

# Helping diversified vegetable farmer to assess the sustainability of their system

Participatory research to create an adapted tool:  
a case study in Maine-et-Loire France.



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# LIST OF ABBREVIATIONS

AMAP – Associations pour le Maintien d’une Agriculture Paysanne

BRF - Bois Raméal Fragmenté

CAB – Coordination Agrobiologique

CIVAM - Centres d'Initiatives pour Valoriser l'Agriculture et le Milieu rural

CRAPL – Chambre Régionale Agriculture Pays de la Loire

CUMA - Coopérative Utilisation Matériel Agricole

EARL - Entreprise A Responsabilité Limitée

ESA - École Supérieure d’Agriculture

FADEAR - Fédération Associative pour le Développement de l’Emploi Agricole et Rural.

FSE - Farming System Ecology

GABB - Groupement d’Agriculteurs Biologique et Biodynamique

GFA - Groupement Foncier Agricole

IDEA - Indicateur de Durabilité des Exploitations Agricoles

INRA - Institut national de la recherche agronomique

INSEE - Institut national de la Statistique et des Études Économiques

MESMIS - Marco para la Evaluación de Sistemas de Manejo de recursos naturales incorporando Indicadores de Sustentabilidad

MSA - Mutuelle Social Agricole

MSV - Maraîchage sur Sol Vivant

SAFE - Sustainability Assessment of Farming and the Environment

SAFA - Sustainability Assessment of Food and Agriculture

WWOOF - World Wide Opportunities on Organic Farms

WUR - Wageningen University Research center

# PREFACE

This research was carried out in the framework of the Master program in Organic Agriculture of Wageningen University, within the research group of Farming System Ecology (FSE) with the cooperation of the Groupe ESA in Angers, France.

In the context of my studies, I encountered many times the world sustainability applied to the agricultural sector, related to specific farming practices. I personally think that farm sustainability is strictly related to farmer's capacity to sustain themselves as a professional category. In France, farmers population is overall decreasing and there are fewer and fewer young farmers to take over. Farming is less attractive than before as a professional career and many are the drawbacks of rural life. Farmers do not only provide goods and produces, but they play an important role in the social and environmental field. Having sustainable farms is the basis for a sustainable development of society as a whole.

In this sense, a sustainable agriculture is highly dependent on the capability of farmers to preserve the continuity of their profession, especially when speaking about small scale and diversified productions.

The main objective of this thesis was to: 1) explore the willingness of farmers to assess their own sustainability, 2) to find indicators that could fit the specificity of their farming systems and 3) to create a tool that farmers could use on their farms in a time saving, costless and easy way. The interest was to focus on a specific production sector and a specific geographical boundary to create a context dependent analysis tool, based on local needs and expectations.

The base of this work was the assumption that when farmers see sustainability concepts as something concrete in their daily life, they are more willing to implement sustainable practices to improve their performances and ensure their professional success.

For the realisation of this thesis research I would like to thanks my two supervisors. Guillaume Piva my supervisor at ESA that helped me to make the research match with the local context. Egbert Lantinga that supervised me since the very beginning of the research project by helping me to realise several drafts of several research topic until I found the good one. Thanks you for your patience and your trust.

I am deeply thankful toward the vegetable farmers that welcomed me in their farm and took the time to test the tool I created. The moments passed on their farms were really rich in exchanges, both on the technical and human side. I would like to thanks the two bosses of my two side jobs: Patrice Lamballe and Michael Richard. They left me the time to go to the library to work on my thesis, even if it took some of the time I had to work on their farms.

To my parents I express my recognition to have supported me in the harder moment, when I wanted to stop the master since I was to overload with work, study and family and that pushed me to continue. If I finish this master is in big part thanks to them. Finally, I express my great gratitude to my family, Giulia that help me with correcting the research and to understand academic and scientific requirement. Finally Thank you to Nayeli that took nap long enough to let me a bit of time to finish this research.

# SUMMARY

The agricultural context in France is living a difficult moment. In the last 20 years the number of farm has decreased by 50% and the farmers already in place have an average age of 55, which shows a progressive aging of the sector (CEP, 2012). Farmer profession is no longer attractive for young people, especially due to its difficult working and life conditions. 83% of farmers in France declared to have intense physical constraints (AGRESTE, 2015). 35% are overwhelmed by their work and 59% have the feeling that cannot stop working (Technologia, 2014). It is a work with high risk of burn out, due to the difficulty of the work: high degree of responsibility, multitasking knowledge, conflicts with associates, social isolation, family pressure are all factors that contribute to fragilize farmers mental wellbeing (Louazel, 2016). It is a profession that have to deal with climate change, which sometimes can have dramatic consequences on productivity and farm resilience. On the economic side, many farmers encounter difficulties in gaining a proper salary and therefore their sustainability is endangered (Dufour et al., 2010).

In the last years, we could observe that in France 60% of the person that install in agriculture have urban origin, without knowledge and previous life experiences related to the farming world (Chambre régionale d'agriculture de Bretagne, 2011). Most of these new agricultural project promoters are changing the face of French agricultural sector with their unusual profiles (Bon, 2010). They want to install in small scale farms with atypical productions, prefer vegetable sectors due to its small initial investments necessary, privilege direct selling and diversified activities such as farm product processing, eco-tourism and pedagogical activities (CEP, 2012).

In cases, already installed farmers and project promoters in vegetable production do not have a clear reference for defining what is a sustainable farm in their field. Existing sustainability assessment tools are generally targeted to all kind of farms together, so no one in particular. They often concern more aspect of sustainability at society scale, to define how farmers can support a sustainable territory, rather than at farm scale, to define how farmers can sustain themselves as a professional category. Moreover, they often imply a complex assessment or data analysis process, that farmers can not undertake independently from an external consultant. In this sense, a reflection on farm business sustainability becomes for vegetable farmers more a load than an inviting possibility to improve.

