where WUR gets its share and generates extra revenues which would allow us to continue pursuing innovations the further development of the SHI tool (both the product/tool and the service provided). For more information see also Annex 15 (page 96).

4.7.2 Soil Health Index (SHI) versus Soil Fertility Tool (SFT)

Recently, Wageningen Environmental Research (WENR) has gained experience with the budgeting of license fees for its Soil Fertility Tool. The Soil Fertility Tool is an online tool that provides a simple, easy and affordable means of assessing both the current and future health and productive capacity of the soil. It also provides advice on soil management. It is based on scientific research that can be easily and practically applied using an ergonomic interface. We will use this experience for the further development of the Soil Health index. As an example, some considerations regarding the pricing of the Soil Fertility Tool (SFT) are listed in the following.

License fee per customer group (excluding support costs)

All costs are exclusive of additional work done specifically for the customer. These are costs based on 'as is'. The functionalities and all other aspects of the SFT that had already been developed before the customer entered into the sea.

End-users Public (governments, development organizations, NGOs, etc.)

Fee is drawn up in proportion to the scope of application:

1. The size of the area for which a license has been purchased (province, region, country or several countries).
2. The number of crops for which a license has been purchased.
3. The number of modules for which a license has been purchased.
4. Specific agreements regarding support, partly based on the total investment that the customer wants to make in the purchase and use of the license.

In future deals, customers less well-off may be offered reduced rates. At this stage, however, this is not yet financially feasible.

Area (basic license)

1. Small country (or part of a country with area similar to a small country): € # / year
2. Medium-sized country € # / year
3. Large country € # / year
4. Very large country: € # / year

Classification of country size categories to be determined.

Number of crops

1. One crop is included in basic license.
2. Each additional crop: 10% of the basic license per additional crop

Number of modules

1. Standard modules (current modules): falls under basic license
2. Additional modules: additional price to be determined, depending on the investment costs specific module.

End-users Private (producers, trading companies, retail, etc.)

Fee is determined on the basis of market demand. This means that the benefit of the SFT for the customer determines the marketing price. The lower limit is the calculation as for public customers. Currently there are no paying customers from the private sector. However, current company contacts may lead to new customer categories.

User support

The SFT package includes user support, the extent of which depends on details of the contract that is concluded with the customer, viz.:

1. The size of the area (province, region, country or several countries).
2. The agreed support level.
3. The number of crops.
4. The number of modules.

Unfortunately, the SHI Business model development process that we have outlined in the preceding paragraphs, stops here. The next - and essential - steps that include a series of decisions, based upon this protocol, have been delayed, but have the highest priority as soon as this project is continued. Conclusions with regard to the SHI and SFT preferences are due in a follow-up project.

5 The Soil Health Index Website

5.1 Introduction

The Soil Health Index (SHI) website (<http://www.soilhealthindex.nl/>) has a number of different purposes, mainly focussed on giving information about the SHI;

- Introduction to the general public about what the SHI is,
- Introduction to the general public about what 'Soil Health' is,
- Explanation about the working principles of the SHI (measurement and soil improvement),
- Give information about the background of the SHI.

This current version of the website will be described in the next paragraph.

There are also a number of functions foreseen for the future, as a front-end website for the SHI once the SHI has been established:

- Website for taking in SHI measurement assignments,
- Dissemination of SHI results and dedicated soil improving measures in a protected user environment,
- Database giving an overview of SHI results, Nation-wide (Netherlands)
- Link with the Dutch 'Basisregistratie Ondergrond' (BRO)¹⁷, where intellectual property of soil data is an important issue. See www.basisregistratieondergrond.nl (in Dutch).

5.2 Overview of the SHI website

The figure below depicts the different webpages of the current version of the SHI website. The different pages are shown below the overview figure.

Figure 26 Overview of the SHI website

¹⁷ Information about the subsoil in the Netherlands is managed by various organizations. As a result, the data has not been digitized, standardized and harmonized in the same way. The 'Basisregistratie Ondergrond' (BRO) collects all data in one place and makes them available through one counter. Thanks to the BRO, governmental bodies can operate more efficiently. Information exchange between governments improves, data is reused and duplication in research is prevented.

Figure 27 Homepage of the SHI website

Figure 28 Menu page of the SHI website

Figure 31 FCB components - page (physical, chemical, biological components)

Figure 32 FCB components - Read more - page (physical, chemical, biological components)

Figure 33 Soil Improving measures – page

Figure 34 Soil Improving measures - Read more... – page

Figure 35 Background of the SHI – page

Figure 36 Page 'Development of the SHI for the Netherlands'

Figure 37 Page 'Contact'

Figure 38 Page where viewers can watch the SHI promotion video

5.3 Conclusion and Recommendation

The current version of the Soil Health Index website, is an effective information portal with clear and extensive amount of information to explain both the general public as well as future customers about how the SHI works and what its background is.

On developing the Soil Health Index for the Netherlands, the website will gain more functions and will be transformed from a purely informative website to the national hub for soil health in this country and beyond (EU).

The functions that will be added to the website in due time are:

- Client login, where (new) clients can create an account and if they have done so.
- Request/order a Soil Health Index measurement and management recommendation to be performed on their field or land.
- Download the SHI report after the SHI assessment has been performed. Also the specific management recommendation connected to the SHI assessment can be downloaded here.
- When enough SHI assessments have been performed, we will create a map page where soil health values can be read from the map of the Netherlands (data will be anonymized, only with approval from the client).
- An English language version of the pages containing information on soil health and the mechanism of the SHI will be made available in order to reach out to other European countries.

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Annex 1 Assessment of Soil Health – Cornell Framework Manual

Introduction

Soil health, or the capacity of the soil to function, is critical to human survival. Soil health constraints beyond nutrient limitations and excesses currently limit agroecosystem productivity and sustainability, resilience to drought and extreme rainfall, and progress in soil and water conservation. With mounting pressure to produce food, feed, fiber, and even fuel for an increasing population, soil health is gaining national and international attention. Research on both assessment and management of soil health, as well as farmers' innovations in soil health management approaches have matured over the decades. Multiple regional, national, and global efforts are now leveraging that work to reach new stakeholder audiences, so that soil health management is expanding into mainstream agriculture. Public recognition of the critical importance of maintaining and rebuilding healthy soils for long term sustainable agricultural production is growing. But while much progress has been made, there is much more to be done.

The more comprehensive assessment of soil health described in this manual is available to the public on a fee-for-service basis, and provides field-specific information on constraints in biological and physical processes, in addition to standard soil nutrient analysis (soilhealth.cals.cornell.edu/). In essence, the assessment expands on a well understood approach that has been foundational to high agricultural productivity. Just as standard soil testing has informed nutrient management based on identified deficiencies and excesses since the 1900s, the assessment developed here, similarly, identifies constraints to biological and physical soil functioning. This information then guides land managers in making targeted management decisions to plan and implement systems of soil health management practices to alleviate identified constraints and maintain healthier soils. The current (2016) version of the assessment and its interpretive scoring was developed for the Northeastern United States. However, the concepts, framework and indicators for soil health assessment and management planning described here can be expanded and adapted for national and global applications. The most relevant components of the framework are 1) measurement of indicators that represent critical soil processes, 2) scoring of measured values that allows for interpretation, and 3) linkage of identified constraints with management practices. The main benefit of this approach is that the identification of physical biological and chemical constraints prompts farmers to seek improved and more sustainable soil and crop management practices. We hope that this framework will evolve and be used widely to measure and monitor soil health status. It is expected that a more comprehensive understanding of soil health status can lead to better, regenerative, and sustainable management of soils through holistic, adaptive, and data-driven approaches.

This manual is laid out in four parts:

- I. Soil Health Concepts (1–18)
- II. Soil Health Assessment (19–78)
- III. Soil Health Management (79–101)
- IV. Additional Resources (102–108)

The purpose of this manual is to:

- Provide an overview of soil health concepts.
- Provide an overview of Cornell University laboratory methods used to assess the health status of soil, the report generated from this more comprehensive assessment of soil health, and its interpretation.
- Present a framework for soil health management planning and implementation based on information gained from soil health assessment that can be adapted for use in other land management systems, soils, and climates.
- Provide a brief overview of in-field qualitative soil health assessment.
- Provide a how-to guide for proper soil health sampling.
- Describe soil constraints and soil health issues common to soils in the Northeast region, especially in vegetable and field crop production systems.
- Identify management strategies for improving soil health based on measured constraints.
- Provide guidelines for standardized and quantitative laboratory-based soil health assessment.
- Provide links to additional soil health assessment and management resources.

Annex 2 Support for soil health improvement in the USA

FFAR Awards \$9.4 Million to Spur Next Leap in Agriculture: Improved Soil Health to Optimize Economic and Environmental Results for U.S. Farmers

Soil Health Institute, Soil Health Partnership and The Nature Conservancy to Collaborate on Research, Benefiting Environment, Farmers and Communities

The Foundation for Food and Agriculture Research, a nonprofit established through bipartisan support in the 2014 Farm Bill, today announced a \$9.4 million grant to the Soil Health Institute, the Soil Health Partnership and The Nature Conservancy to improve soil health and, ultimately, support positive economic and environmental outcomes for American farmers. The grant will be matched by General Mills, the Jeremy and Hannelore Grantham Environmental Trust, Midwest Row Crop Collaborative, Monsanto, Nestlé Purina PetCare Company, The Samuel Roberts Noble Foundation, Walmart Foundation, the Walton Family Foundation, and individual donors for a total investment of nearly \$20 million.

The goal of this project is to support collaborative research and education that accelerates adoption and benefits of soil health management systems nationally. Soil health is a critical component of a productive and sustainable agricultural system. Farming practices that improve soil health can increase profitability while protecting natural resources like air and water for communities.

However, there is no standardized measurement for soil health in the United States; instead, different sets of measurements and methods can conflict and confuse farmers and field conservationists. Furthermore, many landowners of rented farmland are not aware of the benefits soil health improvements can deliver. This project will help the industry adopt standardized measurements to evaluate and improve soil health while expanding education and tools for local farmers, agronomists, and landowners.

'If we can unlock the potential of healthy soil, we can move closer to a sustainable agricultural system for everyone,' said Sally Rockey, Ph.D., executive director of FFAR. 'The Foundation for Food and Agriculture Research is pleased to harness the power of collaboration by supporting three leading organizations in this space for the long-term benefit of our nation's farmers and food system.'

Collaborators will take an integrated, three-pronged approach. The Soil Health Institute will develop and test soil health measurements; the Soil Health Partnership will implement and evaluate soil health promoting practices on working farms; and The Nature Conservancy will work with non-operator landowners to encourage use of science-based soil health practices. The partners believe significant engagement with farmers and landowners will catalyze greater adoption of soil health promoting practices that benefit productivity, farmer livelihoods, and the environment.

'The needs for advancing soil health are far greater than any single organization can provide – public or private,' said Wayne Honeycutt, President and CEO of the Soil Health Institute. 'That's why this project is so important. It leverages public funds authorized by Congress through the Foundation for Food and Agriculture Research with resources provided by other foundations and corporations through the combined capacities of the Soil Health Institute, Soil Health Partnership, and The Nature Conservancy. This kind of partnership creates a way to advance soil health for the benefit of all who need safe, high-quality products from agriculture, natural resources to sustain human and all other life, thriving communities, and a strong economy. In other words, it benefits *everyone*.'

'American agriculture has made extraordinary strides in technology and productivity in this century, but the next frontier is in soil health,' said Nick Goeser, director of the Soil Health Partnership. 'This grant represents one of the largest investments ever made in soil health, one of the best tools we have to optimize productivity while minimizing environmental impact. It will allow us to expand our program to include more farmers who want to benefit from our body of work analyzing how practices like growing cover crops, reducing tillage and using advanced nutrient management can help family farms survive and thrive.'

'With a shared commitment to science and the improved soil health and productivity of America's farmlands, we are pleased to be part of this collaboration,' said Larry Clemens, director of The Nature Conservancy's North America Agriculture Program. 'This grant awarded by the Foundation for Food and Agriculture Research and matched by generous contributors will not only advance the science of soil health, but we expect to see an increase in the adoption of on-field soil health practices. By engaging farmers and the landowners they rent from, we can help increase farm profitability and protect water and land resources.'

FFAR is supporting this collaborative project through its Healthy Soils, Thriving Farms Challenge Area, which aims to increase soil health by building knowledge, fueling innovation, and enabling adoption of existing or novel practices that improve soil health.

Annex 3 Definitions of 'Soil Health'

https://en.wikipedia.org/wiki/Soil_health (070717)

Soil health is a state of a **soil**, meeting its range of **ecosystem** functions as appropriate to its environment. Soil health testing is an assessment of this status.^[1] Soil health depends on **soil biodiversity** (with a robust **soil biota**), and it can be improved via **soil conditioning** (soil amendment).

The term soil health is used to describe the state of a soil in:

- Sustaining plant and animal productivity and **biodiversity** (**Soil biodiversity**);
- Maintaining or enhance **water** and **air quality**;
- Supporting **human health** and **habitation**.^[2]

Soil Health has partly if not largely replaced the expression 'Soil Quality' that was extant in the 1990s. The primary difference between the two expressions is that soil quality was focused on individual traits within a functional group, as in 'quality of soil for **maize** production' or 'quality of soil for **roadbed** preparation' and so on. The addition of the word 'health' shifted the perception to be integrative, **holistic** and systematic. The two expressions still overlap considerably.

The underlying principle in the use of the term 'soil health' is that soil is not just an inert, lifeless growing medium, which modern farming tends to represent, rather it is a living, dynamic and ever-so-subtly changing whole environment. It turns out that soils highly **fertile** from the point of view of crop productivity are also lively from a biological point of view. It is now commonly recognized that soil **microbial biomass** is large: in temperate grassland soil the bacterial and fungal biomass have been documented to be 1–2 t (2.0 long tons; 2.2 short tons)/**hectare** and 2–5 t (4.9 long tons; 5.5 short tons)/ha, respectively.^[3] Some microbiologists now believe that 80% of **soil nutrient** functions are essentially controlled by microbes.^{[4][5]} If this is consistently true, than the prevailing **Liebig nutrient theory** model, which excludes biology, is perhaps dangerously incorrect for managing soil fertility sustainably for the future.

Using the human health analogy, a healthy soil can be categorized as one:

- In a state of composite well-being in terms of biological, chemical and physical properties;
- Not diseased or infirmed (i.e. not **degraded**, nor degrading), nor causing negative off-site impacts;
- With each of its qualities cooperatively functioning such that the soil reaches its full potential and resists degradation;
- Providing a full range of functions (especially nutrient, **carbon** and **water cycling**) and in such a way that it maintains this capacity into the future.

Conceptualisation

Soil health is the condition of the soil in a defined space and at a defined scale relative to a set of benchmarks that encompass healthy functioning. It would not be appropriate to refer to soil health for soil-roadbed preparation, as in the analogy of soil quality in a functional class. The definition of soil health may vary between users of the term as alternative users may place differing priorities upon the multiple functions of a soil.

Therefore, the term soil health can only be understood within the context of the user of the term, and their aspirations of a soil, as well as by the boundary definition of the soil at issue.

Interpretation

Different soils will have different benchmarks of health depending on the 'inherited' qualities, and on the geographic circumstance of the soil. The **generic** aspects defining a healthy soil can be considered as follows:

- 'Productive' options are broad;
- Life diversity is broad;
- Absorbency, storing, recycling and processing is high in relation to limits set by [climate](#);
- [Water runoff](#) quality is of high standard;
- Low [entropy](#); and,
- No damage to, or loss of the fundamental components.

