Agrilink

AGRICULTURAL KNOWLEDGE: LINKING FARMERS, ADVISORS AND RESEARCHERS TO BOOST INNOVATION

AGRILINK'S MULTI-LEVEL CONCEPTUAL FRAMEWORK

THEORY PRIMER: 25) SUSTAINABLE DEVELOPMENT

Coordinated by **The James Hutton Institute**
Author: **Boelie Elzen** with inputs from **Bram Bos** and **Rob Burton**

EUROPEAN UNION

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 727577.

AgriLink

Agricultural Knowledge: Linking farmers, advisors and researchers to boost innovation.

AgriLink's multi-level conceptual framework

Theory primer: 25) Sustainable Development

The elaboration of this Conceptual Framework has been coordinated by **The James Hutton Institute**, leader of AgriLink's WP2.

List of contributors:

- **Lee-Ann Sutherland** (WP lead), **Pierre Labarthe, Boelie Elzen, Anda Adamsone-Fiskovica**,
- with the support and contributions of Chris Blackmore, Marianne Cerf, Danielle Galliano, Alberto Lafarga, Andy Lane, Catherine Laurent, Livia Madureira, Carla Marques, Cristina Micheloni, Geneviève Nguyen, Katrin Prager, Jaroslav Prazan, Herman Schoorlemmer, Egil Straete, Sandra Sumane, Talis Tisenkopfs, Freddy van Hulst

This document presents the multi-level conceptual framework of the research and innovation project AgriLink. It is a living document.

- A first version was submitted as deliverable D1.1 of AgriLink, Month 6 of the project (November 2017).
- **This updated version has been issued on 01/05/2018.**

It has gone through a transdisciplinary process, with implication of both practitioners and researchers in writing, editing or reviewing the manuscript. This participation has been organised within AgriLink's consortium and beyond, with the involvement of members of the International Advisory Board of the project, including members of the Working Group on Agricultural Knowledge and Innovation System of the Standing Committee on Agricultural Research of the European Commission.

Theory Primers

The purpose of the primers is to provide AgriLink consortium members with an introduction to each topic, which outlines the key points and identifies options for further reading. The primers have also served to demonstrate the wide range of expertise in the consortium, and to highlight the specific research interests of consortium members. Primers are intended to act as a **foundation for academic journal articles, and an early opportunity for collaboration between consortium members**.

25) Sustainable Development

Boelie Elzen, with inputs from Bram Bos[1] and Rob Burton[2]

1.0 Introduction

One of the expected impacts of the AgriLink project, as specified in the Call from the EU H2020 Work Programme (EC, 2105), is to provide an "improved understanding of farmers' decision making processes across the EU and the impact of advice/advisory services on the sustainability of agricultural practices". In another expected impact the Call specifies that AgriLink should develop "suggestions for governance approaches and public policy mechanisms ... to support the transition to more sustainable and climate-smart agriculture". Hence the call explicitly specifies that AgriLink should study the farming advisory system within the context of its contribution to making agriculture more sustainable.

Advisors' short- and long-term influence on farm decisions, their impartiality and the way practical knowledge is kept public and conserved in the longer term are determined by how various types of advisors are embedded in their national or regional AKIS, by how public and private advisory services interact, and by the type or combination of financing sources they use. This complex relationship is governed by public policies at national, regional and EU levels and increasingly impacts whether and how society moves towards more sustainable agricultural systems. This raises the question of how the notion of sustainability or sustainable development can best be operationalised in the project.

The term 'sustainable development' was coined in 1987 by the World Commission on Environment and Development, also known as the Brundtland Commission (WCED 1987). The WCED used the following definition:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

In this definition Sustainable Development describes a discrete characteristic: either it's there or it's not. Any activity that has any negative effect is not sustainable by definition. Semantically, in the WCED view sustainability has a static meaning which, at the same time, all-encompassing. In this view, sustainable agriculture should be sustainable in any respect. Sustainability is like being pregnant: one cannot be a little bit pregnant.