The main purpose of the study was to offer to diversified vegetable farmers the possibility to monitor their farm sustainability in an independent, costless, and time saving way. An important criteria for the development of the tool was to keep a participatory approach to better adapt to farmer's needs, availability and expectations. Triangulation of data was considered necessary in order to respond to the purpose of the study.

The research process was divided in three main steps: Research, Design, and Test. In the first step, 'Research', a literature review was performed on existing sustainability tools and sustainability indicators; second, the researcher participated in a sustainability assessment of a local vegetable farm performed by a French organization in order to acquire information and inspiration on assessment methods; Third, an online questionnaire was proposed to local vegetable producers to investigate their perceptions and expectations towards a sustainability assessment tool.

In the second step, 'Design', the tool was created. First, it was 'pre-model' according to the original scope, final end users and practicability. Secondly, sustainability factors and indicators were selected.



The criteria of selection was to find indicators characteristics of French agricultural sector and specifics to diversified vegetable production.

In the third step, 'Test', the tool was tested on two different farms in order to evaluate its practicability and coherence. The objective was to collect not only farmers data and performances but also their evaluation and perception of the tool in order to improve it for further use.

The results from the online questionnaire show that vegetable farmers are used to question themselves about their farm sustainability. They do not have tools yet adapted to their system and they would strongly appreciate to make a diagnosis of their farm with adapted indicators.

The tool created was directed to vegetable farmers as end users and as performers of the evaluation (no need of external mediators). The tool was based on the three pillars of sustainability, mainly with the use of simple indicators that gave scores according to the performance. The analysis of the data is done in an excel file that farmers can fill in themselves in order to get their results in the form of a spider web diagram.

The first on-farm evaluation leads the researcher to change some of the tool characteristics. First, at each indicator it was added a section in which is explained why it was chosen and its importance for farm sustainability. Secondly, few open-ended questions were added to incite farmers to critically reflect on their performances and situation.

The most critical points for the whole process were the limited amount of reactions on the initial farmer's survey, which could be due to lack of time for farmers to respond or a limited access to the survey due to its online format.

Concluding, the testing of the tool proved that it is possible to create a sustainability evaluation tool that is easy to use, cost effective and low time consuming. Moreover, the participatory approach permitted to tailor made the tool to the needs and expectations of vegetable farmers. Another important conclusion was that more than the evaluation of the performance itself, it is important the degree of self-reflection the farmers are able to do when using the tool. In this case, the evaluation is better if performed in a couple of peers to offer to each other an external - and free - advice and feedback on possible changes.

# INTRODUCTION

## 1.1 BACKGROUND

In France, the agricultural sector accounts the higher rate of suicide if compared to other professional sectors (Chiffolleau, 2008). A farmer suicide every two days (Khiredine-Medouni et al., 2016). The reasons are diverse: difficulty of the work conditions, environmental and climate constraints, high number of working hours, low social recognition, professional and social isolation (Ammar, 2016).

Moreover, the number of farmers is decreasing every year: in 2010 we could count in France 764.000 farmers, three years later, they decreased by 25% (INSEE, 2016). The decline of the farmer profession in France is worrying. In the report “acting for youth”, the French ministry engaged to actively promote the integration of young people in the agricultural sectors and to help them to implement their project in order to be innovative, profitable and sustainable (FMFAID, 2015).

This approach take as a base the fact that farmers have a key role for society that go behind feeding the population and therefore a rural dynamics need to be maintained. In this sense the decrease of the farmer population is posing question on the sustainability of the whole society.

On the other side, the European Union is calling for sustainable development and want to promote sustainable agricultural practices (Zahm, 2009). For this, they are pushing different stakeholders to create evaluation frameworks and indicators-based assessments to monitor sustainability of different farming practices (Zahm, 2009).

In scientific literature, the term ‘sustainability’ is often related to the Bruntland definition of sustainable development, described as the “kind of development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Bruntland, 1987).

Agro-ecological production done by small scale farmer is considered more sustainable in the sense that is the model best suited to meet future food needs (Via Campesina, 2010). Agribusinesses are failing to feed people and are destroying the productive capacity of the land for future generation. On the contrary, agro-ecology conserves and restores soils and agro-ecosystems (Via Campesina, 2010). It is proven that small farms are more productive than large farms and what we call agro-ecological or organic are as productive than chemical-dependent monocultures (Badgley et al., 2007; Pretty and Hine, 2001; Rosset, 1999).

Even if some attempts are done to create some boundaries on the definition of sustainable agriculture, the effect of so-called sustainable farming practices are highly dependent by context and farmers needs (Ikerd, 1993). In this sense, the same practice used by different farmers in different geographical areas and economic context can have highly different results (Rigby, & Cáceres, 2001). The concept of “sustainable agriculture” is therefore multifaceted.

## 1.2 CONTEXT DESCRIPTION

Organic agriculture in France is living a period of high development. In the last ten years, both the number of farms certified organic and the surface cultivate with organic certification has doubled (AgenceBio, 2016). In 2015, on the total amount of organic farms, 41% of them were producing vegetables and fruits, half of them as their principal economic activity (AgenceBio, 2016).

The vegetable sector in France is very diverse. To frame this diversity, we will use the categorization illustrated in the paper of Bressoud & al. (2009), which defines four main farm type:

- 1) *Off-ground farms* producing mainly tomatoes, cucumbers and strawberries in greenhouses: these kind of production are not organically certified;
- 2) *Mixed farms* that produce mainly cereals and some vegetables as a cash crop;
- 3) *Specialised vegetable farms* (*Légumier*, in French) producing between 1 to 5 vegetables on an surface included between 1 to 10 hectares. They are mechanised and are mainly selling their production to wholesalers;
- 4) *Diversified vegetable farms* (*Maraicher*, in French) producing between 20 to 60 vegetables, on surfaces going from 1 to 20 hectares. They have a low mechanisation partly due to the high diversity of crops which would need an important diversity of material. They are mainly selling their production in short supply chains, which is defined in this study as the commercialisation with a maximum of one intermediary between the producer and the consumer (Agreste, 2016).