This translates to:

- A comprehensive cover of [vegetation](#);
- Carbon levels relatively close to the limits set by [soil type](#) and climate;
- Little leakage of nutrients from the ecosystem;
- Biological and [agricultural productivity](#) relatively close to the limits set by the soil environment and climate;
- Only geological rates of [erosion](#);
- No accumulation of [contaminants](#); and,
- The ecosystem does not rely excessively on inputs of [fossil energy](#)

An unhealthy soil thus is the simple converse of the above.

Measurement

On the basis of the above, soil health will be measured in terms of individual [ecosystem services](#) provided relative to the benchmark. Specific benchmarks used to evaluate soil health include CO₂ release, humus levels, microbial activity, and available calcium.^[6]

Soil health testing is spreading in the USA, Australia and S. Africa.^[7] Cornell University has had a Soil Health Test since 2006 and offers many types of individual soil health tests as well as three different soil health testing packages.^[8] The approach is to add into common chemical nutrient testing a biological set of factors not normally included in routine soil testing. The best example is adding biological [soil respiration](#) (CO₂-Burst) as a test procedure; this has already been adapted to modern commercial labs in the past 10 years.

There is resistance among soil testing labs and university scientists to adding new biological tests, primarily since interpretation of soil fertility is based on models from 'crop response' studies which match yield to test levels of specific chemical nutrients. These soil test methods have evolved slowly over the past 40 years and are backed by considerable effort. However, in this same time USA soils have also lost up to 75% of their carbon ([humus](#)), causing biological fertility to drop drastically. Many critics of the current system say this is sufficient evidence that the old soil testing models have failed us, and need to be replaced with new approaches. These older models have stressed 'maximum yield' and 'yield calibration' to such an extent that related factors have been overlooked. Thus, surface and [groundwater pollution](#) with excess nutrients ([nitrates](#) and [phosphates](#)) has grown enormously, and is reported presently (in the USA) to be the worst it has been since the 1970s, before the advent of environmental consciousness.^{[9] [10] [11]}

See also

- [Dryland salinity](#)
- [Ecosystem services](#)
- [Soil biodiversity](#)
- [Soil carbon](#)
- [Soil policy \(Victoria, Australia\)](#)
- [Soil quality](#)

- [Soil resilience](#)
- [Soil structure](#)
- [Soil water \(retention\)](#)

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11. Soil CO₂ respiration: Comparison of chemical titration, CO₂ IRGA analysis and the Solvita gel system. *Renewable Agriculture and Food Systems*: 23(2); 171–176

External links

- [Living Soils](#) (Greenpeace)
- [NRCS Soil Health and NPK](#) (NRCS)
- [NRCS Soil Health in Field and Forage Crop Production](#) (NRCS)
- [WEBINARS on SOIL HEALTH](#)
- [Soil Health Tool in The Prairie Star](#)
- [Soil Quality Indicator Sheets](#)
- [National Look at Groundwater Pollution](#) (USGS)

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Categories:

- [Land management](#)
- [Soil](#)

https://en.wikipedia.org/wiki/Soil_Health_Card_Scheme

Soil Health Card Scheme

From Wikipedia, the free encyclopedia

Soil Health Card Scheme is a scheme launched by the [Government of India](#) in February 2015.^[1] Under the scheme, the government plans to issue soil cards to farmers which will carry crop-wise recommendations of nutrients and fertilisers required for the individual farms to help farmers to improve productivity through judicious use of inputs. All soil samples are to be tested in various soil testing labs across the country. Thereafter the experts will analyse the strength and weaknesses (micro-nutrients deficiency) of the soil and suggest measures to deal with it. The result and suggestion will be displayed in the cards. The government plans to issue the cards to 14 crore farmers.^[2]

Contents

- 1 Scheme
- 2 Budget
- 3 Performance
- 4 Plans
- 5 References

Scheme

The scheme aims at promoting soil test based and balanced use of fertilisers to enable farmers realise higher yields at lower cost.^[3]

Soil Health Card Scheme

Prime Minister Narendra Modi launching the Soil Health Card scheme in Suratgarh, Rajasthan

Country	India
Prime Minister (s)	Narendra Modi
Launched	17 February 2015; 2 years ago
Budget	₹568 crore (US\$88 million)
Status	Running
Website	soilhealth.dac.gov.in

Quick links:

- [Testing services](#)
- [Comprehensive Assessment of Soil Health – The Cornell Framework Manual](#)

The Cornell Soil Health Testing Laboratory is the home of the Comprehensive Assessment of Soil Health (CASH):

The Comprehensive Assessment of Soil Health is designed for farmers, gardeners, agricultural service providers, landscape managers and researchers who want to go beyond simply testing the nutrient levels of their soils. It is the first commercially-available laboratory soil health test that provides standardized, field-specific information on important constraints in soil biological and physical processes, in addition to standard nutrient analysis.

The Assessment is regarded as a key tool for soil health measurement by several national initiatives, including [Soil Renaissance](#), the [Soil Health Partnership](#), and the [USDA-NRCS Soil Health Division](#). We have conducted over 10,000 soil health package analyses since its rollout in 2006. Half were for commercial customers. In addition to the laboratory results for each sample, we have developed a soil health management planning framework included with the sample assessment results to help you focus management changes where they will be most effective in improving your soil.

The assessment's indicators and management strategies for improving soil health are also detailed in the [Comprehensive Assessment of Soil Health Training Manual](#), available free online.

Important information regarding changes to shipping and packaging protocols:

Beginning June 1st 2016 each individual sample needs to be double bagged prior to packaging and shipping. Packing material such as crumpled paper or bubble wrap must be placed in the box with the samples to prevent sample movement and spillage during shipping. For more details on proper packaging and shipping instructions, please visit the '[Testing Services](#)' tab on our website.

There are certain counties in the US where soil should neither be packaged nor shipped. Soil received from these counties will be destroyed without processing. For a complete list of prohibited counties please visit the '[Resources](#)' tab on our website.

Annex 4 Feasibility Study for Soil Health Index (2016)

Haalbaarheid en draagvlak Soil Health Index: een voorstudie

Alwin Gerritsen, Wageningen Environmental Research (Alterra)

Dit onderzoek is uitgevoerd door Wageningen Environmental Research, in opdracht van en gefinancierd door Provincie Gelderland.

Summary in English

In 2016, the Province of Gelderland commissioned a feasibility study for the SHI tool. The results of this study indicated that stakeholders like farmers, farmers' organizations, soil laboratories, governments, water boards, and knowledge institutes support the idea to develop this instrument further, together with potential market parties. A list of the stakeholders interviewed is also included. This feasibility study includes an analysis of competing instruments, which indicates a competitive edge for the SHI tool, and therefore was used for the further validation of the SHI Business Model, during the Soil Health Index Partner Accelerator project.

Aanleiding

Sinds het Jaar van de Bodem (2015) staat de bodem volop in de aandacht. Er zijn in Nederland dan ook verschillende initiatieven om de kwaliteit van bodems beter te leren kennen en daar waar nodig te verbeteren. Bodemgezondheid is van groot belang voor een duurzame en grondgebonden agrarische productie. De bodem is een belangrijke bron van natuurlijk kapitaal voor de akkerbouw en de grondgebonden tuinbouw en melkveehouderij. De Provincie Gelderland richt zich met het 'Meerjarenprogramma Bodem en Ondergrond' (2015 – 2020) op een ruimtelijke inrichting van Gelderland met inbegrip van de ondergrond.

Bij de Provincie Gelderland, Wageningen Environmental Research (Alterra) en het NIOO is het idee opgekomen om voor Nederland en op basis van de Amerikaanse 'Soil Health Assessment' (SHA) een zogenaamde 'Soil Health Index' (SHI) te ontwikkelen. De reden hiervoor was dat er nog weinig naar de bodem en bodembeheer gekeken wordt als zijnde een samenhangend ecosysteem, waar chemie, fysica en biologie gezamenlijk bepalen hoe het met de bodemgezondheid staat. De achterliggende doelstelling is om hiermee bij te dragen aan de bodemgezondheid op langere termijn. De SHA doet dit wel en kan met daadwerkelijke meetgegevens ook aangeven aan welke maatregelen de agrariër kan denken om de problemen op zijn of haar land op te lossen, of de algehele bodemgezondheid te verbeteren. De verwachting is dat de omzetting van ruwe meetgegevens naar een index van 1-100 voor elk van de 12 parameters van de Soil Health Assessment aangepast zal moeten worden aan Nederlandse bodems. Zo zijn er waarschijnlijk nog meer technische ingrepen nodig om de SHA bruikbaar te maken voor de Nederlandse situatie. Het ontwikkelen van een Nederlandse SHI zal een relatief omvangrijke inspanning vergen. De initiatiefnemers Provincie Gelderland, Wageningen Environmental Research (Alterra) en NIOO zijn van mening dat voordat hiertoe besloten kan worden, het nodig is om eerst in beeld te krijgen of en onder welke voorwaarden de SHI een instrument kan zijn waar stakeholders als agrarisch ondernemers, overheden, kennisinstituten en keten bedrijven nut van hebben en in hoeverre ze de SHI ook willen ondersteunen.

Achtergrond Soil Health Index (SHI)

De Soil Health Index (SHI) is een index of een 'rapportcijfer' die de gezondheidstoestand van de op een bepaalde locatie aangeeft (als cijfer van 1-100 of als categorie 'goed', 'matig' of 'slecht'). Het cijfer wordt bepaald met behulp van een beoordeling van de belangrijkste fysische (aggregaat stabiliteit, beschikbaar water capaciteit, hardheid van het bodemoppervlak, hardheid van de ondergrond), biologische (organisch stofgehalte, actief koolstofgehalte, bodem eiwitten, respiratie, wortel gezondheid, potentieel mineraliseerbare stikstof) en chemische bodemeigenschappen (pH, extraheerbare fosfor, extraheerbare kalium, Mg, Fe, Mn, Z, water oplosbare zouten en zware metalen)¹⁸. Bij deze beoordeling hoort ook een set aan maatregelen die genomen kunnen worden om de bodemgezondheid te verbeteren. Kenmerkend van de SHI is dat die de bodem benadert als een levend ecosysteem waar de fysische, biologische en chemische kenmerken elkaar beïnvloeden. Maatregelen die bedoeld zijn om een van de eigenschappen van een bepaalde bodem te verbeteren kunnen ook (onbedoeld) invloed hebben op andere delen van het ecosysteem.

De SHI is gebaseerd op het werk dat is gedaan aan de Cornell Universiteit in Ithaca, New York, door het 'Soil Health Assessment' (SHA) team van Harold van Es en Bob Schindelbeck. Wat de Cornell aanpak bijzonder maakt, is de gedegen onderbouwing en toegesneden adviezen die worden gegeven na het bepalen van de index, om de bodem te verbeteren. Opvallend daarbij is dat zowel maatregelen op korte als op lange termijn worden voorgesteld. Het basiswerk van de Soil Health Assessment is te vinden in de SHA manual. De Soil Health Assessment wordt in de Verenigde Staten volop door agrariërs gebruikt om de bodemgezondheid van akkerbouwgronden te beoordelen en te verbeteren. Er wordt met deze methode niet door Cornell University bemonsterd, maar door de agrarische ondernemer zelf die daardoor ook geen grote kosten hoeft te maken, maar zich wel hierin moet bekwalen. De door de agrariër opgestuurde monsters worden vervolgens in het lab van Cornell geanalyseerd en een SHA-rapport met verbetermaatregelen wordt opgesteld.

Het Soil Health Assessment framework zoals dat door Cornell is ontwikkeld, is inmiddels 10 jaar in gebruik en nog steeds in ontwikkeling. Bovendien is het één van de weinige systemen die de bodem zo breed en integraal beschouwt. Omdat er al veel ervaring en kennis is opgedaan met het systeem lijkt het kansrijk deze voor Nederland te gebruiken. Ook zijn er al goede contacten tussen Cornell en Wageningen Environmental Research; er is een principe afspraak voor samenwerking op het gebied van de SHI in Nederland, waarbij Wageningse onderzoekers gebruik kunnen maken van de knowhow die bij Cornell is verzameld.

Doelstelling en beoogd resultaat

In de voorstudie Haalbaarheid SHI is verkend of en hoe het haalbaar is om een systeem voor het meten van bodemgezondheid en in het bijzonder de SHI te introduceren in Nederland. Het vaststellen van de haalbaarheid richt zich in het bijzonder op het draagvlak onder de bij bodemgezondheid betrokken actoren en op hun kennis en visie over wat er nodig is en wat kan en niet kan. Het gaat dus vooral over de percepties op haalbaarheid en een inschatting of er voldoende draagvlak is voor de SHI. De haalbaarheid richt zich vooral op hoe actoren uit markt, overheid, kennis en samenleving dit beoordelen. Hierbij stond het verknopen met andere systemen rondom bodemgezondheid, overheidsbeleid, behoeften van de boer en maatschappelijke organisaties centraal. De voorstudie beoogt niet concreet aan te bevelen welke indicatoren, scoringsfuncties en maatregelen het best in de SHI opgenomen kunnen worden en hoe het best gemeten kan worden. Dat is een actie die na een positief besluit over haalbaarheid en draagvlak door de provincie Gelderland, Wageningen University & Research en NIOO (en wellicht ook anderen) in een separate opdracht uitgevoerd kan worden.

¹⁸ Wortelgezondheid, potentieel mineraliseerbare stikstof, water oplosbare zouten en zware metalen maken onderdeel uit van de uitgebreide versie van de SHA.

Door de voorstudie zal de SHI ook bij relevante actoren onder de aandacht gebracht worden en daardoor wordt het sociale kapitaal versterkt waar een eventueel vervolgproject, waarin de SHI ontwikkeld zal worden, haar voordeel mee kan doen.

Methode

De kern van de methode van de voorstudie bestaat uit een interviewronde. Als eerste is echter een film (6 minuten) gemaakt die gebruikt is om respondenten te informeren over de plannen en potenties voor de SHI en die ook breder beschikbaar is. Deze is op Vimeo gepubliceerd en is te bekijken via <https://vimeo.com/182450088>.

Tussen 19 september en 8 november zijn er interviews gehouden met 33 respondenten, waarvan 17 in twee groeps gesprekken, met naast de directe contactpersoon ook 5 akkerbouwers (De Peel) en 10 melkveehouders (Achterhoek). De interviews hadden een semi-gestructureerd karakter, waarbij de interviewer het interview structuur geeft en stuurt op welke vragen beantwoord moeten worden, maar de geïnterviewde ook ruimte krijgt om eigen ideeën in te brengen. Ten behoeve hiervan is een interview guideline opgesteld. De volgende vragen stonden centraal in de gesprekken:

Bestaat er behoefte aan het verzamelen en gebruiken van meer meetgegevens over de agrarische bodemgezondheid?

Hoe zou dit het best vormgegeven kunnen worden? Is de SHI hiervoor een tool met perspectief?

Aan welke eisen zou een SHI moeten voldoen om acceptabel te zijn voor de stakeholders?

Met welke initiatieven en processen kan de SHI verknoopt worden en hoe?

Zijn de condities aanwezig om de SHI als tool te kunnen gebruiken voor leren en veranderen rondom agrarische bodemgezondheid?

Op 21 november is een afsluitende workshop gehouden waarin de bevindingen gedeeld werden en een discussie georganiseerd werd over het ontwikkelingstraject en over de wenselijkheid om te beginnen met de implementatie.