The Brundland report has spurred an enormous array of activities, in research as well as in practice. It appeared that the WCED definition had the charm of simplicity but was anything but practical. Dozens of definitions have been developed since, many of which share two important characteristics that deviate from the initial definition:

[1] Bram Bos, 7 October 2011. "Memo integrale duurzaamheid voor UDV", v2.1 ("Memo on integral sustainability for UDV"; UDV = Dutch Action Plan for Sustainable Animal Production).
[2] Rob Burton et al., July 2017. PLAID: A practice-based conceptual framework and typology. Deliverable 2.1 from the H2020 PLAID project.

Rather than being objective, sustainability is an inherently normative concept, implying that different opinions will exist concerning what it entails;

Rather than being all-encompassing, the definition of what is sustainable in a concrete case is time-dependent and (partially) situation dependent.

Though it thus seams that sustainability could mean anything (and examples of 'perverse' operationalisations of sustainability indeed abound), in many cases it has proven to be a useful heuristic to induce innovation processes towards more sustainable practices. In many practical situations it appears that a useful distinction can be made between what is more sustainable and what is less sustainable.

1.0 Definitions of sustainability

There are at least 50 different definitions and circumscriptions the concept of "sustainability" (Faber et al., 2014) and, as a result, it is regularly subject to critique. For example, the concept is seen as being confused (Bolis et al., 2014), in a state of "conceptual chaos" (Vallance et al., 2011) or vague and it is often used in meaningless ways (Simmons et al., 2017). The more specific concept of "sustainable agriculture" has similar problems. Even early in its use, researchers noted that it was vague and thus easily adopted by special interest groups (Keeney et al., 1994) as well as being dependent on subjective visions of what sustainable agriculture should look like (Hansen, 1996). Although often addressed, this problem has not been resolved over time. Velten et al. (2015) recently reviewed the literature in an attempt to provide a comprehensive definition of 'sustainable agriculture'. They concluded that the current concept of sustainable agriculture "cannot be streamlined" into a single definition because of its varied and contradictory aspects.

Many publications cite the US Department of Agriculture 's definition from the 1990 Farm Bill as the most comprehensive and accepted single definition of sustainable agriculture (e.g. Aldey et al., 1998; Hilden et al., 2012; Schaffril, 2012; Velten et al., 2015). This defines sustainable agriculture as an integrated system of plant and animal production that should

- satisfy human food and fibre needs;
- enhance environmental quality and the natural resource base upon which the agriculture economy depends;
- make the most efficient use of non-renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls;
- sustain the economic viability of farm operations; and
- enhance the quality of life for farmers and society as a whole.

References in European Union documents have various emphases. The 1999 communication "Directions towards sustainable agriculture" (EC, 1999) has a strong focus on environmental sustainability, suggesting that sustainability is about balancing the use of natural resources for long-term agricultural production with the protection of the environmental and cultural heritage in line with society's values. As a result, according to Binder et al. (2010), much research into sustainability of agriculture has focused on environmental sustainability and neglected both the economic and social aspects of agriculture. However, the 2012 brochure "Sustainable agriculture for the future we want" (EC, 2012, 2) employs a triple bottom line approach to sustainability, defining sustainability as going beyond a purely environmental issue to include economic viability as well as social acceptability such that:

"The delivery of public goods such as environmental benefits is closely interlinked with the capacity of agriculture to be economically sustainable, generate adequate family income, and be socially sustainable. The thrust is to improve the quality of life in rural areas."

A recently emerged concept within the sustainability field is that of “sustainable intensification” (also termed ‘ecological modernisation’ and ‘eco-efficiency’; Tittonell, 2014). A 2014 report commissioned by the RISE foundation for the EU (Buckland et al., 2014) describes sustainable intensification as to involve the simultaneous improvement of productivity and environmental management such that yields are increased without adverse environmental damage. This concept is being promoted by the EU, for example, in the recent establishment of a European Training Network (2016-2020) to train 15 early stage researchers in managing the soil and water impacts of agriculture for sustainable intensification. While Schiefer et al. (2016) contend that within the EU 40% of agricultural land is suitable for sustainable intensification, other researchers are strongly critical of the concept, suggesting it constitutes only a “slight greening” of the industrial agricultural model and thus is essentially meaningless (e.g. Altieri et al., 2017).