In France in 2015, 81% of vegetable producers declared to practice direct selling (Agreste, 2016). This commercial strategy requires to assure a clientele and for that a high range of different vegetables are been grown all year long to satisfy consumers demand. Producers involved in direct selling are often giving more attention to the preservation of landscape and biodiversity and effective use of natural resources (Marsden et al., 1999). Being in direct contact with consumers, diversified vegetable produces are more eager to highlights theirs efforts in environmental preservation in order to better place their produce in the market.

Many are the advantages of this type of production and market strategy. First, it permits to reduce the risk of extreme climatic condition: if a production fail, many others are there to assure an income, therefore reducing vulnerability to climate and economic fluctuations.

Secondly, farmers benefit of a higher independence in their production in term of decision and a better distribution of the added value (Le Caro et Daniel, 2007). Lastly, commercialising directly to consumers, diversified vegetable farmers create social relationships with their consumers enhancing the link between rural and urban areas (Bon, 2010). Their market choice have a positive social impact in terms of rural dynamics, while consumers participate to a process of valorisation of farmers products in a win-win situation (Rossi & Brunori, 2010). Overall, production diversified results in complex agro-systems asking for a wide range of competences and technology (Dufour et al., 2010).

In vegetable production, plants have an infra annual cycle: vegetable can be planted several times in the year and this result is a complex calendar of seedling and crop maintenance task such as irrigation, fertilisation, weeding, etc. (Bon, 2010). During the spring and summer there is a pic of production, which can result in a burn out for vegetable farmers (Salmona, 1994; Solidarité Paysans, 2016). This intense rhythm all year long is a source of stress and tiredness for the vegetable farmers that rarely

manage to take a period off (Solidarité Paysans, 2016). In addition to physical and mental fatigue, many vegetable producers sustain to have a revenue that is too low if compared to the effort and working time passed in the production (AgroBio Basse Normandie, 2015, Dufour, 2010; Chiffolleau, 2008).

All these factors makes that nowadays vegetable producers, in France, are suffering from a social and economic situation that weaken their social and economic sustainability (Dufour, 2010). Their environmental sustainability can be therefore threaten by an overall weakness if compared to the biggest market and work context.

Ever since the Brundtland definition of sustainable development (World Commission on Environment and Development, 1987), the concept of agricultural sustainability has gradually evolved. The implementation and evaluation of sustainable agriculture has become a principal challenge for agricultural research, practice and policy.

Some French NGO's and research institute attempted the creation of tools to assess farmer's sustainability (FADEAR, 2014; IDEA, 2008). Nevertheless, these tools are often shaped on the average French farm: 55 ha of cereal or animal production. A unique tool with fixed indicators to analyse such a diverse range of farms, agricultural production and practices is naturally lacking of context credibility (Zahm, 2008). Moreover, a sustainability assessment is often proposed by consulting institution and technician as a paying service, requiring farmer's time and money availability, both things that are lacking in the domain of diversified vegetable production (Lebacqz et al., 2013; Dufour, 2010).

### **1.3 STUDY OBJECTIVES AND RESEARCH QUESTIONS**

The main purpose of the study is to offer to diversified vegetable farmers the possibility to monitor their sustainability in an independent, costless, and time saving way. In order to respond to the purpose of the study the objective was to create a tool that could permit farmers to assess their systems.

A tool adapted to measure sustainability of vegetable farming systems would have the following advantages:

- To analyse farmer's performances based on context and production dependent indicators and therefore being coherent with local realities;
- To observe trade-offs, changes and eventual improvements over the years on the same farm;
- To compare the results of one farm with other farms with the same production system, and eventually to exchange and reflect on their practices;
- To allow neo-peasant to understand, when installing, which are the key point to look at in order to be sustainable.

A tool of this kind will not only help farmers to monitor their overall farm sustainability, but will incite them to reflect on their practices and hopefully lead them to a change whenever some indicators shown a weakness in farm sustainability.

To address the purpose of this study, the following research questions were formulated:

RQ1: Do diversified vegetable farmers feel the need to assess their system sustainability? If yes, which are the conditions that would make them invest time and energy in the assessment?

RQ2: Which are critical indicators to assess diversified vegetable farms sustainability?

RQ3: How to assess sustainability in a participatory way, which can also be costless, easy and time saving?

## MATERIALS AND METHODS

Three main steps were planned in order to investigate a case study and answer the research questions (Figure 1). First, an exploratory phase - hereby indicated as 'research' - in order to comprehend the state of the art regarding tools of sustainability assessment. Secondly a design phase was performed to create a tool specifically shaped to the use of diversified vegetable producers. Thirdly and lastly, the tool an experimental phase had the aim to test the tool in order to verify its practicability and coherence with the local context.