Aanvullend aan genoemde activiteiten is ook een beperkte deskstudie uitgevoerd naar bestaande en voor de SHI relevante bodemtools.

Draagvlak en haalbaarheid - begripsverklaring

Draagvlak gaat over het van tevoren verwerven van steun en goedkeuring voor het uitvoeren van plannen. Draagvlak moet er niet alleen aan het begin zijn, maar ook gedurende de implementatie. Bij onvoldoende draagvlak heeft het weinig zin de SHI te ontwikkelen of wordt deze na ontwikkeling niet gebruikt. Het lastige van draagvlak aan het begin vaststellen is dat het om steun gaat voor iets dat er nog niet is en waarvan ook nog niet helemaal duidelijk is wat het zal worden en wat de werking ervan zal zijn. Daarom is draagvlak in de voorstudie opgevat als steun voor het beginnen met het uitwerken van de SHI. En de nadruk ligt daarbij niet zozeer op expliciete steun, maar meer op impliciete steun, door te kijken naar waar verschillende organisaties mee bezig zijn in relatie tot bodemgezondheid en hoe de SHI zich daartoe zal verhouden.

De SHI kan niet beschouwd worden zonder de bredere bewegingen in de landbouw en het landgebruik mee te nemen. Specifiek betreft dit de opkomst van een centralere rol voor bodemgezondheid in het management van landbouw en voedselproductie. In dergelijke 'transities' gaat het om nieuwe

innovatieve praktijken te 'institutionaliseren' (o.a. Geels, 2002¹⁹). Dat klinkt wellicht abstract, maar het gaat onder andere over overname en opschaling van (delen van) innovatieve landbouwpraktijken door andere agrarisch ondernemers (de volgers), door voedselketens te veranderen, door waar nodig aanpassingen in wet- en regelgeving en ondersteunend beleid door te voeren en door aanpassingen bij ondersteunende organisaties als banken, erfbetreders, wetenschap en onderwijs. De SHI kan in principe een concrete stap zijn, binnen een bredere transitie naar een landbouw die stuur op *bodemgezondheid*.

Een informatiebron, als de SHI is hierbij niet zozeer neutraal of objectief, maar een manier om via informatie deze gewenste verandering te bewerkstelligen (Soma et al., 2015²⁰; Gerritsen et al., 2013²¹; Haas, 1992²²). Een dergelijk resultaat van de toepassing van de SHI kan zowel bewust ingezet worden, als wel een onbedoeld effect zijn. De informatie is zelf wel neutraal, maar deze wordt gebruikt ter onderbouwing en legitimering van bestaande en nieuwe normatieve agenda's en (landbouw) praktijken rondom bodemgezondheid. Daarom is het dan ook aan te bevelen om hier bij de ontwikkeling van de SHI rekening mee te houden door keuzes te maken in de organisatie en bij de technische implementatie.

Resultaten

In dit hoofdstuk zullen de resultaten van de interviewronde en afsluitende workshop samengevat worden. De woorden zijn van de auteur, de inhoud is een weergave van de verschillende geuite *meningen* die naar boven kwamen in de voorstudie. Het is dus niet op te vatten als conclusies van de auteur, maar als weergave van de onderzoeksresultaten. Hierbij is wel een selectie gemaakt. Er is geprobeerd om vooral het pallet te schetsen en te bedenken wat de gevolgen van deze meningen zijn voor de implementatie van de SHI. Als bepaalde meningen duidelijk breed gedeeld werden, wordt dit ook in de tekst zo gepresenteerd.

Aandacht voor bodemgezondheid

De respondenten nemen waar dat er vooral in de akkerbouw issues zijn met het op peil houden van de bodemgezondheid waardoor op de langere termijn de 'volhoudbaarheid'²³ van het landbouwkundig gebruik van bodems onder druk komt te staan en agrarisch ondernemers ook nu al problemen ondervinden. In de melkveehouderij speelt dit weliswaar minder, maar het is ook daar een punt van zorg en aandacht. In wetenschappelijk onderzoek wordt deze trend nog niet eenduidig waargenomen, maar in de praktijk wel. Een mogelijk verklaring die genoemd werd, zit in de continue verjonging van akkerbouwbodems en van tuinbouwbodems door het aanvoeren van organische stof. Specifieke problemen zijn stikstof-oxiderende bodems, verdichting van de bodem en problemen met waterafvoer (inclusief afvoer van nutriënten naar het oppervlaktewater). Deze problemen spelen niet alleen bij de gangbare landbouw, maar ook bij de biologische landbouw. Ook in de opkomende hightech precisie landbouw is er veel aandacht voor de bodem. Duidelijk is het dat bodemgezondheid niet alleen gaat over het vermogen van de bodem om voedsel te produceren, maar ook over andere ecosysteemdiensten zoals waterregulatie.

Er werd in de interviews geconstateerd dat de bodem een opkomend onderwerp is dat volop in de aandacht staat. Er is veel meer aandacht voor dan een paar jaar geleden. Het Jaar van de Bodem heeft hier aan bijgedragen. Tegelijkertijd gaan de ontwikkelingen ook weer niet zo snel; aldus enkele

¹⁹ Geels, F.W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case study. In: *Research Policy*: 31 (8/9) (2002): 1257–1274.

²⁰ Soma, K., C.J.A.M. Termeer & P. Opdam (2015) Informational governance – A systemic literature review of governance for sustainability in the Information Age, *Environmental Science & Policy* 56: 89–99.

²¹ Gerritsen, A. L., Stuiver, M., Termeer, C. J. A. M. (2013). Knowledge governance: An exploration of principles, impact, and barriers. *Science and Public Policy*, 40(5) (2013), pp. 604–615.

²² Haas, P. (1992) Introduction: epistemic communities and international policy coordination, *International Organization* 46:1, 1–35.

²³ Dit is een term die door meerdere respondenten genoemd is als alternatief voor het begrip duurzaamheid.

respondenten. Een groot deel van de agrarisch ondernemers, zeker in de melkveehouderij, maar ook daarbuiten, is niet gewend om hun percelen en productie te managen op bodemgezondheid en stuurt nog vooral via het toedienen van kunstmest en pesticiden. In de akkerbouw bestaat er al meer aandacht voor sturen op bodemgezondheid, omdat dit voor hen ook direct van nut is. Binnen de melkveehouderij betreft het vooral relatief extensieve bedrijven (al dan niet biologisch), waarbij het ook past binnen hun bredere bedrijfsstijl. Veel van de toenemende aandacht voor bodemgezondheid betreft vooral bewustwordingstrajecten. Dit kan in principe in de nabije toekomst tot een groei van concrete initiatieven leiden, maar er werd ook opgemerkt dat de oriëntatie vooral op de korte termijn ligt, op het verhogen van de opbrengsten of verminderen van de uitgaven voor de ondernemer. Daarmee ligt er minder nadruk op de lange termijn en op de volhoudbaarheid of duurzaamheid van landbouwkundig gebruik. Evengoed werd wel geconstateerd dat het momentum voor aandacht voor de bodem volop in opbouw is en dat dit moment wellicht al bereikt is.

Op het eerste gezicht is er veel overeenkomstig in wat de respondenten aangaven. Een nadere beschouwing maakte echter duidelijk dat er rondom bodemgezondheid verschillende aandachtspunten te onderscheiden zijn die in de interviews wel deels aan elkaar verbonden worden. Aandacht voor bodemgezondheid wordt genoemd als manier om bij te dragen aan:

Het verhogen of op peil houden van de bestaande hoge voedselproductie²⁴. Deels, maar niet uitsluitend met gebruik van hightech oplossingen.

Het garanderen van de volhoudbaarheid van het landbouwkundige gebruik van de bodem.

Het reduceren van productiekosten voor agrarisch ondernemers.

Het op peil houden en verbeteren van de kwaliteit en kwantiteit van grond- en oppervlaktewater en het mitigeren van en aanpassen aan klimaatveranderingen.

Het als landbouwsector en / of voedsel ketens invullen van maatschappelijk verantwoord ondernemen.

Het voldoen aan beleid en regels van overheden en ketenbedrijven.

Deze aandachtspunten sluiten elkaar niet altijd uit en kunnen elkaar ook aanvullen en versterken, maar de achterliggende aannamen en belangen kunnen wel leiden tot een verschillende focus en daarmee ook afwijkende effecten op de bodemgezondheid.

Het landschap aan bodemtools

De respondenten zijn overwegend positief over de Soil Health Assessment. Men waardeert de benadering van de bodem als systeem en vindt dat er voor bodemfysica en bodembioogie een aantal interessante en voor Nederland nieuwe indicatoren onderdeel van uitmaken. De SHA is ook door enkele respondenten al verkend en er worden soms zelfs al bodemonsters naar Cornell University gestuurd ter analyse met de SHA omdat er interessante indicatoren gebruikt worden. Er is overwegend een welwillende houding waargenomen, maar respondenten hebben wel vragen over de implementatie in de SHI. Deze zijn als volgt samen te vatten:

Kun je het opzetten van een SHI voor Nederland waarmaken? Is de kennis er wel? ()

Wordt de SHI wel bruikbaar voor de agrarisch ondernemer?

Is het wel nodig?

²⁴ Dit is niet hoe de initiatiefnemers dit zien.

Er bestaan verschillende tools die zich richten op kwaliteit of gezondheid van bodems. Nog recent was de kennis over de bodem verspreid over verschillende disciplines, maar de laatste jaren is een opkomst waar te nemen van een meer integrale blik. In tabel 1 is een overzicht gegeven van relevante tools en databases zoals tijdens de interviews aan bod zijn gekomen. Het algemene beeld is dat tools en indicatorensets, zoals Bodem Paspoort, Bodem Scan, Eurofins indicatoren, RIVM indicatoren, LANDMARK, Minimale Datasets, SINDI en SoilQ ofwel grover en minder nauwkeurig ofwel specifiek zijn, dan de SHI ambieert. Ook zijn er tools die op andere methoden gebaseerd zijn, zoals de Bodem Conditie Score of het Bodemlabel, waar de SHI aanvullend aan zou kunnen zijn. Ook zijn er verschillen in het beoogde gebruik. Het Bodemlabel richt zich vooral op bodembeoordeling voor grondbezitters die hun gronden verpachten of verhuren. LANDMARK richt zich op een meer Europees schaalniveau en ambieert, net als SoilQ om ook andere bodemecosysteemdiensten te beoordelen dan landbouwproductie. De SHI bestaat in ieder geval nog niet in Nederland en lijkt door de koppeling met bodem verbeterende maatregelen een toegevoegde waarde te hebben. In de afsluitende workshop bleken hier overigens wel twijfels over te bestaan. Temeer aangezien uit de interviews blijkt dat er onvrede bestaat over de bestaande tools. In het bijzonder in de mate waarin deze geschikt zijn om bruikbaar advies richting de agrarische ondernemer op te leveren en dan vooral rondom bodembiochemie en in mindere mate bodemfysica. Bodemchemie zou voldoende in de huidige systemen zitten, aangezien Nederland hierin voorop loopt in de wereld. De minimale dataset (zie tabel 1) is een belangrijke poging om op basis van wetenschappelijke inzichten tot een beperkt aantal indicatoren te komen die gebruikt kunnen worden voor bodembeoordeling en –verbetering. Respondenten geven aan dat deze nog niet goed functioneert; mede vanwege het aantal indicatoren en het hoge detailniveau van geselecteerde indicatoren en omdat deelnemende partijen moeite hebben om tot overeenstemming te komen.

Hieronder wordt een overzicht gegeven van de belangrijkste tools en datasets die in Nederland in gebruik zijn, samen met hun belangrijkste eigenschappen en verschillen met de SHA/SHI.

Tabel 1 Beschrijving en duiding tools en datasets (op basis van bureaustudie Alwin Gerritsen, in samenwerking met Erik van den Elsen)

Tools en datasets	Beschrijving	Positionering SHA / SHI
Bodem Conditie Score	De Bodem Conditie Score (BCS) maakt gebruik van een visuele bodembeoordeling en wordt vooral gebruikt als tool om de bewustwording bij agrariërs te vergroten. De BCS wordt toegepast binnen allerlei agrarische praktijknetwerken en als onderdeel van een Bodem APK. Er is ook een promotieonderzoek in uitvoering naar de betrouwbaarheid van de resultaten. Voor meer informatie: http://www.mijnbodemconditie.nl/	De SHI maakt gebruik van metingen en niet van visuele beoordeling. De SHI is ook niet primair op bewustwording gericht.
Bodem Label	Het Label Duurzame Bodem wordt ontwikkeld door CLM en bestaat uit een set aan maatregelen die (potentiële) grondgebruikers kunnen toepassen en die vervolgens beloond kunnen worden door de grondbezitter. Er is gekozen voor maatregelen die in principe bevorderlijk zouden moeten zijn voor de bodemkwaliteit en al een status hebben; bijvoorbeeld als groenblauwe dienst. Er wordt vooraf niet gekeken of deze maatregelen ook noodzakelijk zijn. De maatregelen staan niet in directe relatie tot de gezondheid van de betreffende bodems. Er is sprake van het hieraan koppelen van een evaluatiecyclus.	In de SHI staat het gericht nemen van maatregelen op basis van het vaststellen van de actuele bodemgezondheid centraal. In hoeverre deze mogelijke maatregelen geaccepteerd worden door grondbezitters en anderen maakt hier in principe geen deel van uit. Er worden dus geen maatregelen genomen waarvan wordt aangenomen dat deze 'altijd' goed zijn voor de bodem, maar alleen die maatregelen die nodig zijn om een slecht scorend aspect van een bodem te verbeteren.