In AgriLink we take the starting point that agriculture cannot be sustainable unless it is economically viable. Hence, we will move beyond the earliest definitions of sustainability as purely an environmental issue and incorporate wider concepts of sustainability. To achieve this we start from the triple bottom line or three pillars of sustainability model (e.g. Maxey, 2006; Kuhlman & Farrington, 2010; Sardain et al., 2016). This model has its early origins in the Brundtland report (WCED, 1987) and suggests that there are three main dimensions to sustainability, the triple P model: social sustainability (people), environmental sustainability (place or planet) and economic sustainability (profit) with sustainability being achieved when these three pillars are balanced such that all can be maintained simultaneously in the long term (Murphy, 2016). Although some researchers have argued for changes to the model (e.g. the inclusion of cultural sustainability as a pillar (Soini & Birkeland, 2014) or incorporating three dimensions to the “place” pillar (Seghezzi, 2009), while others have suggested that the distinction between the pillars is “conceptually fuzzy” (Kuhlman & Farrington, 2010), this model has been widely used in the sustainable agriculture literature (e.g. Rasul & Thapa, 2004; van Calker et al., 2005; van Cauwenbergh et al., 2007) and provides a practical, though not perfect, solution to conceptualising sustainability.

2. Sustainable agriculture and innovation

Developing a practical means of assessing whether development is sustainable has proved extremely difficult. Sardain et al. (2016) argue, for example, that over 20 years after sustainability was identified in Agenda 21 as a principal objective for nations, there is anything but agreement on how to measure sustainability. Tait and Morris (2000, 253) identify a similar issue with agricultural sustainability noting that “precise, repeatable and value free” measures of sustainability are required if sustainability is to become a useful concept for farming systems. This issue is even more problematic on the individual innovation level. On the one hand, innovation is critical to the development of an agriculture that is both productive and sustainable. The level of innovation itself can even be an indicator of the long term sustainability of farms since meeting sustainability objectives requires constant innovation (Ryan et al., 2016). On the other hand, however, the extent to which innovation contributes to sustainability is extremely difficult to measure as it is the *collective effect* of innovativeness that determines the sustainability of the farming system as a whole, not the characteristics of any individual innovation. The systemic nature of agriculture means that it is the overall performance of the system that determines its “sustainability” and this depends on many interrelated factors that differ among systems and that change over time (Ripoll-Bosch et al., 2012). Therefore, as Pretty (1994, 39) observes, there is no “fixed set of practices or technologies” that will necessarily lead to sustainable agriculture.

For AgriLink, a key problem is that farming advice typically addresses individual farmers while sustainable agriculture should be defined at the farm system level (Frater & Franks, 2013; Ryan et al., 2016). Thus the focus of the study on the advisory system and the objective of assessing innovation for sustainable agriculture are not easily compatible. As Ryan et al. (2016, 116) put it with respect to innovation for sustainability:

> "Research and business [and farming advice; add. by authors] provide inputs into farm-level innovation, but actual innovation only occurs when farmers put something new into use."

Consequently, sustainability can only be accurately assessed through observing how the innovation is applied within the overall farm system, not by assessing any characteristics of the innovation itself at the farm where it is initially applied. Even innovations that appear to be focused solely on profitability and *could* be used in a manner that promotes unsustainable land use may yet contribute to sustainability when applied to a farming system in a sustainable manner.

A further problem for assessing innovation's contribution to sustainability relates to the stage in the development process at which the sustainability of innovations is often assessed. In their review article on strategic niche management, Schot & Geels (2008) observe that new agricultural innovations with "sustainability promise" tend to be crude and inefficient when they are recognised as 'innovative', implying that they are unable to compete immediately with established technologies. Furthermore, many farmers initially are unwilling to make a transition to new and more sustainable approaches because of " … (perceived or real) increased economic risk, including the cost of materials and equipment, the uncertainty of profitability and potential reduction in yields" (Teschner et al., 2017, 99). This has consequences for any assessment of the sustainability potential of innovations as innovations that promote sustainability may not be adopted in the short term, however large the 'theoretical' potential is. The necessity of being put into use on the farm for the innovation to become evident (Ryan et al., 2016) suggests that the true extent to which innovations contribute to sustainability may only be assessible years after they have been initially demonstrated.