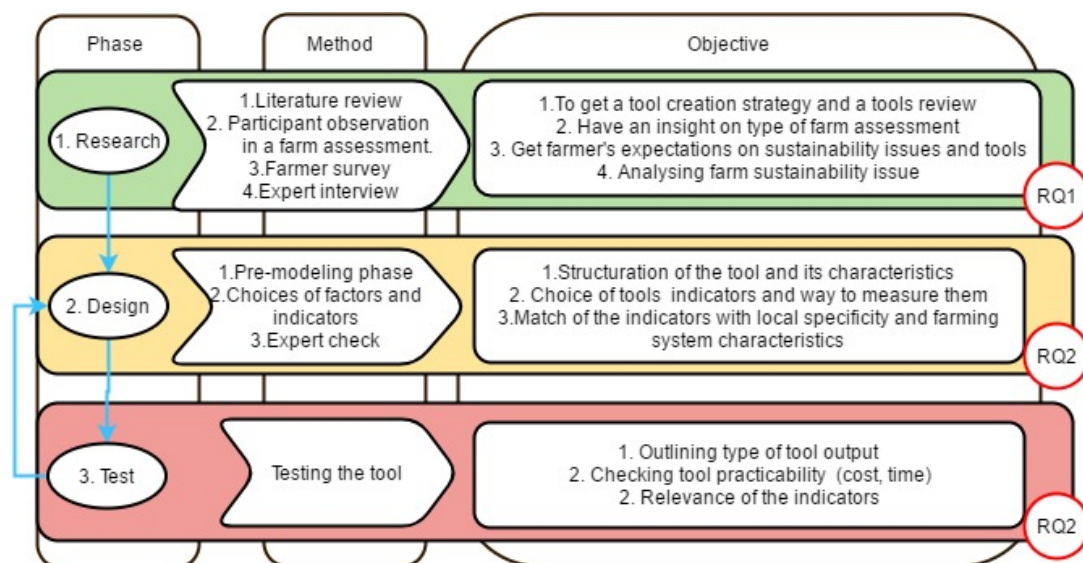


FIGURE 1 - RESEARCH PROCESS

### 2.1 CASE STUDY

The case study took place in the region Pays de la Loire, more precisely the department of Maine et Loire, in the North West of France. Maine-et-Loire has a mild oceanic climate with an annual average temperature of 12°C, annual precipitations of 690mm and 1800 hours of sunlight through the year (Agreste, 2016).

The high heterogeneity in soil type and the mild climate permit to have an high diversity of farming systems such as animal production, vegetable production, arboriculture, vineyard, horticulture, tree nursery, medicinal plant and seeds production. Due to the high labour demand of those farming systems, Maine et Loire is the second French department in terms of agricultural employment (Agreste, 2016).

In 2010 there were 8250 farms in the department, of which 630 were vegetable farms, representing 3100 ha (Agreste, 2011). In the department 650 farms were certified organic. In Maine et Loire in the last ten years the number of farm decreased of one third. The reduction of farm touched especially smallholdings, which decreased of nearly 60%. This tendency highlights an up scaling of farm size in the department. The number of vegetable farms reduced of 15% over the past 10 years but the size increased with an average size of 15 ha in 2000 and now 19,4 ha (Agreste, 2011).

The whole region of Pays de la Loire has experienced in the last five years an increased organic production. This lead the region to be the second in the country in terms of hectares certified organic (111800) and number of organic farms (2000), representing the 5,9% of the total agricultural land (Agreste, 2015). In addition to the growth of organic market, and related to it, there is a popularisation of direct selling. Around 50% of organic vegetable producers in Maine et Loire chose to strengthen the link with consumers using farm shops, box schemes and local markets as a preferential market channel (CRAPL, 2013).

## **2.2 RESEARCH**

In order to better understand the state of the art and knowledge gaps on sustainability assessments and indicators, four main actions were undertaken:

- Literature review
- Participant observation to farm assessments
- Farmer's survey
- Expert interview

Those different resources permit to have a multitude of viewpoints on the same subject, giving a triangulation of data and therefore a greater accuracy in the creation of the tool. With triangulation is meant "the combination of methodologies in the study of the same phenomenon" (Denzin; 1978, 291).

### **2.2.1) LITERATURE REVIEW**

A literature review was made to: 1) understand to which structure and format should a sustainability tool respond to; 2) compare already existing tools in function of the end users, the objectives, structure and efficiency (Flint, 2014; FADEAR ) (Appendix 1).

The literature review was made both on scientific literature and grey literature such as technical booklets made by associations or government and destined to vegetable farmers. The literature review was made through the search engine Google Scholar for the scientific literature and with Google for the grey literature. The following keywords were used in different combination depending of the subject of research: sustainability, Maine-et-Loire, assessment, vegetable production, diversified, short supply chain, tool, impact, farm, action research, and agriculture. No restriction on scientific rigour of the

literature has been made in order to be able to show the initiatives that have already been taken by local associations in order to help farmer. Relevant documents referenced in the literature funded with the keywords were also researched and analysed.

The grey literature was found through farmers syndicate websites and association who are engaged in promoting sustainable food production and helping farmers to improved their system. The regional Agricultural Chamber permitted to access to regional data about farming.

To find the two main inspirational tools between the whole horizons of sustainability assessment tools the following assumptions were made:

- The tool should contain the evaluation of the three dimensions of sustainability: economics, social and environmental. It is considered that these three dimensions are the common baseline for sustainability assessment and are also easily understandable by people.
- The tool should be based on the French agricultural system. Agricultural systems vary very much in different countries according to national regulation, economic and geographical context. Even though the French territory is very diversified in terms of geography, the economic and legislative context is the same and permit to make comparisons between systems;
- The tool should not require expert competences to fill in the assessment. To be freely accessible to end users the tool should permit stakeholders themselves to compile their evaluation and eventually make the analysis of their farm performance.

### 2.2.2) PARTICIPANT OBSERVATION IN A SUSTAINABILITY ASSESSMENT

Participant observation is described as “An observation of some social event, and explanations of its meaning by participants and spectators, before, during, and after its occurrence” (Becker and Geer, 1957).

In order to comprehend how a sustainability assessment is performed by a technician and perceived by a farmer, the researcher assisted to the feedback session of a farm assessments performed by the organisation FADEAR (*Fédération Associative pour le Développement de l'Emploi Agricole et Rurale*). This organisation is a federation of associations that work at national scale for the development of agricultural and rural work. The tool under analysis was the so-called ‘*Diagnostic agriculture paysanne*’, or ‘Peasant agriculture diagnostic’, which was conducted in one organic vegetable farms in Maine et Loire. The scope of the participant observation was to understand how FADEAR is collecting data about farm sustainability and which means they use to give feedback to the farmers based on their performances.