Tools en datasets	Beschrijving	Positionering SHA / SHI
Bodem Paspoort	Het Bodem Paspoort wordt door ZLTO ontwikkeld en beoogt bestaande kennis en informatie over bodemkwaliteit en indicatoren beschikbaar te stellen en te gebruiken om een oordeel te geven over de bodemkwaliteit. Het is niet duidelijk of een universele 'score' wordt gegeven. Het systeem bevat op dit moment (nog) geen bodemverbeterende maatregelen.	Vooralsnog gebruikt het Bodem Paspoort alleen bestaande kennis en rust deze niet op nieuwe meetgegevens, zoals de SHI wel zal doen.
Bodem Scan	De Bodem Scan is door LBI ontwikkeld; vooral voor akkerbouw en grondgebonden tuinbouwgronden. In de Bodem APK is naast de BCS ook de Bodem Scan opgenomen.	De bodem Scan is breed begonnen, maar de indicatorenset is versmald om de toepasbaarheid door de landbouw te verhogen. In de SHI en SHA zijn deels andere indicatoren opgenomen dan in de Bodem Scan.
Eurofins indicatoren	Eurofins is marktleider in bodemanalyses; vooral op het vlak van de bodemchemie. Bovendien is er ook een bodembologische indicator. Eurofins' analyses worden vooral gebruikt om bemestingsadviezen aan agrariërs te verstrekken.	De chemische indicatoren van Eurofins zijn de standaard in Nederland en worden volop toegepast; onder andere in verplicht bodemonderzoek. De brede blik van de SHI past bij de ontwikkeling die Eurofins ziet voor eigen productontwikkeling.
Landelijk Meetnet Bodem	Het Landelijke Meetnet Bodem werd beheerd door het RIVM, maar is niet meer operationeel. Wel zijn de onderliggende database, de set aan indicatoren, waaronder de bodembologische indicator (BoBi), en de bodemprofielen nog (zeer) relevant als referentie.	De indicatorenset van het Landelijke Meetnet Bodem is erg uitgebreid en geldt als de standaard voor Nederland. Belangrijk referentiemateriaal voor het uitwerken van de SHI. De database bevat historische gegevens en kan daarom geen actuele toestand van de bodemgezondheid op een specifieke locatie weergeven.
LANDMARK	Horizon 2020 project waar RIVM in participeert. Hierin wordt een tool ontwikkeld op basis van bodem-ecosysteemfuncties.	De tool zal grover worden dan de SHI (gericht op Europese schaal), maar de ontwikkelde bodemfuncties kunnen referentiemateriaal vormen.
Minimale Dataset	In de PPS Bodem van de Topsector Agri & Food wordt een minimale dataset ontwikkeld door Wageningen Plant Research en anderen. De PPS Bodem (oud en nieuw) richt zich vooral op akkerbouw en bevat een veelheid aan bodemmetingen.	De minimale dataset bevat belangrijk referentiemateriaal voor uitwerking SHI. Het aantal indicatoren lijkt groter te worden dan in de SHI. De minimale dataset is geen tool, maar er zijn wel plannen om deze te ontwikkelen. Behalve de indicatoren zijn ook bestaande en toekomstige meetgegevens binnen de PPS Bodem een belangrijke bron van informatie.
SINDI	SINDI is een web-based tool uit Nieuw Zeeland om de resultaten van de kwaliteit of gezondheid van verzamelde bodemsamples te beoordelen. SINDI kijkt naar de breedte aan chemische, fysische en biologische aspecten van de bodem. Voor meer informatie: https://sindi.landcareresearch.co.nz/	SINDI lijkt op de SHA, maar heeft een beperktere indicatoren set en is meer gericht op bodemkwaliteit, dan bodemgezondheid.
SoilQ	SoilQ is een assessment tool van het NMI om integrale beoordelingen van bodemkwaliteit uit te voeren. Naast landbouwproductie richt SoilQ zich ook op natuurontwikkeling en andere bodemecosysteemdiensten. SoilQ richt zich op chemisch, fysisch en biologisch.	SoilQ lijkt op de SHA, maar een beperktere indicatorenset en meer gericht op bodemkwaliteit, dan bodemgezondheid. Beoogde toepassing is breder dan bij SHI. SoilQ doet uitspraken over bodemgeschiktheid. SHI is in principe nauwkeuriger en formuleert ook maatregelen.

Behoefte aan bodeminformatie

De vraag of de SHI in een vraag voorziet is niet zo eenvoudig te beantwoorden, aangezien de potentiële vragers inzicht nodig hebben in wat de SHI precies zal kunnen, om dit aan te kunnen geven en dat kan pas als deze ontwikkeld is. Dit is ook afhankelijk van het beoogde gebruik. Er kan wel een aantal behoeften onderscheiden worden waar de SHI op in kan spelen:

Behoefte aan beter inzicht in de toestand van de bodem en concrete maatregelen

Grondbezitters en gebruikers kunnen informatie gebruiken over de daadwerkelijke bodemgezondheid voor en binnen percelen, bedrijven en gebieden. Zowel grondbezitters als grondgebruikers hebben hier in principe behoefte aan, maar er zijn wel duidelijke verschillen tussen deze groepen. De grondbezitters willen vooral dat de (jaarlijkse) pachters en huurders van de grond door middel van maatregelen de bodemgezondheid op peil houden en niet uitputten, zoals nu veel zou gebeuren. In Brabant telt dit vanaf 2017 bijvoorbeeld mee in de verdeling van haar jaarlijkse pachtgronden, naast het bedrag dat de grondgebruiker wil betalen. Daarbij hoort ook een monitoring van de ontwikkeling van de bodemgezondheid, ook al is deze vaak niet 1:1 toe te schrijven aan de maatregelen die de pachter of huurder neemt.

Onder agrarische grondgebruikers bestaat de zorg dat overheden en ketenbedrijven extra informatie over bodemgezondheid gaan gebruiken om extra verplichtingen op te leggen. Daar zit men niet op te wachten, maar anderzijds zijn er ook geluiden te horen dat men juist wil dat de overheid gaat beseffen dat er een probleem is met bodemgezondheid en dat er ook ondernemers zijn die goed voor hun bodems zorgen. De grootste groep agrarisch ondernemers zou nog nauwelijks met de bodem bezig zijn en zich vooral richten op de korte termijn. Veel van de bestaande tools worden gebruikt om bewustzijn te creëren bij deze groep. Naar verwachting gaat dit effect hebben en is er over enkele jaren een grote groep agrarisch ondernemers die wil sturen op bodemgezondheid. Dan is er instrumentarium nodig dat hen kan helpen om concrete maatregelen te nemen en op dit moment zouden er nog geen tools bestaan die dit goed kunnen doen voor andere aspecten dan de bodemchemie. Tevens werd aangegeven dat het belangrijk is dat ondernemers kunnen excelleren in bodembewust boeren; 'ze moeten een 10 kunnen halen', vertelde één van de respondenten. Dit betekent ook dat de referentiewaarden realistisch moeten zijn en in de praktijk moeten kunnen worden gerealiseerd op het boeren bedrijf.

Agrarische ondernemers verzamelen vaak al informatie over de bodem. Zij doen dit deels omdat het verplicht is. Als daar op aangesloten wordt, hoeft de agrarisch ondernemer hier niet twee keer voor te betalen. Betaalbaarheid is sowieso een issue. Zonder duidelijke meerwaarde zijn de kosten al snel te hoog, maar ook met een duidelijk profijt voor de boer is de prijs een issue. Bij melkveehouders is nog sterkere mate dan bij akkerbouwers en grondgebonden tuinders. Bovendien is het belangrijk dat het advies niet alleen heel concreet is, maar ook beknopt. De bemestingsadviezen (meestal van Eurofins) zijn al snel 5 pagina's lang en dat wordt te veel gevonden. Tijdens de afsluitende workshop betwijfelde een meerderheid van de respondenten dat agrariërs de SHI gaan gebruiken, omdat het moeilijk zal zijn om aan alle benodigde condities te voldoen. Opvallend was wel dat de deelnemers met een agrarische achtergrond van mening waren dat zij dit wel zullen gaan doen, aangezien de SHI een antwoord geeft op waar de agrariërs over enkele jaren vragen over zullen hebben: de bodemgezondheid.

Behoefte aan breed overzicht chemisch, fysisch biologisch met indicatieve acties

In de interviews is ook genoemd dat er juist meer in de breedte behoefte bestaat aan informatie over de bodemgezondheid. Dit kan dan gaan over gezondheid in relatie tot verschillende ecosysteemdiensten, of om voor bodemgezondheid een beeld te schetsen over de duurzaamheid van voedselketens. De SHI hoeft dan ook minder op details antwoorden en advies te geven en krijgt dan meer de functie van een dashboard, waarmee bedrijven en consument kunnen zien hoe de betreffende producten scoren op het aspect bodemgezondheid. Mogelijke gebruikersgroepen zijn waterschappen, voedselbedrijven, verzekeringsbedrijven en provincies. In de afsluitende workshop was er geen consensus over of de food industrie de doelgroep moet zijn. Wel was er een overgrote meerderheid voor de stelling dat overheden een belangrijke doelgroep zijn.

Versterking van andere tools

Samenhangend met de hierboven benoemde behoeften wordt er ook naar de SHI gekeken als een manier om andere tools en datasets aan te vullen. Dit kwam het duidelijkst naar voren bij de Bodem Conditie Score, het Bodemlabel en de indicatorensets van Eurofins. Dat gaat dan vooral om fysische en biologische indicatoren en de daarbij behorende maatregelen, welke bij de andere tools ontbreken. Een nieuwe indicator voor bodemchemie kan interessant zijn, maar vooral als niche toepassing. De inschatting is overwegend dat de kennis over bodemchemie in Nederland uitmuntend is en dat dit beter is dan elders in Europa en zeker in de VS. De behoefte bestaat uit het realiseren van een verdiepingsslag van bestaande tools die daarmee ook leidt tot betere adviesmogelijkheden. Dit betekent ook het vanuit de wetenschap bijdragen aan de ontwikkeling van commerciële tools. Daar waren de respondenten relatief eensgezind over: maak er geen Wageningse tool van, maar werk samen met de uiteindelijke gebruikers; meestal commerciële partijen.

Rekening houden met verschillen

Voor de verschillende toepassingen geldt volgens sommige respondenten dat er rekening gehouden dient te worden met verschillen in bodemsoorten. Nederland kent een grote variatie in bodemsoorten. De staat New York (waar de SHA in is ontwikkeld) is redelijk homogeen en daarom maakt de SHA daar geen sterk onderscheid in. In Nederland maakt het echter veel uit of je op zand, op klei of op veen zit. Ook zijn er in Nederland relatief voedselrijke bodems en dat wijkt sterk af van de overwegend arme bodems in de staat New York. Daarbij is het ook van belang om te kijken naar verschillen binnen percelen. Er kunnen hier grote verschillen bestaan die verklarend zijn voor de productiefunctie van een perceel en een bedrijf. Vaak wordt er alleen naar het schaalniveau van het perceel gekeken, maar dit is eigenlijk te grof om te kijken naar een optimalisatie van het bodemgebruik.

Een ander aspect is dat er niet één landbouw is en dat de SHI hier rekening mee zou moeten houden. Er zijn verschillende bedrijfsstijlen te onderscheiden. De ene ondernemer richt zich op productiemaximalisatie, de ander op kostprijsreductie en weer een ander op autonomie. Ook zijn er bedrijven die met hightech oplossingen werken en bedrijven die meer biologische maatregelen gebruiken. Die kunnen in de praktijk wel samenvallen, maar dit is niet vanzelfsprekend. Extensievere bedrijven blijken vaak niet goed meegenomen te worden in tools, terwijl juist hier (voor de melkveehouderij) er wel relatief veel aandacht is voor bodemkwaliteit en bodemgezondheid. De behoefte is dat bij de implementatie van de SHI verkend kan worden of hier rekening mee gehouden kan worden in de vaststelling van de scoringfuncties en bij de maatregelen die voorgesteld kunnen worden. Het is ook de vraag of dit in de SHI zelf moet, of dat dit vooral relevant is voor het gebruik van de SHI.

De SHI kan bijdragen aan de bewustwording bij grondgebruikers en grondbezitters over de bodemgezondheid. In die zin draagt de SHI bij aan het leren door partijen. Het instrument zal zelf ook moeten kunnen 'leren'. Dit houdt in dat de SHI zich ontwikkelt naar de stand van de techniek en van wetenschappelijke innovaties. Respondenten geven aan dat vooral rondom biologische bodemgezondheid en de relaties tussen biologisch, chemisch en fysisch veel kennis nog niet bestaat. Er wordt hier dan ook veel onderzoek naar gedaan. De SHI zou in staat moeten zijn om deze nieuwe inzichten te incorporeren. Dit gaat ook over de ontwikkelingen binnen de hightech precisielandbouw (SMART farming). In het bijzonder in het zuiden van Nederland gaat deze ontwikkeling snel en via drones en big data wordt hierin ook veel informatie verzameld. De SHI zou de optie moeten hebben om deze informatie te gebruiken. Dit betekent dat technische maatregelen onderdeel zouden moeten uitmaken van de set aan mogelijke maatregelen en dat er bij de meetmethoden ook gekeken wordt naar geo-informatica en big data. De SHI zou dus niet alleen het leren over de bodem moeten ondersteunen, maar zelf ook lerend zijn.

Implementatie

Er is door geen van de respondenten gezegd dat er het best maar mee gestopt kan worden. Integendeel, men is overwegend nieuwsgierig en positief. Dit wil niet zeggen dat iedereen het als kansrijk ziet. Dit hangt ook sterk af van de doelgroep waar de SHI zich (in eerste instantie) op zal richten. Als dit ondernemers zijn die op korte termijn baten in opbrengstverhoging of kostprijsreductie willen zien²⁵, dan zijn er twijfels of dit wel mogelijk is, omdat die kennis er nog niet lijkt te zijn. Over gebruik bij een lange termijn perspectief is men positief. Dan is het wel een aandachtspunt dat de SHI meerwaarde heeft ten opzichte van andere tools. Een andere optie die door een deel van de respondenten geadviseerd werd, is om de SHI aan andere tools te koppelen. Het ging vooral om de bemestingsadviezen, het bodemlabel en het bodempaspoort. Ook de bodemconditiescore kan hier volgens de respondenten voor in aanmerking komen. Voor Noord-Nederland is een Bodem APK ontwikkeld, waarin de Bodemscan van het Louis Bolk Instituut gecombineerd wordt met de bodemconditiescore. Zo zou het in principe ook kunnen met de SHI, mochten de initiatiefnemers dit wenselijk vinden.

Sommige respondenten raden aan om de SHI niet zozeer te richten op gebruik door de boer, maar eerder door waterschappen of provincies die op gebiedsniveau willen weten hoe het met de bodemgezondheid staat en eventueel afspraken willen maken met (groepen) boeren. Een andere optie is om de SHI te gebruiken om de voedselindustrie te ondersteunen in het verduurzamen van hun producten; hiervoor is samenwerking nodig met Europese organisaties en netwerken, zoals bijvoorbeeld de RISE foundation (<http://www.risefoundation.eu/>).

Tijdens de afsluitende bijeenkomst op 21 november 2016 werd meermalen geadviseerd om een duidelijke keuze te maken over de doelgroep en het beoogd gebruik. Niet te lang hierop studeren, maar wel beredeneerd een keuze maken en dan aan de slag en al doende ervaren hoe de SHI zich verhoudt tot andere instrumenten. Hier verschillen wel de meningen over. Er is door twee respondenten ook aangegeven dat er alleen begonnen zou mogen worden als een commerciële partij (dus niet WUR) de leiding neemt. Dit vanwege de zorg dat de SHI dan niet gebruikt zou worden en ook dat er belangrijke kennis zou missen. De respondenten gaven aan mee te willen denken over de verdere implementatie en riepen daarmee op met hen in contact te blijven. Ook om de SHI te gebruiken in de praktijknetwerken van agrariërs die een deel van hen begeleiden. Deze netwerken kunnen ook voor een praktijk-validatie zorgen van de SHI. Het gaat om groepen rondom praktijk bedrijf Vredepeel, in Noord-Nederland en de themagroep bodem in het project Vruchtbare Kringloop in de Achterhoek (tevens gerelateerd aan proefbedrijf De Marke).

Eén respondent gaf aan te overwegen of er niet gewoon de concurrentie aangegaan moet worden. Op den duur zou dan het meest bruikbare of gedragen instrument overblijven, zoals ook bij de KringloopWijzer het geval is geweest. Wel heeft de KringloopWijzer een gebruikersgroep waarin de beheerders van deze andere instrumenten in deelnemen. Een dergelijke constructie zou ook voor de SHI opportuun kunnen zijn.