4.0 AgriLink's conceptual approach to assessing agricultural sustainability

AgriLink focuses on the role of the farming advisory system. But it will do so within the overall context of stimulating sustainable development in agriculture. This implies that in assessing sustainability, AgriLink in fact has two tasks:

Assess which sustainability objectives farming advisors use in their interaction with farmers, how they do so and how this affects the decisions taken by farmers.

Assess the effect that the previous point has on sustainable development in the farming system at large, taking into account the AKIS context in which this takes place.

Each of these tasks will be briefly discussed below.

5.0 Role of sustainability in farming advice

Farming advisors will not use the complex type of assessments of sustainability that researchers work with. Their use will be based on fairly simple models and in a very practical way. This implies that in mapping how they approach sustainability (via the AgriLink cases studies) we can probably also use fairly simple schemes

A number of studies have proposed that overall agricultural sustainability can be assessed by considering whether the system achieves a balance between economic, environmental and social dimensions of sustainability (e.g. Meul et al., 2008; Bezlepkina et al., 2011; Bachev, 2017). Others have suggested that bottom up participatory assessments of sustainability are most effective at assessing the relationships between the sustainability pillars and therefore any integrated assessment of agricultural sustainability in multi-functional agriculture (Binder et al., 2010; Rippoll-Bosch et al., 2012). However, others still have tried to develop quantitative measures of integrated sustainability (e.g. Bachev, 2017).

In AgriLink we propose to gather information on sustainability from within a broader set of objectives that advisors may, either implicitly or explicitly, seek to realise in their interaction with farmers, including:

- Strengthen the farming community (Social pillar)
- Assist farm families (Social pillar)
- Local economic development (Economic pillar)
- Profit/Financial (Economic pillar)
- Improved environmental conditions (Environmental pillar)
- Nature conservation (Environmental pillar)
- Competitiveness/Productivity (Economic pillar)

Note: we need to discuss this list in some depth to ensure this is indeed the list we need.

From this we do not intend to develop an overall integrative numerical measure of 'contribution to sustainability' for each innovation that an advisor provides advice on. However, what we can explore is which sustainability measures are important considerations for advisors in their interaction with farmers.

Although advisors themselves may use rather simple models, to assess these models, how they are applied and their impacts, the AgriLink analytical framework will use a more refined scheme to categorize how they deal with sustainability. In this framework we will address the following aspects:[3]

- *Unit of analysis*: farms vs. 'agro-food systems': to what extent do advisors focus on the farm (farming procedures, use of pesticides, husbandry system, etc.) or do they also address wider aspects of the whole agro-food chain, such as raw materials, transport of these materials and produce (including animals), production of food, etc.?
- *Static or dynamic criteria:* Do advisors use a fixed set of parameters to measure sustainability that are taken to be valid now and in the future? Or do they leave room for adaptation of parameters on the basis of new future insights and considerations.
- *Sustainability versus sustainable development:* Do advisors see sustainability as a situation at a certain point in time or do they see it as a continuous process of making things more sustainable?
- *Discrete or gradual:* Do they distinguish between sustainable and non-sustainable situations or do they see it as a gradual concept in which things can be sustainable to a certain extent, e.g. a percentage.
- *Absolute versus relative:* Do they define sustainability in absolute terms that defines the situation at a specific farm as sustainable, independent of the situation at other farms? Or do they 'measure' the degree of sustainability in relation to other farms.
- *Attainable versus desirable:* Do they define sustainability (implicitly or explicitly) in relation to what is considered attainable? Or do they define it in relation to what is considered desirable, independent of what is considered attainable? In the latter case, do they think of a process of intermediate steps that are considered attainable?

[3] Based on and adapted from Bram Bos, 7 October 2011. "Memo integrale duurzaamheid voor UDV", v2.1 (Memo on integral sustainability for UDV; UDV = Dutch Action Plan for Sustainable Animal Production).

- *Goals versus means:* Do they see sustainability in terms of the goals to be achieved, e.g. emissions of ammonia lower than a certain threshold? Or do they define it largely in terms of concrete means and measures, e.g. equipment, substances, procedures?
- *Range: single issue, connected, or integral*. Do they relate sustainability to a single issue (e.g. environment), to connected issues (several issues, e.g. environment and animal welfare) or do they see it as all-encompassing or "integral" (spanning all relevant sustainability dimensions, including environmental, societal and economic dimensions).