### 2.2.3) FARMER’S SURVEY

As stated in section 1.2, many are the tools that nowadays are used to assess sustainability performances in the agricultural domain. Nevertheless, the call for context dependent assessments made that most of them do not perfectly fit the needs and interest of the end users of this research. In this sense, the researcher performed a survey designated to diversified vegetable farms of Maine et Loire, the future end users of the tool for the participatory farm sustainability assessment.

The survey was divided in three main parts (Appendix 2). The first part investigates the characteristics of the farm and the farmer to get general data about the sample population. The second part was first dedicated to investigate farmer’s perceptions about sustainability concept and secondly dedicated to

test their interest and willingness to assess the sustainability of their farms. The last part was constructed to get farmer's expectations for such a tool. Practical questions were asked such as the numbers of hours they would be ready to dedicate to it, the format they would appreciate, etc.

The survey was constructed in the form of a questionnaire with close-ended questions. The questionnaire was created in Internet with the software Qualtrics and sent by email to a total number of 43 farmers. The selection criteria to choose to whom send the survey were the followings:

- 1) Geographical boundary: the area of investigation was the department of Maine et Loire;
- 2) Production orientation: only diversified vegetable farmers that produce more than 20 vegetables;
- 3) Market orientation: only farmers that are involved in direct selling for a part or the totality of their production.

The list of farmers was derived with the help of an internet national database of organic producers called AgenceBio.

#### **2.2.4 EXPERT INTERVIEW**

In order to get a different perspective on local vegetable farmers situation, an expert interview was conducted. Kaspar Poter works as a technical consultant in vegetable production for the CAB (Coordination Agrobiologique Pays de la Loire) federation of departmental associations of organic producers. Because of his role, he has a good overview of the specificity of the farming systems in the department and he is regularly in contact with vegetable farmers. The semi structured interview lasted one hour and was divided in two parts: a part about sustainability factors in general and a second part in which the tool made by the researcher was presented and discussed together.

### **2.3 DESIGN OF THE TOOL**

In order to create a tool to assess sustainability performances, different steps were needed (Figure 2). First, there was the need to define first which will be its objective, its end users and its structure and outlook. The analysis of grey literature permitted to evaluate the outlook and organisation of the great diversity of sustainability assessment tools and to choose which one was more convenient for the purpose of this study (table 1).



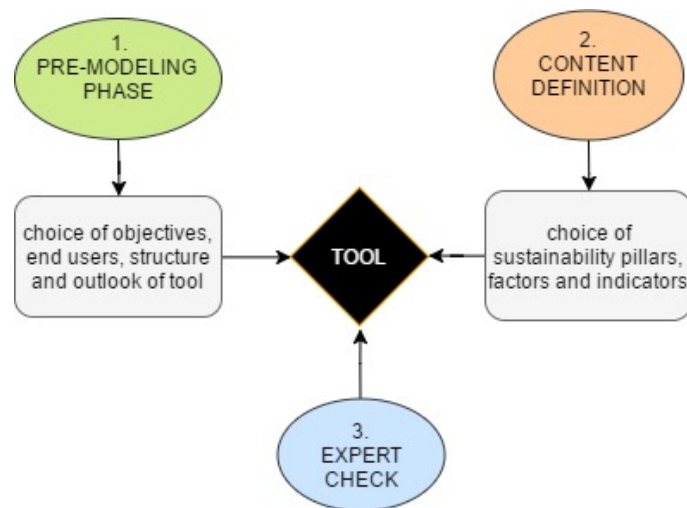


FIGURE 2 - DESIGN PHASE PROCESS

Secondly, to permit the assessment, it was needed to define sustainability factors and indicators in order to create boundaries of evaluation. The starting point for the decision of which sustainability factors to include or not in the tool was the analysis of the thesis research of the WUR student Giulia Ciaghi, “Participatory sustainability assessment of AMAP farmers in Maine-et-Loire, France: confronting farmers perceptions and practices”. During her thesis fieldwork, Ciaghi interviewed 35 diversified vegetable farmers in the department of Maine et Loire asking them to identify the main factors that influence the sustainability of their farming systems. In her work Ciaghi present a list of 89 factors (36 environmental, 27 social and 26 economics) that farmers recognized, with different degree of accordance, as important for the sustainability of their farm. These sustainability factors can have either a positive or a negative force of influence. To define the sustainability factors that compose the three pillars of sustainability of the tool, the thesis research conducted by Ciaghi (2017) has been use. Between the 89 factors funded by the research, only few of them were retained after a selection base on two criteria:

- The 10 most cited factors in each sustainability pillar;
- Factors that are not redundant or too abstract to be analysed on farm.

Seen the non-measurability of the factors derived by the thesis research of Ciaghi, it was necessary to transform them into measurable indicators to be able to assess them. The analysis of academic and grey literature helped to find indicators that could be related to the selected sustainability factors. Academic and grey literature were analysed to find relevant indicators adapted to diversified vegetable production (Argouarc'h et al., 2008; AgroBio Basse Normandie, 2015; FADEAR, 2014; IDEA, 2008).

Once the tool was created, an expert interview was conducted with Kaspar Poter, agronomic technical consultant specialized in vegetable production, with the aim of checking the accuracy of the indicators used and the appropriate format for such analysis.

## 2.4 TESTING OF THE TOOL

The purpose of this step was to test the tool, to check its accuracy and to see if it was fitting farmer's availability and expectations. The comparison of the two farms was not the final objective of this phase, but their results are used to illustrate how the tool should be used.

The comparison was made between two farms in the department that responded to the researcher's criteria: 1) being different in terms of land, economic results and work organization to see if the tool was able to assess different situations; 2) being interested in the tool and willing to assess their farms. For the last criteria, human exchanges with the farmers and the results of the survey were taken into account.

The interviews were conducted on the farms. The meeting accounted on a conversation - lasting around 2 hours - guided by the close-ended questions of the tool, followed up by a visit of the farms. In both cases the interview was taped. No transcription of the interviews was made, but the interviews were listened again to confirm the correctness of the notes taken during the conversations. After having processed the tool data, a meeting was planned with each farmer, according to their availability, to return them the research findings, with some of the researcher observations and suggestions. The return of the data to the farmers is not included in this work.