Resumerend

Het plan voor een Soil Health Index is te zien als één van de initiatieven in een bredere beweging om meer bewust om te gaan met bodemgezondheid in de agrarische bedrijfsvoering. Vooral de integraliteit in chemisch, fysisch en biologisch wordt gewaardeerd en wordt door verschillende partijen ook zelf nagestreefd. De Soil Health Assessment was bij een deel van de respondenten ook al bekend. Tot nu toe is het echter niet gelukt een vergelijkbaar systeem in Nederland operationeel te krijgen voor gebruik door de agrariër en zijn adviseurs. De huidige tools en databases zijn nog maar beperkt in staat om echt bruikbare adviezen te geven aan agrariërs en grondbezitters over de volle breedte van bodemgezondheid en kunnen daarmee ook niet adequaat rekening houden met de relaties tussen chemie, fysica en biologie. Als de SHI hier een grote stap in kan zetten, dan heeft dat meerwaarde. Er

²⁵ De initiatiefnemers beogen dit niet, maar willen juist een bijdrage leveren aan de bodemgezondheid op langere termijn.

bestaan onder sommige respondenten twijfels of het formuleren van zinvolle adviezen daadwerkelijk mogelijk zal zijn maar dat zal alleen duidelijk worden door het te proberen. Er zijn ook twijfels geuit over of agrariërs de SHI zullen gebruiken, maar respondenten geven ook aan dat de aandacht voor bodemgezondheid toeneemt onder hen en dat er over enkele jaren betere instrumenten nodig zijn die antwoorden kunnen geven op de vragen die zij dan waarschijnlijk zullen stellen. Als de SHI hier aan kan bijdragen, dan wordt dat gewaardeerd. De agrarische deelnemers aan de eind workshop verwachtten interesse van agrarische ondernemers.

Er is op het eerste zich dus sprake van draagvlak voor het initiatief. Dit kan pas echt duidelijk worden als een aantal keuzes gemaakt worden. De eerste keuze betreft de diversiteit aan aandachtspunten van bodemgezondheid en achterliggende motivaties zoals eerder in deze notitie beschreven is. Als er voor een meer lange termijn benadering wordt gekozen, waarbij de nadruk niet zozeer ligt op korte termijn productiemaximalisatie, dan sluit dat een deel van het speelveld uit. Dat wil dan niet zeggen dat er geen draagvlak is, maar dat er bewust gekozen wordt voor een benadering waarvan verwacht wordt dat het nodig is en de mainstream zal worden over een aantal jaren. Het zelfde geldt voor een keuze tussen grondgebruikers of grondbezitters.

Er rest nog een aantal te maken keuzes. Ten eerste omtrent het hoe, met wie en waartoe het vervolgproject plaats zal vinden en wie er in de klankbordgroep zullen zitten en of er sprake zal zijn van een praktijkvalidatie door praktijknetwerken. Een meer diepgaande kwestie is de relatie van de implementatie van de SHI met andere trajecten, met bestaande databases en met het onderzoek en technologie ontwikkeling, zodat de laatste informatie en methodes te gebruiken zijn. Het is de vraag of dit wel vanzelf plaats zal vinden, gezien de verscheidenheid aan partijen en agenda's. De PPS Bodem (binnen Topsector Agri & Food) kan in principe als een coördinerend mechanisme functioneren, maar de SHI maakt daar (vooralsnog) geen onderdeel van uit. Het is een open vraag of er iets anders hiervoor geregeld moet worden. In Duitsland bestaat bijvoorbeeld een Bodemdienst die een coördinerende functie heeft rondom bodemgezondheid. Een andere optie is om de SHI onderdeel te laten uitmaken van een bredere overeenkomst, naar voorbeeld van de Greendeals, de Topsectoren PPS'en of de in Europa gangbaar worden de Innovation Deals. Dit hoeft niet opgelost te worden voor er begonnen kan worden, maar kan onderdeel uitmaken van het implementatietraject. Met het instellen van de gebruikersgroep of klankbordgroep zou hier ook rekening mee gehouden moeten worden. Deze kan breder samengesteld zijn dan de direct ondersteunende partijen, maar zal hier wel mee dienen te overlappen. Partijen die hier aan deel zouden kunnen nemen zijn: ZLTO, LTO Noord, relevante (nog te vormen) operationele groepen in het kader van EIP Agri (POP3), Eurofins, provincies, EZ, ketenbedrijven, BO Akkerbouw, en agrarische adviesbureaus. Eventueel zouden Boerennatuur.nl (de koepel van collectieven in het agrarisch natuurbeheer) en Bionext, de vertegenwoordiger van de biologische landbouw hier ook plaats in kunnen hebben. Ook hier geldt weer dat goed gekeken moet worden wat het beoogde doel van de SHI zou moeten zijn, voordat partijen worden uitgenodigd deel te nemen aan de gebruikersgroep. Dit om de veelheid van belangen binnen de gebruikersgroep binnen de perken te houden.

Advies

Het doel van de voorstudie is om tot een advies te komen voor een go-no-go beslissing door de provincie Gelderland, WUR en NIOO. De resultaten van de studie leiden tot een positief advies aangezien de SHI een nuttige rol lijkt te kunnen vervullen bij wat 'het veld' ook ambieert. Daarmee wordt geadviseerd om met de ontwikkeling van de SHI voor Nederland te beginnen en hierbij rekening te houden met adviezen en opmerkingen zoals in paragraaf 3 beschreven zijn. Er zijn bovendien een aantal zaken te benoemen waarvan het advies is om dit te adresseren bij de implementatie van de SHI:

Stel een gebruikersgroep of klankbordgroep in. Neem daar niet alleen partijen in op met expertise over de bodem en over dergelijke instrumenten, maar ook partijen die zich engageren rondom het thema bodemgezondheid. Van bijzonder belang hierbij is de relatie met de bredere onderzoeksagenda binnen Wageningen Universiteit & Research en R&D van commerciële partijen, zodat de SHI zich hiertoe kan verhouden en methoden en data gedeeld kunnen worden. Ook zitten in deze groep de

partijen die de landbouw onder andere met behulp van de SHI gaan ondersteunen in het werken aan een betere bodemgezondheid. Zij zullen hier dan ook kennis van moeten nemen en in hun praktijk willen gebruiken.

Maak naast deze groep of als onderdeel hiervan ook gebruik van bestaande praktijknetwerken van agrariërs voor een praktijkvalidatie en om de SHI in de praktijk in te bedden en bekend te maken. Denk hierbij ook aan de EIP Agri operationele groepen waarvan de eersten waarschijnlijk in 2017 opgericht worden en die vanuit de Europese Commissie een bevoorrechte status hebben als er op Europees niveau acties in gang gezet zullen worden. Het is aan te raden om een aantal hiervan via o.a. de proefbedrijven Vredepeel, Valthermond en De Marke en via adviseurs in de gebruikersgroep gedurende het vervolgproject te informeren en om feedback te vragen en om actief te proberen pilots op te zetten.

Maak een heldere en beredeneerde keuze voor het beoogde gebruik van de SHI en werk uit wat dit betekent voor de kenmerken van de SHI. Betrek hierbij de volgende zaken: de mate van concreetheid van maatregelen, de beoogde gebruiker, de relatie met andere instrumenten en trajecten.

Stel een projectgroep in, na een besluit of hier nog andere organisaties bij nodig zijn dan Wageningen Environmental Research en NIOO.

Stel een begeleidingsgroep in met financiers en andere essentiële partijen.

Verbindt de SHI, de begeleidingsgroep en de klankbordgroep aan een project-overstijgende agenda, of sluit je aan bij een al bestaande (bijvoorbeeld in het kader van TKI Agri & Food of als samenwerking van provincies). Hiermee kan de SHI onderdeel uitmaken van leerprocessen van verschillende partijen die met bodemgezondheid bezig zijn. Te denken is ook aan een Green Deal, zoals het Rijk die hanteert, of de Europese Innovation Deals. Duurzaamheidsprogramma's van ketenbedrijven zijn hierbij ook een relevant ankerpunt. Deze bredere agenda betreft ook de organisatie van het bredere relevante onderzoek, de ondersteuning van het werken aan bodemgezondheid door agrariërs en de kennisvalorisatie via erfbetreders en andere bedrijven. Deze bredere agenda kan al doende gerealiseerd worden.

Respondenten

LTO Noord Projecten, BO Akkerbouw, LBI + Themagroep Bodem van project Vruchtbare Kringloop – 10 melkveehouders, Eurofins, LBI, NIOO, WUR Proefbedrijf Vredepeel + 5 akkerbouwers/ tuinders, ZLTO, RIVM, WUR, Provincie Brabant, Agrifirm, een gemeenteterraadslid, Boeren Verstand Consultancy, CLM, Ministerie van Economische Zaken.

Deelnemers SHI bijeenkomst 21 november 2016

LTO Noord Projecten, Kadaster, Provincie Gelderland, Eurofins, WUR, LTO Noord, afdeling West Achterhoek, LBI, WUR-proefbedrijf Vredepeel, NIOO, Agrifirm, Gemeente Lochem, ZLTO, Provincie Brabant, RIVM, WUR-Proefbedrijf De Marke, Boeren Verstand Consultancy, CLM.

Annex 5 Development of an interactive app in Akkerweb (in Dutch)

Akkerweb en een SHI-app

1. We hebben kennis, maar de vertaalslag naar iets waar een boer dagelijks gebruik van kan maken ontbreekt vaak. Hier in ons bedrijfsmodel aandacht aan besteden; voorstel: inbrengen in Akkerweb.
2. WUR heeft Akkerweb ontwikkeld. Akkerweb is een DSS, voorzien van vele app's, dat boeren ondersteunt met perceelsbeheer. Daar past een SHI-app naadloos in.
3. Voor WUR is Akkerweb een belangrijke acquisitietool waarmee grote projecten worden binnengehaald.
4. Akkerweb is gezamenlijk eigendom van WUR, Agrifirm²⁶, en er zit voor 10% nog een klein ICT-bedrijfje bij.
5. **Iedereen kan apps op Akkerweb plaatsen, bijv. Syngenta, WUR en Agrifirm. Gebruikers betalen een jaarlijkse licentievergoeding, via Akkerweb, aan de app eigenaar.**

WUR verzoekt Akkerweb-gebruikers om een vinkje te zetten, waarmee zij worden gedwongen te accepteren dat WUR toegang krijgt tot hun data, hetzij anoniem, hetzij geaggregeerd op metaniveau.

Innovatieve app / webgebruik bij bepaling SHI

1. Innovatief: in Akkerweb geeft een boer de opdracht: ik wil mijn perceel getest hebben op N, P. Effect: automatisch bemonsteren + labanalyses. Het resultaat komt 'binnen' via hetzelfde Akkerweb.
2. Je hebt dus een app waar je niet alleen een datum invult en een uitkomst krijgt, maar waar ook nog een bemonsteringssysteem onder ligt. Dat is innovatie!
3. We moeten dus alle mogelijkheden hoe je dingen kunt exporteren, verkennen. Misschien dan concluderen: Wij willen best met Eurofins in zee, maar zij gaan geen exclusiviteit krijgen want wij willen ook zelf dit soort dingen ontwikkelen, bijvoorbeeld op een platform zoals Akkerweb.

Een SHI-app op Akkerweb kan op het scherm komen met een icoontje van WUR/ESG, Agrifirm, Eurofins, Syngenta²⁷ e.d. ESG moet daar dan afspraken over maken, want ook wij hebben investeringen gedaan en dingen aangebracht **en moeten daar een vergoeding voor krijgen.**

²⁶ <https://nl.wikipedia.org/wiki/Agrifirm>: Agrifirm is een Nederlandse coöperatieve onderneming die actief is in de veehouderij en landbouwsector. Ze is in 2010 ontstaan uit een fusie van Agrifirm en [Cehave Landbouwbelang](#). De oorsprong van deze organisaties ligt in het begin van de twintigste eeuw. De [coöperatie](#) Agrifirm is een holding van zelfstandige dochterbedrijven. Bij de organisatie zijn 17.000 boeren en tuinders aangesloten en de onderneming telt ongeveer 3.000 medewerkers. Het hoofdkantoor staat in [Apeldoorn](#). In 2012 werd gelijktijdig met de opening van het nieuwe hoofdkantoor in Apeldoorn het [predicaat Koninklijk](#) verleend aan Agrifirm.^[2] De naam is daarop gewijzigd in *Koninklijke Coöperatie Agrifirm U.A.*

²⁷ <https://en.wikipedia.org/wiki/Syngenta> Syngenta AG is a global Swiss [agribusiness](#) that produces [agrochemicals](#) and seeds. As a biotechnology company, it conducts genomic research. It was formed in 2000 by the merger of [Novartis](#) Agribusiness and [Zeneca](#) Agrochemicals. As of 2014 Syngenta was the world's largest crop chemical producer, strongest in Europe.^[2] As of 2009 it ranked third in seeds and biotechnology sales.^[3] Sales in 2015 were approximately US\$13.4 billion, over half of which were in [emerging markets](#).

Annex 6 Soil health classification tools proposed in The Netherlands

Er bestaan verschillende tools die zich richten op kwaliteit of gezondheid van bodems. Nog recent was de kennis over de bodem verspreid over verschillende disciplines, maar de laatste jaren is een opkomst waar te nemen van een meer integrale blik. In tabel 1 is een overzicht gegeven van relevante tools en databases zoals tijdens de interviews aan bod zijn gekomen. Het algemene beeld is dat tools en indicatorensets, zoals Bodem Paspoort, Bodem Scan, Eurofins indicatoren, RIVM indicatoren, LANDMARK, Minimale Datasets, SINDI en SoilQ ofwel grover en minder nauwkeurig ofwel specifiek zijn, dan de SHI ambieert. Ook zijn er tools die op andere methoden gebaseerd zijn, zoals de Bodem Conditie Score of het Bodemlabel, waar de SHI aanvullend aan zou kunnen zijn. Ook zijn er verschillen in het beoogde gebruik. Het Bodemlabel richt zich vooral op bodembeoordeling voor grondbezitters die hun gronden verpachten of verhuren. LANDMARK richt zich op een meer Europees schaalniveau en ambieert, net als SoilQ om ook andere bodemecosysteemdiensten te beoordelen dan landbouwproductie. De SHI bestaat in ieder geval nog niet in Nederland en lijkt door de koppeling met bodem verbeterende maatregelen een toegevoegde waarde te hebben. In de afsluitende workshop bleken hier overigens wel twijfels over te bestaan. Temeer aangezien uit de interviews blijkt dat er onvrede bestaat over de bestaande tools. In het bijzonder in de mate waarin deze geschikt zijn om bruikbaar advies richting de agrarische ondernemer op te leveren en dan vooral rondom bodembioïlogie en in mindere mate bodemfysica. Bodemchemie zou voldoende in de huidige systemen zitten, aangezien Nederland hierin voorop loopt in de wereld. De minimale dataset (zie tabel 1) is een belangrijke poging om op basis van wetenschappelijke inzichten tot een beperkt aantal indicatoren te komen die gebruikt kunnen worden voor bodembeoordeling en -verbetering. Respondenten geven aan dat deze nog niet goed functioneert; mede vanwege het aantal indicatoren en het hoge detailniveau van geselecteerde indicatoren en omdat deelnemende partijen moeite hebben om tot overeenstemming te komen.