Note: we should also discuss this list in some depth to ensure this is indeed the list we need.

6.0 Assessing sustainable development of the farming system

As an overall objective, AgriLink should contribute to the development of sustainable agriculture at large. Above, we have argued it is more appropriate and practical focus on 'sustainable development' as a continuous process rather than on sustainability as a state of affairs with concrete characteristics. This emphasises the importance of innovation as a continuous process to realise sustainable agriculture. In this, innovation does not just refer to the creation of novelty but, equally important, also to the uptake of this novelty by the larger farming community. And, as is argued in ##,[4] this uptake is an active process in which the novelty undergoes further change to be made to work in the farming context of larger groups of farmers.

This uptake takes place within the context of the prevailing (regional, national) AKIS that can have an substantial (stimulating or impeding) effect on the wider process of sustainable development. To characterise the 'sustainability pressure' coming from this AKIS we can largely use the same parameters as were listed above for individual advisors with the important difference that these parameters are now operationalised at the farming system level. These parameters are (excluding some that are only relevant at the farm level):

Static or dynamic sustainability criteria;

Focus on sustainability or sustainable development;

Is sustainability seen as discrete or gradual;

Attainable versus desirable objectives;

Defining goals versus defining means;

Range of sustainability dimensions: single issue, connected issues, or integral sustainability.

These factors are largely descriptive, helping to map what goes on. Next to that, we can identify a number of parameters that are more prescriptive which derive from insights in innovation processes, more specifically innovation for sustainability. These are not without problems, though, and each of them is associated with one or more dilemma's. These parameters include:

It is wise to set 'integral sustainability' as a long-term goal but to seek and achieve that via concrete intermediary steps which in themselves will not be 'integrally sustainable". **Dilemma**: Keeping 'integral sustainability' as a longer-term vision helps to keep the objective alive to strive for improvements that may not seem very realistic in the near term. On the other hand, to make a sense of urgency tangible for stakeholders requires the formulation of attainable near-term steps. The dilemma is what to emphasise: the progress that has been made or the remaining gap that needs to be bridged.

[4] Cf. the section on MLP in the CF.

It is better to define goals rather than means to stimulate diversity of approaches and appeal to the innovative power of various stakeholders.

Dilemma: goals may often be general and not very specific. This will make it complicated to monitor (lack of) progress.

The primary goal of stimulating sustainable development should be to spur a wider process of change and innovation, taking into consideration the factors that stimulate this process and ones that impede. Only in the second place should it set concrete targets.

Dilemma: this stimulates the innovative activities by farmers and other stakeholders but may make it difficult to provide legitimation for public funding that usually require measurable targets. It may also make it more complicated to provide guidance on the courses taken.

Innovation studies have shown that what is considered attainable may vary widely across stakeholders. A small group of 'innovators' tend to tinker with changes that most others consider unrealistic. Once these innovators have demonstrated a novelty to work in practice, however, others (the 'followers') may follow. The definition of sustainability should acknowledge these different roles.

Dilemma: This makes the definition and governance measures derived from it complicated. Politically it is often difficult to target different groups from the same population with different instruments.

By a clever combination of the descriptive and prescriptive parameters above in the analysis of our case studies we can both analyse how the system works as well as develop recommendations on how the farming advisory system may be improved as to improve its contribution to the development of sustainable agriculture.

References

Altieri, M.A., Nicholls, C.I., Montalba, R. (2017) Technological Approaches to Sustainable Agriculture at a Crossroads: An Agroecological Perspective. Sustainability 9, 349; doi:10.3390/su9030349

Bachev, H. (2017) A Study on Sustainability of Unregistered Agricultural Holdings in Bulgaria. Annals of Agricultural & Crop Sciences 2 (1): 1022.