## 3. RESULTS

In this section are presented the main findings of this study. Again, the order of presentation follow the structure presented in figure 1.

### 3.1 RESEARCH

#### 3.1.1. LITERATURE REVIEW

##### Sustainability tools characteristics

Different sustainability tools have been created and many studies had as objective the assessment of their characteristics. According to different authors, the first step in the design of a tool is to contextualise the use and functioning of the tool. This phase is also called 'pre-modelling phase' or 'preliminary choices and assumptions' (Bockstaller *et al.*, 2008; Alkan, 2009). Hereby a summary of many of the possible choices that can be made in this phase of the creation of a tool for sustainability assessment (Table 1).

TABLE 1 - ELEMENTS OF CHARACTERIZATION OF A SUSTAINABILITY ASSESSMENT TOOL

Assessment characteristics	Possible choices
<i>Sustainability definition</i>	Different sustainability definitions can be retained and used according to the objective of the tool.
<i>Approach and objectives</i>	'Expert oriented' in which the assessment is the base for a policymaking or evaluation; 'Participatory' in which the local communities are the ends

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	group to benefit from the evaluation (Moreno-Pires and Fidelis, 2012). When a tool is participatory, it can include stakeholders in the definition of the indicators, in the data collection moment or in both. The objective is strictly related to the approach.
<i>Defining criteria</i>	They can be diverse and are related both to the objectives of the tool but also to its format. Between the criteria we can find adaptability, representativeness, low cost, measurability, etc. (Flint, 2014)
<i>Type</i>	Ex ante (in case of potential system assessed by a virtual model) or ex post (in case of the assessment of an already existing system) (Flint, 2014)
<i>Scale and system boundaries</i>	Global, local (territorial), sector-specific (eg. milk production sector), farm and plot (Flint, 2014)
<i>End users</i>	Farmers, policy makers, consultants
<i>Type of evaluation</i>	Quantitative, qualitative or mixed.
<i>Nature of indicators</i>	Simple indicators (based on one measure) or composite indicators (based on the accumulation of different indicators); Simple indicators (based on a causal variable) or predictive indicators (based on modelling results of a prediction) (Flint, 2014)
<i>Presentation of indicators results</i>	Table (very detailed but not reader friendly), charts (visually appealing but not very precise) or AMOEBA graph (useful to present non-equivalent information)(Flint, 2014)
<i>Management of data collection and analysis</i>	Consultant based method, which imply the help of an expert in performing the assessment or analysing the results; software-based assessments, which use the mean of a virtual platform to collect and analyse data; participatory based assessment, which take into account knowledge and expertise of local farmers.

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### **Sustainability assessment tools panorama**

The analysis of grey literature lead to the choice of two main inspirational tools, between the full landscape of sustainability assessment methods (Appendix 1). This choice was made based on the criteria cited in section 2.3. The two tools that were retained to take inspiration from are: “IDEA method” (*Indicateur de Durabilité des Exploitations Agricole*) and the “Manual of Peasant Agriculture” of FADEAR (*Fédération Associative pour le Développement de l’Emploi Agricole et Rurale*) (table 2).

TABLE 2 - SUSTAINABILITY ASSESSMENT TOOLS REVISED

Method	3 dimension of sustainability	Based on French context	Not required expert competences to fill in the assessment
<b>SAFE</b> (Van Cauwenbergh et al., 2007)	X		
<b>MESMIS</b> (Lopez Ridaura et al., 2000)	X		
<b>SAFA tool</b> (FAO, 2014)	X		
<b>RISE</b>	X		
<b>IDEA</b> (Vilain, 2008)	X	X	
<b>Peasant farming manual</b> (FADEAR, 2014)		X	X

SAFE was not considered to be useful as an inspirational tool due to its quantitative base and its complexity in the conduction of the assessment and elaboration of the data. MESMIS is a tool that is mainly used in an Latin American context for smallholders production, and the 7 attributes of sustainability which is based on – Reliability, Resilience, Productivity, Equity, Stability, Adaptability, Self-Reliance - can be rather confusing for people that do not have an academic background (Speelman et al., 2007; Masera et al., 2000). Its long process and the need of external and pluridisciplinary mediators makes that the MESMIS method was not considered to be an inspiration for the aim of this study. The SAFA tool, add the governance dimension to the three already cited, it is a freely downloadable tool, and do not need an external mediator to conduct the assessment. Even if the tool claims to be adaptable to different geographical context, in this study it was supposed that a tool that is too general do not permit to respond to specific context-related needs and issues. Therefore, neither the SAFA tool was taken into account.

The IDEA method has been published the first time in 2000. It is a method that has been promoted by the General Board for Education and Research of the French Ministry of Agriculture and created by an interdisciplinary group of researchers. The tools assess the three dimensions of sustainability, called in the tool agro-ecological, economic and socio-territorial. These three dimensions are divided in different sustainability components, which propose some sustainability indicators. In the booklet that aim to present the tool it is explained the objective of every indicator, the argumentation of why did they chose specifics indicators, precision regarding the way to measure them and to finish an illustrative example. Results are redistributing to the farmer on form of an AMOEBA graph with the performances of the farm on each sustainability components. The method assesses sustainability at the plot or farm level using value methods, meaning that it provides a final score to farms (Diazabakana, 2014). Functional units can be used to compare farm between each other's or to compare to national average or sustainability threshold. E.g. The gross margin per ha of the farm compared to the regional one. The method is considered by the authors as a management tools enhancing reflexion and highlighting sustainability components (Vilain, 2008). The researchers have made an effort to extend and adapt the sustainability indicators in order to assess the main types of French farm, in this sense the tool is not specific to one farming system (Diazabakana, 2014). The method has been retained because it responded to all the three criteria cited in section 2.3.