Hieronder wordt een overzicht gegeven van de belangrijkste tools en datasets die in Nederland in gebruik zijn, samen met hun belangrijkste eigenschappen en verschillen met de SHA/SHI

Tools en datasets	Beschrijving	Positionering SHA / SHI
Bodem Conditie Score	De Bodem Conditie Score (BCS) maakt gebruik van een visuele bodembeoordeling en wordt vooral gebruikt als tool om de bewustwording bij agrariërs te vergroten. De BCS wordt toegepast binnen allerlei agrarische praktijknetwerken en als onderdeel van een Bodem APK. Er is ook een promotieonderzoek in uitvoering naar de betrouwbaarheid van de resultaten. Voor meer informatie: http://www.mijnbodemconditie.nl/	De SHI maakt gebruik van metingen en niet van visuele beoordeling. De SHI is ook niet primair op bewustwording gericht.
Bodem Label	Het Label Duurzame Bodem wordt ontwikkeld door CLM en bestaat uit een set aan maatregelen die (potentiële) grondgebruikers kunnen toepassen en die vervolgens beloond kunnen worden door de grondbezitter. Er is gekozen voor maatregelen die in principe bevorderlijk zouden moeten zijn voor de bodemkwaliteit en al een status hebben; bijvoorbeeld als groenblauwe dienst. Er wordt vooraf niet gekeken of deze maatregelen ook noodzakelijk zijn. De maatregelen staan niet in directe relatie tot de gezondheid van de betreffende bodems. Er is sprake van het hieraan koppelen van een evaluatiecyclus.	In de SHI staat het gericht nemen van maatregelen op basis van het vaststellen van de actuele bodemgezondheid centraal. In hoeverre deze mogelijke maatregelen geaccepteerd worden door grondbezitters en anderen maakt hier in principe geen deel van uit. Er worden dus geen maatregelen genomen waarvan wordt aangenomen dat deze 'altijd' goed zijn voor de bodem, maar alleen die maatregelen die nodig zijn om een slecht scorend aspect van een bodem te verbeteren.
Bodem Paspoort	Het Bodem Paspoort wordt door ZLTO ontwikkeld en beoogt bestaande kennis en informatie over bodemkwaliteit en indicatoren beschikbaar te stellen en te gebruiken om een oordeel te geven over de bodemkwaliteit. Het is niet duidelijk of een universele 'score' wordt gegeven. Het systeem bevat op dit	Vooralsnog gebruikt het Bodem Paspoort alleen bestaande kennis en rust deze niet op nieuwe meetgegevens, zoals de SHI wel zal doen.

	moment (nog) geen bodemverbeterende maatregelen.	
Bodem Scan	De Bodem Scan is door LBI ontwikkeld; vooral voor akkerbouw en grondgebonden tuinbouwgronden. In de Bodem APK is naast de BCS ook de Bodem Scan opgenomen.	De bodem Scan is breed begonnen, maar de indicatorenset is versmald om de toepasbaarheid door de landbouw te verhogen. In de SHI en SHA zijn deels andere indicatoren opgenomen dan in de Bodem Scan.
Eurofins indicatoren	Eurofins is marktleider in bodemanalyses; vooral op het vlak van de bodemchemie. Bovendien is er ook een bodembioologische indicator. Eurofins' analyses worden vooral gebruikt om bemestingsadviezen aan agrariërs te verstrekken.	De chemische indicatoren van Eurofins zijn de standaard in Nederland en worden volop toegepast; onder andere in verplicht bodemonderzoek. De brede blik van de SHI past bij de ontwikkeling die Eurofins ziet voor eigen productontwikkeling.
Landelijk Meetnet Bodem	Het Landelijke Meetnet Bodem werd beheerd door het RIVM, maar is niet meer operationeel. Wel zijn de onderliggende database, de set aan indicatoren, waaronder de bodembioologische indicator (BoBi), en de bodemprofielen nog (zeer) relevant als referentie.	De indicatorenset van het Landelijke Meetnet Bodem is erg uitgebreid en geldt als de standaard voor Nederland. Belangrijk referentiemateriaal voor het uitwerken van de SHI. De database bevat historische gegevens en kan daarom geen actuele toestand van de bodemgezondheid op een specifieke locatie weergeven.
LANDMARK	Horizon 2020 project waar RIVM in participeert. Hierin wordt een tool ontwikkeld op basis van bodem-ecosysteemfuncties.	De tool zal grover worden dan de SHI (gericht op Europese schaal), maar de ontwikkelde bodemfuncties kunnen referentiemateriaal vormen.
Minimale Dataset	In de PPS Bodem van de Topsector Agri & Food wordt een minimale dataset ontwikkeld door Wageningen Plant Research en anderen. De PPS Bodem (oud en nieuw) richt zich vooral op akkerbouw en bevat een veelheid aan bodemmetingen.	De minimale dataset bevat belangrijk referentiemateriaal voor uitwerking SHI. Het aantal indicatoren lijkt groter te worden dan in de SHI. De minimale dataset is geen tool, maar er zijn wel plannen om deze te ontwikkelen. Behalve de indicatoren zijn ook bestaande en toekomstige meetgegevens binnen de PPS Bodem een belangrijke bron van informatie.
SINDI	SINDI is een web-based tool uit Nieuw Zeeland om de resultaten van de kwaliteit of gezondheid van verzamelde bodemsamples te beoordelen. SINDI kijkt naar de breedte aan chemische, fysische en biologische aspecten van de bodem. Voor meer informatie: https://sindi.landcareresearch.co.nz/	SINDI lijkt op de SHA, maar heeft een beperktere indicatoren set en is meer gericht op bodemkwaliteit, dan bodemgezondheid.
SoilQ	SoilQ is een assessment tool van het NMI om integrale beoordelingen van bodemkwaliteit uit te voeren. Naast landbouwproductie richt SoilQ zich ook op natuurontwikkeling en andere bodemecosysteemdiensten. SoilQ richt zich op chemisch, fysisch en biologisch.	SoilQ lijkt op de SHA, maar een beperktere indicatorenset en meer gericht op bodemkwaliteit, dan bodemgezondheid. Beoogde toepassing is breder dan bij SHI. SoilQ doet uitspraken over bodemgeschiktheid. SHI is in principe nauwkeuriger en formuleert ook maatregelen.

Annex 7 Flyer Soil Health Index (in Dutch)

de Soil Health Index

Een geïntegreerde methode om inzicht in de bodemgezondheid te krijgen

Wat is de Soil Health Index?

De Soil Health Index (SHI) is een index of een 'rapportcijfer' die de gezondheids-toestand van een bepaalde bodem op een bepaalde locatie aangeeft (als cijfer van 1-100 of als categorie 'goed', 'matig' of 'slecht'). Het cijfer wordt bepaald mbv een beoordeling van verschillende Fysische, Biologische en Chemische bodemeigenschappen.

Eigenschappen

- Geïntegreerde graadmeter voor het bepalen van de algehele gezondheid van de bodem met beperkt aantal (14) Fysische, Biologische en Chemische key-parameters,
- Uitermate geschikt als eenvoudig monitoring instrument bij uitvoering van beleid of maatregelen,
- Door een brede blik (Fysisch, Biologisch, Chemisch) is relatief snel de bron van een probleem te vinden.
- Gekoppeld aan de scores van de afzonderlijke parameters zijn beheers-maatregelen om de parameters te verbeteren.

Welke 14 parameters?

De SHI wordt samengesteld uit de voor de bodemgezondheid 14 belangrijkste Fysische, Chemische en Biologische parameters.

14 Key parameters* die de bodemgezondheid bepalen	
FYSISCH	Aggregaat Stabiliteit Beschikbaar Water Capaciteit (*) Hardheid van het bodemoppervlak Hardheid van de Ondergrond Verzadigde doorlatendheid (*) Bodemtype (*)
BIOLOGISCH	Organisch stof gehalte (*) Actief koolstof gehalte Potentieel Mineraliseerbare Stikstof Wortel gezondheid score
CHEMISCH	pH (*) Extraheerbare Fosfor Extraheerbare Kalium Andere elementen (Mg, Fe, Mn, Z)

De parameters voor de Soil Health Index zijn geselecteerd uit een lijst van 39 bodemgerelateerde parameters. Criteria voor selectie zijn: gevoeligheid voor management, relevantie t.a.v. bodemprocessen, reproduceerbaarheid en kosten van de bepaling. Van een aantal parameters zijn al (kaart) gegevens voorhanden(aangegeven met () in de tabel).*

Hoe ziet de Soil Health Index er uit?

De SHI wordt doorgaans als puntscore (1-100) gegeven maar kan ook geïnterpoleerd in kaarten worden weergegeven. Voor interpolatie zijn meerdere puntwaarnemingen nodig, afhankelijk van het aantal bodemtypen.

Uit een serie van puntwaarnemingen kan een geïnterpoleerde kaart worden samengesteld waarin in een enkele oogopslag kan worden gezien waar de probleemgebieden liggen. Afhankelijk van het aantal basispunten zal de nauwkeurigheid van de kaart variëren.

De Bodem als Ecosysteem

We kunnen de bodem zien als een Ecosysteem waar bodemleven, zoals insecten, wormen, bacteriën en schimmels, zorgen voor de afbraak van organische stoffen, het opruimen van verontreinigingen, het beschikbaar maken van nutriënten en het luchtig houden van de bodem. Samen met de in de bodem levende planten, vormt deze gemeenschap een levend Ecosysteem dat in evenwicht is en waarin Fysische, Chemische en Biologische eigenschappen elkaar beïnvloeden. Verstoring in een van de drie deelgebieden Fysica, Biologie en Chemie, zal vroeg of laat zijn weerslag hebben in elk van de andere twee deelgebieden. Bij het nemen van beleidsmaatregelen zal hier terdege rekening mee moeten worden gehouden.

De belangrijkste eigenschappen van de Soil Health Index

- De 14 parameters van de Soil Health Index zijn de belangrijkste graadmeters van de bodemgezondheid.
- De SHI levert snel een inventarisatie van de bodemgezondheid, indien nodig ook over een groot oppervlak.
- Beoordelen van de bodemgezondheid in een van de drie deelgebieden (Fysisch, Biologisch, Chemisch) levert slechts een deel van het complete beeld op, de SHI geeft een compleet (maar vereenvoudigd) beeld.
- De drie deelgebieden zijn onlosmakelijk met elkaar verbonden en hebben invloed op elkaar; een belangrijk punt om rekening mee te houden bij uitvoering van beleid.
- De Soil Health Index omvat ook een hele serie aan beheersmaatregelen om de bodemgezondheid gericht te verbeteren.
- De basiseigenschappen van het bodemtype vormen uiteindelijk de limiterende factor voor het gebruik, (geen landbouw op duinzand, geen stedenbouw op veen).

Meer informatie over de Soil Health Index:

de Soil Health Index wordt op dit moment ontwikkeld voor Nederlandse bodems

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ALTERRA – Team Bodem Water en Landgebruik

Annex 8 Market Segmentation Questions (in Dutch)

Concurrerende omgeving van het product – Value Proposition – Business Strategy ²				
#	onderdeel	WP	Informatiebronnen Lodewijk	Informatiebronnen Erik
10	Wie zijn bij de SHI onze concurrenten, en wat is ons competitieve voordeel ten opzichte van de concurrenten?		Is over de 'concurrentie' genoeg bekend? Willen ze met ons meedoen en hun eigen ontwikkeling stopzetten? Is er al sprake van succesvolle, perspectiefrijke ontwikkelingen in NL? Wat zijn de consequenties voor ons als ze doorgaan met hun eigen applicatie?	'White Paper' (2017). Internet (zoeken)
Bodempaspoort (LTO) en bodemlabel (opdracht ASR) zijn essentieel anders.				
11	Benoem onze potentiële klanten en klantgroepen.		Is benoemd, maar niet uitputtend?	Erik, ?
Moeten we nog doen.				
12	Formuleer voor elke klant(groep) 'The pain of the customer'. Welke redenen heeft een klant om te kopen? Wat beweegt een klant? Wil deze bijvoorbeeld kosten verlagen, minder investeren, risico's verkleinen (waarop) of een kwaliteit verhogen (waarvan)?		Wat is de daadwerkelijke toegevoegde waarde van de SHI? Wat investeert een klant, en wat bespaart hij vervolgens, verbetert dit zijn marktkansen of het perspectief hierop? Dit zal in generieke termen wel ergens zijn geanalyseerd, maar waarschijnlijk niet concreet? We moeten niet aanbodgericht bezig zijn, maar de beoogde klanten gaan vragen wat zij van de SHI verwachten.	a. Wij (Lodewijk, Erik) kunnen dit beredeneren voor elk van de klanten. b. We kunnen gaan dit vragen aan elk van de klanten
c.				
13	Waar zijn klanten vooral naar op zoek? Waar zijn ze gevoelig voor? Een goed ontwerp? Een sterk merk (WUR, Eurofins e.d.)?		De doelgroep hierover open vragen stellen, maar misschien is dit al uitgezocht?	a. Wij (Lodewijk, Erik) kunnen dit beredeneren voor elk van de klanten. b. We kunnen gaan dit vragen aan elk van de klanten.
c.				
14	Welke functionaliteit verwachten onze klanten van de SHI? Moeten we kiezen voor één specifieke functionaliteit (een		De doelgroep hierover open vragen stellen.	Zie 12 en 13. Deels bepalen de klanten dit, deels bepalen we dit

² https://en.wikipedia.org/wiki/Value_proposition: A **value proposition** is a **promise** of **value** to be **delivered**, communicated, and acknowledged. It is also a belief from the **customer** about how value (benefit) will be delivered, experienced and acquired.

A value proposition can apply to an entire organization, or parts thereof, or customer accounts, or products or services.

Creating a value proposition is a part of **business strategy**. Kaplan and Norton say "Strategy is based on a differentiated customer value proposition. Satisfying customers is the source of sustainable value creation."^[1]

Developing a value proposition is based on a **review** and analysis of the **benefits**, **costs**, and value that an **organization** can deliver to its customers, prospective customers, and other **constituent** groups within and outside the organization. It is also a positioning of value, where Value = Benefits - Cost (cost includes economic risk).^[2]

	simpele 'app' is gemakkelijk), of juist een groot aantal functies ('tailor made solutions')?			zelf (wat vinden wij belangrijk / noodzakelijk?)
15	Wat voor soort prestaties, en op welk kwaliteitsniveau, verwachten klanten van de SHI? Wat wordt ervaren als 'kwaliteit'? Probeer dit zo concreet mogelijk te beschrijven. Hoe realiseer je dit vervolgens?		? De doelgroep hierover open vragen stellen.	a. Wij (Lodewijk, Erik) kunnen dit beredeneren voor elk van de klanten. b. We kunnen gaan dit vragen aan elk van de klanten.
16	Wat waarderen gebruikers van bestaande, SHI-achtige producten? Welke specifieke kenmerken zijn bij hen het meest populair?		? De doelgroep hierover open vragen stellen.	Potentiele klanten-onderzoek.
Klantgroep = voornamelijk agrariërs.				
17	Wat voor soort besparingen zouden potentiële klanten van de SHI waarderen? In termen van tijd, geld, inspanning etc.?		? De doelgroep hierover open vragen stellen.	Potentiele klanten-onderzoek.
18	Hoe meten uw klanten successen en mislukkingen? Hoe beoordelen ze prestaties en kosten?		? De doelgroep hierover open vragen stellen.	Potentiele klanten-onderzoek.
Klantgroep = voornamelijk agrariërs.				
19	Is er sprake van een 'blokkerende' competitie?		? Volgens mij niet, maar (sluimerende) patenten kunnen roet in het eten gooien.	Marktonderzoek

Overig				
#	onderdeel	WP	Informatiebronnen Lodewijk	Informatiebronnen Erik
40	Ontwikkel een laagdrempelige pilot met enkele proactieve, positief ingestelde potentiële klanten om te bepalen in hoeverre de SHI aan hun verwachtingen voldoet, welke verbeteringen gewenst zijn en documentatie van de voorgestelde aanpassingen ('trackrecord'). De pilot geeft inzicht in de ervaringen van de klant, inclusief alle fasen die hij doorloopt en de contactmomenten die hij met het project heeft. Aan de hand hiervan identificeren we kansen voor een succesvolle introductie en vermarkting van de SHI.		<p>Dit wordt onze 'Beachhead market'; daar is veel over bekend. Wellicht kiezen voor een locatie in Flevoland.</p> <p>https://www.youtube.com/watch?v=2KpOZ9N2QOQ</p>	<p>Erik.</p> <p>Een pilot is al voorzien in het projectplan (1 jaar). Locaties moeten nog wel worden bepaald.</p>