Bezlepkina, I., Reidsma, P., Sieber, S., Helming, K. (2011) Integrated assessment of sustainability of agricultural systems and land use: Methods, tools and applications. Agricultural Systems 104: 105–109

Binder, C.R., Feola, G., Steinberger, J.K. (2010) Considering the normative, systemic and procedural dimensions in indicator-based sustainability assessments in agriculture. Environmental Impact Assessment Review 30: 71–81

Bolis, I., Morioka, S.N., Sznelwar, L.I. (2014) When sustainable development risks losing its meaning. Delimiting the concept with a comprehensive literature review and a conceptual model. Journal of Cleaner Production 83: 7-20.

EC (1999) Directions towards sustainable agriculture. Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions. Brussels, 27.01.1999 COM (1999) 22 final

EC (2012) Sustainable agriculture for the future we want. EU, Brussels.

EC (2015) *Horizon 2020 Work Programme 2016 – 2017.* Ch9. "Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy". Call RUR-14-2016: "Advisors' roles in the functioning of AKIS and advisory policies boosting innovation in sustainable agriculture", p.147-150.

Frater, P., Franks, J. (2013) Measuring agricultural sustainability at the farm-level: A pragmatic approach. International Journal of Agricultural Management 2 (4): 207-225

Hansen, J.W. (1996) Is Agricultural Sustainability a Useful Concept? Agricultural Systems 50: 117- 143

Keeney, D.R. (1994) Sustainable agriculture and sustainable development: at the crossroads. International Fertiliser Development Center, Alabama.

Kuhlman, T., Farrington, J. (2010) What is Sustainability? Sustainability 2: 3436-3448

Meul, M., Van Passel, S., Nevens, F., Dessein, J., Rogge, E., Mulier, A., & Van Hauwermeiren, A. (2008) MOTIFS: A monitoring tool for integrated farm sustainability. Agronomy for Sustainable Development, 28 , 321–323

Pretty, J.N. (1994) Alternative systems of inquiry for a sustainable agriculture. IDS Bulletin 25 (2): 37-49

Rasul, G., Thapa, G.B. (2004) Sustainability of ecological and conventional agricultural systems in Bangladesh: an assessment based on environmental, economic and social perspectives. Agricultural Systems 79: 327–351

Ripoll-Bosch, R., Díez-Unquera, B., Ruiz, R., Villalba, D., Molina, E., Joy, M., Olaizola, A., Bernués, A., (2012) An integrated sustainability assessment of Mediterranean sheep farms with different degrees of intensification. Agricultural Systems 105 (1), 46–56

Ryan, M., Hennessy, T., Buckley, C., Dillon, E.J., Donnellan, T., Hanrahan, K., Moran, B. (2016) Developing farm-level sustainability indicators for Ireland using the Teagasc National Farm Survey. Irish Journal of Agricultural and Food Research 55 (2): 112-126.

Sardain, A., Tang, C., Potvin, C. (2016) Towards a dashboard of sustainability indicators for Panama : A participatory approach. Ecological Indicators 70: 545–556

Scheifer, J., Loira, G.J., Blum, W.E.H. (2016) Potential and limits of land and soil for sustainable intensification of European agriculture. Agriculture, Ecosystems and Environment 230 (2016) 283–293

Schot, J., Geels, F.W. (2008) Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy. Technology Analysis & Strategic Management 20 (5): 537-554

Seghezzo, L. (2009) The five dimensions of sustainability, Environmental Politics 18 (4): 539-556

Tait, J., Morris, D. (2000) Sustainable development of agricultural systems: competing objectives and critical limits. Futures 32: 247–260

Tittonell, P. (2014) Ecological intensification of agriculture — sustainable by nature. Current Opinion in Environmental Sustainability 8: 53–61

Vallance, S., Perkins, H.C., Dixon, J.E. (2011) What is social sustainability? A clarification of concepts. Geoforum 42: 342–348

Van Calker, K.J., Berentsen, P.B., Giesen, G.W., Huirnel, R.B.M. (2005) Identifying and ranking attributes that determine sustainability in Dutch dairy farming. Agriculture and Human Values 22: 53–63

Velten, S., Leventon, J., Jager, N., Newig, J. (2015) What Is Sustainable Agriculture? A Systematic Review. Sustainability 7: 7833-7865

WCED (1987) Our Common Future. World Commission on Environment and Development. Oxford University Press, Oxford.