*“Agriculture paysanne le manuel”* (Peasant farming, the manual) is a tool created by FADEAR (*Fédération des associations pour le Développement de l’Emploi Agricole et Rural*). FADEAR is an association created in 1984 by peasant farmers. They regroup 60 associations that have for missions to educate peasant, accompany new farmer to install and to promote peasant and small-scale farming. The tool is based on the charter of the peasant agriculture (FADEAR, 1984). This charter is composed of three part: a definition about peasant farming, ten principles and six themes. To them, peasant agriculture: “ permit to a maximum of peasants spread on all the territory to live decently of their work producing on a farm at human size a healthy and quality food without compromising natural resources of tomorrow. It participate with the citizen to make the rural area alive in an environment appreciated by all”(FADEAR, 1984).

The tool is not using the three pillars of sustainability to assess the farms but the 6 themes related to peasant agriculture: 1) Working with nature, 2) Quality products, 3) Local development and rural dynamic, 4) Autonomy, 5) Sharing volume and production means, 6) Transmissibility of the farm. For each principle there are different criteria, groups of indicators and indicators giving a score. The indicators are composed of a title, the way to calculate it, and argumentation regarding the choice of the indicator and some clarification regarding the indicator.

FADEAR has developed software to report the scores and give the final result on the shape of a flower similar in its concept to an AMOEBA graph. The petals are bigger or smaller in function of the sustainability score of the principles (Figure 3). The tool aim to assess all kind of farming system but the part about ecological sustainability for vegetable producer and fruit producer is specifically to them. We can see a first step in recognizing farming system particularity. The method *“Agriculture paysanne le manuel”* has been retained especially for its specificity to the French small scale farming context.



FIGURE 3 - OUTLOOK OF THE RESULTS OF FADEAR EVALUATION

### 3.1.2 PARTICIPANT OBSERVATION IN A SUSTAINABILITY ASSESSMENT

The assessment took place in the farm EARL les Rochelles, at Saintes Gemmes sur Loire in the Maine et Loire department. The main actors that performed the evaluation were one consultant of FADEAR and two local FADEAR technicians learning how to use the tools. The assessment procedure lasted two days.

The first day they arrived on the farm in the afternoon. They started by a tour of the farm with the farmer. Then they passed three hours to ask question to the farmer in order to fulfil the diverse indicators. Sometimes questions were not making to much sense for the farmer so other questions were used to make him think about the indicator. For some indicators argumentation of why such an indicator were used in order to clarify the objective of the indicators. Once all the data were recorded, the consultant went away to work on the data collected in order to redistribute them to the farmer the next morning. For the afternoon the farmer was invited to the FADEAR office and an explanation of the result was given. The consultants delivered the results going through the assessment by each pillars, explaining the scores regarding the characteristic of the farm and highlighting positive and negative points.

### **3.1.3 FARMER'S SURVEY**

Thirteen farmers in total responded to the online questionnaire sent by the researcher. The number of respondents, way under the expectations, does not permit to have significant result but it can illustrate some trends that have been used as a base for the tool creation. The results of the survey show a wide range of farm characteristics, which makes them really diverse between each other's.

#### **Farmers and farm characteristics**

The sample is composed mainly of males (75%), with an average age of 36 (SD=6). This is way under the regional average, which is of 47 years old (Chambre d'agriculture 2012). Installed in average less than 10 years ago, 91% of the respondent did not come from an agricultural family. Nevertheless, 80% of those farmers followed agricultural studies (80%).

They work in average 45 hours per week during the low season (from October till March) and 58 hours during the high season (from April till September) (SD=11). For 42% of farmer this workload is consider as 'intense', for 33% as 'supportable', for 17% as 'adapted to the work', and for 8% 'not sustainable'. The average salary is about 1047€ per month (SD= 517€).

The average farm size is of 6.42ha. 58% of the farms were between 4 and 6 ha. On their farm, farmers are cultivating in average 47 vegetables, with a range from 25 to 78 different types of vegetables. 7 of the farmers are only producing vegetable while the 5 others have diversified production such as laying eggs or orchards. 91% of the farmers were certified organic, 41% following the principle of MSV (*Maraichage sur Sol Vivant*), which is a movement in France of vegetable production that goes beyond conservation agriculture. 33% of them declared to produce according to biodynamic principles.

In term of work organisation, half of the group were having at least one associate. Half of the group were having full time employees. Seasonal workers were employed by half of the group. 75% of the farmers declared to receive help from the family in term of free labour, representing in average a full time work through the year.

#### **Sustainability perception**

58% of the farmers questioned affirm to think often about the sustainability of their farms, 16% to think about it really often, 16% not frequently and 8% rarely. On the other hand none of the farmers questioned affirmed to have already performed on their farms a sustainability assessment. Nearly all of them (81%) agreed or strongly agreed that they feel the need to realise a global sustainability assessment of their farm. Almost all the sample 91% agreed or strongly agreed that a tool created

especially for diversified vegetable farmers would be useful. From the respondents, 82% of them would be interested or very interested to use such a tool on their farms.

### **Characteristics of the tool**

Regarding the time availability to perform a sustainability assessment, the farmers would be ready to dedicate to it 7.4 hours, which can be deduce on a full day of work. The range of the answers is from 1 to 24 hours. For 72% of the farmers, the tool should be based on both qualitative and quantitative data. Almost all the sample (90%) would appreciate if the tool would be realised on a digital form. The same amount of farmers (91%) would appreciate to repeat the test over the years and would be interested to share their results with other peers.

#### ***3.1.4 EXPERT INTERVIEW***

According to Kaspar Poter, the market demand for organic vegetable production is fastly growing in the region. Nowadays, there is more demand than offer and all the statistics show that it will evolve in the same way for the coming years. Organic producers do not have concurrence in direct selling since conventional vegetables in the region are sold for 90% in supermarket. On the other side, organic vegetables in Pays-de-la-Loire are sold for 67% directly to consumers through markets, box schemes, farm shops, etc. Kaspar Poter highlighted that in the region, consumer shown to be more and more willing to buy organic food and give preference to local production.