Markt/ klanten / doelgroepen				
#	onderdeel	WP	Informatiebronnen Lodewijk	Informatiebronnen Erik
20	Welke nieuwe markten zouden we kunnen verkennen aanboren? Klanten die in eerste instantie (helemaal) niet vanzelfsprekend zijn?		<p> Dit is 'Market Segmentation'. Is daar wel eens over gesproken? https://www.youtube.com/watch?v=4uEQJFW06wY </p>	Erik Saskia Visser komt geregeld bij Erik langs met nieuwe 'potentiele klanten'.
We moeten kijken of we actieve agrariërs kunnen benaderen; hopelijk zijn er collega's die zulke contacten hebben; daar moeten we achteraan gaan.				
21	Kunnen de beoogde klanten zich de SHI financieel veroorloven?		Is daar überhaupt wel eens over nagedacht?	Potentiele klanten-onderzoek.
22	Zijn de beoogde klanten toegankelijk voor ons, en/of voor degene die de SHI gaat 'verkopten'.		Eerst de klantgroepen identificeren, en dan deze vraag beantwoorden.	Marktonderzoek.
23	Wie gaat de SHI verkopen? Een private partij? Een consortium? Hoe moet de rolverdeling tussen ESG en Eurofins eruitzien?		Dit staat in het projectplan?	Erik. Rolverdeling: consult met Ruud van den Bulk
24	Waarom zouden deze klanten bij ons kopen, en niet bij andere aanbieders?		Zie de 'White paper'. Daarin worden verschillen helder gemaakt, echter op een aanbodgerichte manier. 'Beter' betekent niet automatisch grotere marktkansen!	Erik en Lodewijk. Zie ook 10.
We moeten werken aan de beeldvorming: SHI is anders dan 'al het andere'.				
25	Aan hoeveel verschillende klanten kunnen we de SHI verkopen? Zijn dit jaarlijks dezelfde klanten ('repeat customers'), of komen er elk jaar nieuwe klanten bij?		Is daar überhaupt wel eens over nagedacht?	Eurofins, marktonderzoek.
26	Hoe gaan we de SHI op de markt brengen?		https://www.youtube.com/watch?v=H52WASQrEhM	?
27	Wanneer verwachten we de SHI voor het eerst te kunnen verkopen?		Hoe realistisch is onze planning, gegeven het gebrek aan funding?	Is opgenomen in onze planning.
Dat is nu lecht nog onbekend.				

Annex 9 Market Segmentation Table

MARKET SEGMENT	1	2	3	4	5	6	7	8	9	10	11
USER <i>Who will use your product or service?</i>	Arable Farmers	Livestock Farmers (grassland)	Nature (organisations) SBB etc.	Provinces	Water Boards	Municipalities	Ministries	Rijkswaterstaat	Comparable systems: Soil Passport	Farmers' Unions (LTO etc.)	Soil data systems (BRO)
TOEPASSING <i>For which activities does the end user need the SHI?</i>	Individuele boeren	Individuele boeren	SBB, gemeenten	Plattelandontwikkeling (POP3) ²⁸	Klimaatverandering en duurzaam bodembeheer, o.a. i.v.m. waterberging in de bodem	Openbaar groen, groene ruimte	LNV: Landbouwbeleid Deltaplan Agrarisch Waterbeheer	Sustainable Development Goal 15. ²⁹	Grondeigenaren, individuele boeren	Dossier 'Kennissen en Innovatie' ³⁰	Gebruikers van BRO-informatie
VOORDELEN <i>What are the advantages of SHI as a solution for (an) existing problem(s)?</i>	Periodieke monitoring bodemkwaliteit i.v.m. gewasopbrengst	Periodieke monitoring bodemkwaliteit i.v.m. gewasopbrengst	Toetsen bodems op geschiktheid voor natuur + verbeteracties	Beleidsontwikkeling beheer groene ruimte (is dat wel provinciale taak?)	Periodieke monitoring bodemkwaliteit i.v.m. beheer grondwaterreservoir	Periodieke monitoring bodemkwaliteit	Periodieke monitoring bodemkwaliteit	Periodieke monitoring bodemkwaliteit	Periodieke monitoring bodemkwaliteit	Beleidsontwikkeling periodieke monitoring bodemkwaliteit i.v.m. gewasopbrengst	Allelei categorieën BRO-gebruikers attenderen op (meerwaarde) SHI
	1-rapportcijfer; 2-tijdige signalering ongewenste trends; 3-suggesties verbeteracties.	1-rapportcijfer; 2-tijdige signalering ongewenste trends; 3-suggesties verbeteracties.	1-rapportcijfer; 2-tijdige signalering ongewenste trends; 3-suggesties verbeteracties.	1-rapportcijfer; 2-tijdige signalering ongewenste trends; 3-suggesties verbeteracties.	1-rapportcijfer; 2-tijdige signalering ongewenste trends; 3-suggesties verbeteracties.	1-rapportcijfer; 2-tijdige signalering ongewenste trends; 3-suggesties verbeteracties.	1-rapportcijfer; 2-tijdige signalering ongewenste trends; 3-suggesties verbeteracties.	1-rapportcijfer; 2-tijdige signalering ongewenste trends; 3-suggesties verbeteracties.	1-rapportcijfer; 2-tijdige signalering ongewenste trends; 3-suggesties verbeteracties.	1-rapportcijfer; 2-tijdige signalering ongewenste trends; 3-suggesties verbeteracties.	1-rapportcijfer; 2-tijdige signalering ongewenste trends; 3-suggesties verbeteracties.

²⁸ [https://www.flevoland.nl/dossiers/plattelandontwikkeling-\(pop3\)](https://www.flevoland.nl/dossiers/plattelandontwikkeling-(pop3))

²⁹ <https://sustainabledevelopment.un.org/sdg15>

³⁰ <http://www.lto.nl/dossiers/Kennissen-en-innovatie>

MARKT-KENMERKEN <i>What specific characteristics does this market have?</i>	Jonge generatie is nieuwsgierig en gevoelig voor innovatie	Jonge generatie is nieuwsgierig en gevoelig voor innovatie	Veel bodems moeten worden geschikt gemaakt voor natuur-ontwikkeling, terwijl expertise ontbreekt	Stroperig; sterk afhankelijk van netwerk	Stroperig; sterk afhankelijk van netwerk	Stroperig; sterk afhankelijk van netwerk	Stroperig; sterk afhankelijk van netwerk	Stroperig; sterk afhankelijk van netwerk	Informatie rapportje Alwin Gerritsen?	Stroperig; sterk afhankelijk van netwerk	Sterk in ontwikkeling
GROOTTE VAN DE MARKT <i>How big is this market?</i>	+++	+++	+++	+	+++	+	+	+	+	++	++
VOORNAAMSTE KLANT <i>Who could be the main customer(s) in this market segment?</i>	Individuele boeren	Individuele boeren	Beleidsadviseurs, projectleiders	Beleidsadviseurs (agendering SHI cruciaal)	Beleidsadviseurs (agendering SHI cruciaal)	Beleidsadviseurs (agendering SHI cruciaal)	Beleidsadviseurs (agendering SHI cruciaal)	Beleidsadviseurs (agendering SHI cruciaal)	Ontwikkelaars en gebruikers	Onduidelijk; LTO; LTO-noord	
MARKTSEGMENT <i>Beschrijf het marktsegment</i>	1 Akkerbouwers	2 Veetelers (Grasland)	3 Natuur (organisaties) SBB etc.	4 Provincies	5 Waterschappen	6 Gemeenten	7 Ministeries	8 Rijkswaterstaat	9 Vergelijkbare systemen: Bodempaspoort	10 Belangen-organisaties (LTO etc.)	11 Bodemdata-beheersystemen (BRO)
PAIN OF THE CUSTOMER <i>Welke urgentie(s) zou de klant met/dankzij de SHI kunnen oplossen?</i>	Suboptimale oogsten (of erger)	Moelijkheden met beweiding; verminderde grasopbrengst	Men weet niet of bodem geschikt is voor gebruiksdoel en hoe ver je hiervan verwijderd bent	Beschikt niet over eenduidige informatie m.b.t. bodemkwaliteit	Beschikt niet over eenduidige informatie m.b.t. bodemkwaliteit i.v.m. waterbeheer	Beschikt niet over eenduidige informatie m.b.t. bodemkwaliteit in stad en buitengebied	Beschikt niet over eenduidige informatie m.b.t. bodemkwaliteit	Beschikt niet over eenduidige informatie m.b.t. bodemkwaliteit	SHI heeft toegevoegde waarde t.o.v. bodempaspoort	Monitoring belangen van leden	

Annex 10 B to B and Marketing considerations (in Dutch)

<i>Huidige/ toekomstige bedrijfspositie</i>				
#	onderdeel	WP	Informatiebronnen Lodewijk	Informatiebronnen Erik
33	Beschrijf de (juridische) entiteit die de SHI-producten/ diensten gaat vermarkten.		Geen idee, maar hier moet nu al over worden nagedacht. Ruud van den Bulk.	Juridisch adviseur (niet persé ESG), startup adviseur
34	Wanneer zal deze entiteit worden gevestigd?		Zie 33). Ruud van den Bulk.	Erik / Juridisch adviseur.
35	'Business-to-Business' aspecten: invulling van de samenwerking met bedrijven als Eurofins op inhoud, financiële en juridische randvoorwaarden.		Zie 33). Ruud van den Bulk.	Juridisch adviseur (niet persé ESG), startup adviseur
36	Bescherming van het intellectuele eigendom: beschrijf wat er in dit verband moet gebeuren (juridische expertise nodig).		Hier is al over gesproken? Ruud van den Bulk. Cathelijne Stoof.	Juridisch adviseur (niet persé ESG), startup adviseur
37	Beschrijf het team dat de SHI zal ontwikkelen en vermarkten. Wie zijn de belangrijkste personen voor succes, met welke competenties?		Dit lijkt me wel in orde, maar hebben we overal aan gedacht? Voelt iedereen zich in voldoende mate vertegenwoordigd?	Erik

Annex 11 Strategyzer help & Templates

In our study to assess the SHI Marketing Potential, we have consulted the following publication frequently.

The material, provided on the web and discussed in the book, has been extremely helpful. We have downloaded quite some pdf's from their site, e.g.

Directory of D:\BACKUP 1\~~SHI-Soil Health Index\Businessplan\Strategyzer boek	
05-12-2017 14:21	200,540 innovating-in-established-organizations.pdf
05-12-2017 15:08	25,321 blah-blah-blah-card.pdf
05-12-2017 15:09	39,208 the-business-model-canvas.pdf
05-12-2017 15:10	30,902 the-learning-card.pdf
05-12-2017 15:10	32,025 the-test-card.pdf
05-12-2017 15:10	36,906 the-progress-board.pdf
05-12-2017 15:11	65,042 7-questions-to-assess-your-business-model-design.pdf
05-12-2017 15:11	244,886 business-model-canvas-constraint-cards.pdf
05-12-2017 15:14	36,142 designing-crystal-clear-business-model-canvases.pdf
05-12-2017 15:14	1,124,015 testing-your-business-model-a-reference-guide.pdf
05-12-2017 15:14	210,191 the-business-model-canvas-instruction-manual.pdf

We highlight one example: 05-12-2017 15:28 40,828 where-to-start.pdf

A pictorial in which value proposition for intended customers and the Canvas business model are schematically integrated:

Annex 12 Interview round Soil Health Index

Key Findings

1. Momentum is developing to implement the SHI. For different objectives, but all in relation to soil health and in relation to public and commercial payments for soil measures by farmers, there is a need to be aware what measures should be taken and how effective they are. The more so with regards to unexpected issues such as the energy transition, scheduled in The Netherlands in the years ahead.
2. Policy stakeholders are discussing the need to have one, generally accepted, protocol that can function as the shared point for reference for improving soil health by farmers. This needs to be organised at the national level.
3. The wide and integrated approach to assess soil quality is strongly appreciated. A crucial factor will be if the application of the SHI will offer concrete perspectives to act for farmers and other actors.
4. It is great if farmers can use the information that comes from the SHI, yet there is a clear need for public authorities and chain companies as well. Stakeholders are dependent on these public and private actors for developing valorisation models for soils. Therefore, the SHI needs to be able to assist public authorities and chain businesses in their initiatives and activities in relation to soil health.
5. The SHI also has potential for soils in nature areas. 'Nature managers' (e.g. municipalities) need to know what they can do to battle soil quality issues, like acidification.

Summaries of the interviews

1. Emile Hagelen, Province of Gelderland

Measuring soil health and the SHI as a tool for this is getting on the agendas. It is being discussed during meetings on soil, biodiversity and land use, increasingly at national government level. An insurance company is interested as well. There is discussion about the need to have one system for assessing soil health as the foundation for measures at farms, in food chains and at public authorities. Moreover, there is also a need to coordinate this process at national level. A sense of urgency is emerging and when this getting more obvious (a matter of time), there will be a short term need for baseline assessments. Therefore, it is important to start with the follow up project on short notice. Because the issue of soil health is wider than just the area of the province of Gelderland, Gelderland is willing to finance the entire project. That does not mean that Gelderland is not committed to support the implementation of the Soil Health Index. They consider funding Work Packages 3, 4 and 5, of the project proposal of Wageningen University & Research. This is about the parameters of the physical, chemical and biological soil health. Eurofins, who can do this (partly) as their contribution in kind, will probably do much of this work.

Gelderland is making a baseline assessment for 15 hectares in an area between the cities of Arnhem and Nijmegen. They already follow the SHI framework. The idea is to lease the land to farmers under conditions of sustainable soil measures. It is not yet formally decided; that will likely take place on the 8th of February 2018.

2. Willemien Geertsema, Boerennatuur.nl

Boerennatuur.nl is the association of the 40 agri-environmental collectives in the Netherlands. In these collectives ca. 8,000 farmers manage ca. 80,000 hectares nature on agricultural land. The soil is an aspect in these management activities by farmers because the soil is important for foraging, especially for birds on arable land. The main challenge is to increase organic matter in the soil. This is part of the water measures farmers can take as part of agri environmental schemes. For instance, they can use biomass to enrich the land with organic matter.

What is the need for soil information? We know that there is a problem with too low levels of organic matter in agricultural soils. It varies, but generally, this is the case. In principle, measures that increase the organic matter are good ones, although organic matter does not increase rapidly, this process takes time. Regrettably, we do not know how effective various measures are. More specifically, there is a shortage of knowledge on biological soil quality and specifically on measures to improve it. The physical soil quality is not fully grasped either. Chemical soil quality is not an issue. Farmers know what the chemical quality of their land is and how they can improve this.

Currently, soil measures are not funded in Agri Environmental schemes in the Netherlands, but this could very well change. There may be payments for soil measures after that. If an urgency occurs, it is important to know what measures are most effective and to measure the envisaged increase in organic matter. There will be the need to measure this. The SHI may very well be instrumental for this. It is crucial to not only measure; the SHI findings have to be translated to what farmers can do to remediate. It has to be directed towards action in practice. And then, questions like 'how much organic matter is stored into the soil?' and 'how much is enough?' need to be answered. This needs to be explicated for various soil types and the SHI must be able to provide this service. Existing soil tools disappoint in this respect. If the SHI would succeed where other systems fail: this will be a strong asset.

It could be very useful to aggregate soil health and soil measures for areas or groups of farmers, but the level of a parcel of land is of primary interest.

3. Gerdien Kleijer, Municipality of Ede

Gerdien Kleijer is program manager rural areas at the municipality of Ede. Before this, she worked at the NGO Natuur & Milieu at its Food Vision. Ede is the leading municipality in the Food Valley Region, is developing the World Food Centre and sees itself as a food city, with specific interest in short chains and the protein transition. There is an ambition to source more vegetables from the region that will be healthier than what people now buy at the supermarkets. Circularity is also an issue.

Mrs. Kleijer notes that there is a number of initiatives in the Netherlands (such as 'Land van Waarde' in which 30 farmers take soil measures) and elsewhere in Europe (for instance Ökoregion Kaindorf in Austria). In the Kaindorf initiative, farmers receive €45 from Aldi for each ton of CO₂ they store in the soil. There is a great variation in carbon storage between farms, yet it is not well known why this is the case. Indeed, it is not well known what the amount of carbon is that can be stored in soils, also in the Netherlands. Land van Waarde is developing a system in which farmers are able to earn an additional income by taking environmental measures, such as carbon storage. In both cases, there is a need to know what the impacts are on soil health. It is a particularly good idea to approach this in a broad and integrated manner such as the SHI proposes and not only focus on specific indicators. It could be even widened by considering livestock health issues. The presence of certain worms is a condition for the cow being able to source selenium, zinc, etc. The relation between soil quality and food quality is also an issue, healthy food. There has been contact with NIOO about these issues. Ede is a city of more than 70.000 inhabitants, but also has a big rural area with agriculture, and large parts are nature areas. Ede has relatively many organic farmers. Many of these are chicken farms. Many farmers will close their companies in the coming years, as elsewhere in the Netherlands. Currently, there is a discussion on what to do with environmental permits that otherwise would remain in place after the business is closed down. Another issue is the environmental quality (omgevingskwaliteit) and the new Omgevingswet (Environmental Law). Ede is thinking about an approach in which objectives are at the core of the approach and not so much the formal framework. When a farmer (or other actor) wants to implement a plan, he or she can earn credits by taking specific measures and can compensate violations of municipal regulations at other issues. This has to be discussed and experimented with thoroughly, so this will not be implemented on short notice, but a system as the SHI could help in this system. Soil is relevant to environmental quality for climate adaptation and mitigation, for storage of water in the soil, and for biodiversity. Ede owns a limited acreage of agricultural lands, which is preferably leased to organic farmers and they pay a lesser lease than regular farmers do.

Another issue is the energy transition. Ede aims to use less energy, to produce solar energy from rooftops, to have 12 windmills and to have 13 hectares of solar panels on farmland. Still energy from wind at sea needs to be 'imported'. Ede also takes the position that good agricultural lands should preferably be used for agriculture and not for other land uses. At the same time, there is much interest in developing solar panels. Presently, there is a plan to develop 10 hectares of solar panels on

farmland. There is a discussion that this would possibly be acceptable if the soil quality would increase. It is not known whether this is possible at all. What do these panels do with the soil beneath them? More municipalities struggle with this issue.

In principle, Ede welcomes SHI as a good initiative, because there is a clear need to measure soil quality for various discussions on the rural areas of the Netherlands and to do this in a broad and integrated manner. There is also a need for advice on what measures to take. This initiative needs to be developed and funded on a national or even European level. Farmers can make use of the SHI, but from the perspective of the municipality, it is more relevant to use it in negotiations with landowners and users and for developing business models for farmers who are willing to take environmental measures, including soil health improvement.

Ede recommends using the SHI for nature areas as well. In Ede, the soil in its woods is too acid. This leads to health issues for animals, with quite some attention in the media. What measures can we take? Is applying chalk to the soil a feasible option?

Annex 13 Business Model Canvas SHI

Business Model Canvas [2017]				
Key partners	Key Activities	Value Proposition	Customer Relationships	Customer Segments
<p><i>Partners supplying technology:</i></p> <ul style="list-style-type: none"> • Eurofins 	<p><i>K.A., required to realise the SHI</i></p> <ul style="list-style-type: none"> • Reporting and advice <ul style="list-style-type: none"> - sampling - measurements on samples - analyses, interpretations 	<p><i>What is the benefit of the SHI?</i></p> <ul style="list-style-type: none"> • SHI soil health assessment report • Soil health improvement recommendations • Customer support on soil management 	<p><i>What kind of relationship do our customers expect to have with us?</i></p> <ul style="list-style-type: none"> • 'thematical partnerships', where WENR shares all expertise and innovations, and supports with technical advice at scientific level 	<p><i>For whom does the SHI create added value?</i></p> <ul style="list-style-type: none"> • Arable farmers • Cattle breeding • Provinces • Water boards ('soil as water storage reservoir') • Municipalities • Ministries • Rijkswaterstaat → SDG 15.3 Sustainable land use • Existing qualification systems, like the Dutch 'Soil Passport' • Unions and Interest Groups (LTO etc.) • Education (colleges, Gerard van Os?) • Soil data management (BRO)
<p><i>Scientific partners:</i></p> <ul style="list-style-type: none"> • WUR-WenR, team BWL • CSE-NIOO Wageningen (biology) 		<p><i>What is the user-specific 'pain of the customer'?</i></p> <ul style="list-style-type: none"> • Suboptimal harvests • Unknown 'soil status' 	<p><i>How do we maintain interaction with our customers / customer groups?</i></p> <ul style="list-style-type: none"> • SHI website, including digital FAQ desk • At least one soil/SHI specialist, available via Whatsapp, Skype, conventional phone etc. • Field support (charged) • Interactive support meetings 	
<p><i>Partner-developer-customer integrated:</i></p> <ul style="list-style-type: none"> • LTO (Dutch Farmers' Union) • Farmer (beachhead market-pilot?) 	<p><i>K.A. concerning customer relations</i></p> <ul style="list-style-type: none"> • Helpdesk • Promotion • Information supply (FAQ) 	<p><i>Which are our concrete products and services?</i></p> <ul style="list-style-type: none"> • SHI-assessment(report) at field scale • Soil management advice at regional scale • Development of soil health indicators supporting land lease contracts 		
<p><i>Partners that can market the SHI:</i></p> <ul style="list-style-type: none"> • Eurofins • SoilCares • WUR-WenR • Dutch technology supplier/developer (Eijkkelkamp, Dacom etc.) • External Startup • Existing yet unknown company 	<p><i>K.A. concerning revenues</i></p> <ul style="list-style-type: none"> • Investments by partners 	<p><i>Which needs of customer groups do we anticipate?</i></p> <ul style="list-style-type: none"> • SHI-assessment(report) at field scale • Soil management advice at regional scale • Development of soil health indicators supporting land lease contracts 	<p><i>How expensive are customer relationships and what does this depend on?</i></p> <ul style="list-style-type: none"> • Support via website and digital channels assessed at €10k/y • More elaborate support will be charged (e.g. annual support fee) 	<p><i>Who are our most important customers?</i></p> <ul style="list-style-type: none"> • Arable farmers • Cattle breeding • Provinces • Water boards ('soil as water storage reservoir') • Municipalities
<p><i>Key resources of our partners:</i></p> <p><i>Technology:</i></p> <ul style="list-style-type: none"> • Eurofins: sampling, measuring, logistics, website (?) 				
<p><i>Scientific:</i></p> <ul style="list-style-type: none"> • Soil Expertise (WenR-BWL) • CSE-NIOO Wageningen (biology) 	<p><i>What resources do we need to realize the SHI?</i></p> <ul style="list-style-type: none"> • Capacity building by members of SHI developing Consortium • Investments in training of dedicated expertise by Wageningen University & Research • Financial 			
<p><i>Core activities of our partners:</i></p> <p><i>Technology:</i></p> <ul style="list-style-type: none"> • Technology • Scientific Expertise • Business 	<p><i>Which distribution channels?</i></p> <ul style="list-style-type: none"> • Field support, including measurements, will be outsourced 		<p><i>Through which channels are we going to maintain contact with our customer groups?</i></p> <ul style="list-style-type: none"> • <u>Assignment</u>: WhatsApp, facebook page, (mail, telephone) → cheap • <u>Report</u>: download via link • <u>Information supply</u>: YouTube videos (what kind of information? What does the customer expect?) → reasonable costs • Concentrate everything in the 'Akkerweb' app 	
	Key Resources		Channels	

	<ul style="list-style-type: none"> Future needs to be discussed and decided upon in SHI developing Consortium 		<p><i>Which channels are to be preferred?</i></p> <ul style="list-style-type: none"> Trending: web-based exclusively. Conventional information service (privatized). Public Service <p><i>Which channels are most cost-effective?</i></p> <ul style="list-style-type: none"> Linking to existing digital tools, protocols etc. <p><i>How do we integrate the channels with existing customer routines?</i></p> <ul style="list-style-type: none"> Negotiations 	
Cost Structure		Revenue Streams		
<i>What are the most important costs inherent to our business model?</i>		<i>For which added value do our customers really want to pay?</i>		
<ul style="list-style-type: none"> Determination of SHI by means of sampling and measurements (capacity, material, logistics) We still have to develop a lot and, hence, invest before we can supply 		<ul style="list-style-type: none"> For information that solves their urgencies ('pain') 		
<i>Which essential activities are the most expensive?</i>		<i>What are they paying for now - how do they pay - how would they want to pay?</i>		
<ul style="list-style-type: none"> Sampling Laboratory analyses Reporting Sales, content marketing 		<ul style="list-style-type: none"> Not, as far as known (surely for the 'Soil Passport?') 		
		<i>Which income streams can we distinguish, and how much do they contribute (%)?</i>		
		<ul style="list-style-type: none"> (Regional) governments (50%) Farmers (25%) Interest organizations (15%) Soil data management (BRO) (5%) Ministries (5%) 		

Annex 14 Assessment matrix for marketing the SHI

Suitability Assessment Matrix SHI Marketing Company														
1 = yes; 0 = unknown, -1 = no		ASSESSMENT					SCORE (= Assessment times weighing factor)							
weighing factor		Eurofins	SoilCares	WUR (WENR)	External existing company	External Startup	Technology Developer	weighing factor	Eurofins	SoilCares	WUR (WENR)	Extern bestaand bedrijf	External Startup	Technology Developer
1	Can measure (NIRS)	1	-1	-1	0	0	1	1	1	-1	-1	0	0	1
2	Has its own infrastructure for sampling	1	1	1	0	0	0	1	1	1	1	0	0	0
3	Strong brand with (regional) governments	3	1	1	-1	-1	-1	3	3	0	3	-3	-3	-3
4	Strong brand among intended customers, including farmers	3	0	0	-1	-1	-1	3	0	0	3	-3	-3	-3
5	Strong brand at nature organizations (SBB etc.)	3	0	1	-1	-1	-1	3	0	0	3	-3	-3	-3
6	Strong brand in 'the soil world' (i.c. which customer?)	0	1	1	-1	-1	-1	0	0	0	0	0	0	0
7	Has a field service for measuring	1	-1	1	0	0	0	1	1	-1	1	0	0	0
8	Young, compact company with innovative power	3	0	1	1	1	1	3	0	3	0	3	3	3
9	Is running fast for the SHI	3	0	1	1	1	1	3	0	3	3	3	3	3
10	Can roll out the SHI as an activity	4	1	0	1	1	0	4	4	4	0	4	4	0
11	Has experience with such activity	4	1	0	1	0	1	4	4	4	0	4	0	4
12	Can draw up and publish SHI report	2	1	1	1	1	1	2	2	2	2	2	2	2
13	Is not focused on technology	2	-1	1	0	0	-1	2	-2	-2	2	0	0	-2
14	Is a service provider (instead of seller of devices)	3	1	-1	1	1	-1	3	3	3	-3	3	3	-3
15	SHI = Core business	2	-1	-1	0	1	0	2	-2	2	-2	0	2	0
16	Affinity with the product SHI	3	0	0	0	0	0	3	0	3	0	0	3	0
17	A lot of knowledge about soil	2	1	1	0	1	1	2	2	2	2	0	2	2
18	Simple financial / business construction	3	-1	0	-1	0	0	3	-3	0	-3	0	3	0
19	Financially robust-reliable	4	1	-1	0	0	1	4	4	-4	0	0	0	4
18 19 11 10 16 5														
A marketer does not necessarily have to be the partner who takes samples and does the measurements. Marketing, sampling and measuring are separate activities.														
22 november 2017-Cathelijne Stoof heeft nuttig contact gehad met gemeente Breda: die zijn geïnteresseerd wegens natuurontwikkeling in het buitengebied.														
Can measure (NIRS)														
Has its own infrastructure for sampling														
Strong brand with (regional) governments														
Strong brand among farmers														
Strong brand at nature organizations (SBB etc.)														
Strong brand in 'the soil world' (i.c. which customer?)														
Has a field service for measuring														
Young, compact company with innovative power														
Is running fast for the SHI														
Can roll out the SHI as an activity														
Has experience with such activity														
Can draw up and publish SHI report														
Is not focused on technology														
Is a service provider (instead of seller of devices)														
SHI – Core business														
Affinity with the product SHI														
A lot of knowledge about soil														
Simple financial / business construction														
Financially robust-reliable														

Annex 15 Budgeting Considerations (in Dutch)

Begroting				
#	onderdeel	WP	Informatiebronnen Lodewijk	Informatiebronnen Erik
28	Beschrijf hoe een SHI als marktrijp product voor de ontwikkelpartners in financiële zin succesvol kan zijn, met aandacht voor de rollen/ marges van ontwikkelpartners <u>WenR</u> , Eurofins en CSE?		Dat kun je pas doen als je een marketingplan hebt ontwikkeld. Hoe je zoiets doet wordt door vele bronnen duidelijk gemaakt.	Erik, consult met Ruud van den Bulk.
29	Bepaal de kostprijs van de standaardbepaling van de SHI, gegeven de gewenste kwaliteit, marge, verkoopprijs e.d. Hoe verhoudt deze prijs dit met vergelijkbare producten/ diensten van onze concurrenten?		Deze informatie moet van Eurofins komen; ik heb geen idee waar we op uit gaan komen.	Erik, Eurofins.
Relevante vraag, maar het is nu nog te vroeg.				
30	Hoeveel inkomsten kan de SHI in 2018 genereren?		Ik beschik over spreadsheets waarop we in elk geval kunnen zien wat we moeten invullen.	? Zie 25.
31	Hoeveel SHI-producten/ diensten moeten we in een jaar verkopen om begrote inkomsten te realiseren?		Ik beschik over spreadsheets waarop we in elk geval kunnen zien wat we moeten invullen.	Hebben we inkomsten begroot? Rekensom.
32	Wat is het verdienmodel van partners Eurofins en <u>WenR</u> ? CSE (=Centre for Soil Ecology ³) heeft geen winstoogmerk?		Dit moeten we met onze consortiumpartners bespreken; zij zullen hier zeker een visie op hebben, en eisen stellen (marges etc.). Vervolgens moeten we in onderling overleg vaststellen wie hoeveel marge krijgt.	Zie 23. Erik, consult met Ruud van den Bulk. En Gerard Korthals (CSE).

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