Even though the market for organic vegetable is flourishing, on the producer's side the situation is sometimes critical. From his experience advising farmers, he reports that most of the producers are complaining about their heavy workload, factor that can put in danger their mental wellbeing and family life. This problematic is confirmed by many other studies done on the situation of vegetable farmers in France (Ciaghi, 2017; Solidarité Paysans, 2016; AgroBio Basse Normandie, 2015). In response to this shortage of time many farmers decide to take an associate, without considering that it can represent a second level of danger. According to Kaspar Poter work observations, many farmers do not have the key to have a healthy communication, therefore the relation with their associate might become toxic.

On the ecological side, Kaspar Poter highlight the fact that due to climate change, extreme climatic conditions are more and more affecting vegetable production. As an example, in 2016 the region Pays-de-la-Loire lived a summer starting with heavy rain for one month, followed by a long drought and late frost. To face these extreme conditions and to secure their production farmers are answering by the expansion of protected surfaces such as greenhouses. Due to this increase in demand, in the market the price of second hand greenhouse highly increased. In 2009 it was possible to find them for 3€/m<sup>2</sup> while the price now is around 7€/m<sup>2</sup>. It is the way farmers find for securing their production. Climatic and economic fluctuations can play an important role on sustainability of local farms.

## **3.2 DESIGN**

### ***3.2.1 PRE-MODELING PHASE***

The pre-modelling phase was necessary to develop the shape and format of the tool (Appendix 3). The main objective of the tool is to bring farmers to reflect on their practices by the mean of an indicator-based assessment. The highlights of strengths and weaknesses can incite farmers to act in order to improve critical points. The aim of the adaptability of the tool to the production sector and geographical situation is to enhance coherence with diversified vegetable farmers life. The participatory based approach want to enlarge the adoption of the tool and makes possible for farmers to auto assess

themselves alone. This goal is reached by creating a tool that is easy to use, low cost, low time consuming. The tool is based on three pillars of sustainability (economic, social and environmental), divided in 25 criteria of sustainability, themselves divided in 33 measurable indicators. The compilation of the tool is subjective because based on farmers experience and observations. In table 3, the main guide choices are resumed.

TABLE 3 - CHARACTERISATION OF THE TOOL

Assessment characteristics	Researcher choice
<i>Sustainability definition</i>	<i>"A farm that is viable, livable, transferable and reproducible."</i> (Landais, 1998).
<i>Approach and objectives</i>	<p>The main objective of the tool is to permit to farmers to assess the sustainability of their farms at a "t" moment, in order to reflect upon weaknesses and strengths, and possibly change some practices in case they put in danger their sustainability.</p> <p>The final objective of the tool is not to 'grade' the farmers but to bring to a reflexion via a list of indicators to give attention to and with some questions to support reflexion. Therefore the aim is not to give an overall judgment on farm sustainability but to highlight critical points.</p> <p>The tool can also serve for new farmers that want to install to help design the farming system in a sustainable way.</p> <p>The approach is 'Participatory', because the farmers are involved in the tool definition criteria, in the assessment conduction and they are end users that benefit from the result of the evaluation.</p>
<i>Defining criteria</i>	<ul style="list-style-type: none"> <li>- <u>Context dependency</u>: to adapt the tool to production sector peculiarities and geographical situation;</li> <li>- <u>Coherence</u>: with what really matters for farmers in order to sustain their farm business;</li> <li>- <u>Participatory</u>: to empower farmers in the conduction of the assessment, the analysis and the following decision making process;</li> <li>- <u>Easy measurement, low cost and low time consuming</u>: to facilitate the adoption of the tool from farmers. Vegetable farmers are occupied all year long. They might have a lower work rhythm in winter, but still they hardly can take a break and dedicate time to unproductive task. In this sense, the tool needs to be concise. Secondly vegetable farmers often do not have a high capital and hardly make investment, in this sense the tool should be done without any expenses.</li> </ul>
<i>Type</i>	Ex post, in order to give a picture of the sustainability of the farm in a precise moment. Farmers can repeat the assessment over the years to observe possible evolutions.
<i>Scale, system boundaries</i>	<ul style="list-style-type: none"> <li>- Sector specific: dedicated to diversified vegetable production systems;</li> <li>- Geographic boundaries: France.</li> <li>- Individual scope: evaluation at farm level, of farmer life and the farm characteristic.</li> </ul> <p>The adaptation of the tool to a specific sector situation (vegetable production) and geographic territory is done to increase farmer's adoption</p>



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	of the tool, due to its familiarity.
<i>End users</i>	Farmers, as manager of an agro-ecosystem.
<i>Type of evaluation</i>	Mixed, qualitative and quantitative.
<i>Nature of indicators</i>	<ul style="list-style-type: none"> <li>- Three pillars of sustainability as main sections of the tool. The tool does not give general score by pillar since those scores could hide critical situations for individual indicators. The choice of using the three pillars is clarifying for the end users the gather of indicators data for similar fields.</li> <li>- Deriving from the sustainability pillars, there are sustainability factors, which represent non-measurable aspect of sustainability. They have a cumulated score that derive from the indicators results and can be used as benchmark to make decisions (Gras et al., 1989).</li> <li>- To measure the sustainability factors, simple indicators were chosen. Some of the indicators have a quantitative nature and permit farmers to situate themselves in comparison with the departmental average or others farmers performances. Qualitative indicators are used to collect data on perceptions and feelings of farmers.</li> </ul> <p>Open-ended questions will be used to incite farmers to reflexion. This method is subjective, since it come from farmers experience and it rely on their own observation.</p>
<i>Presentation of indicators results</i>	AMOEBE graph that farmers can create filling in an Excel file.
<i>Management of data collection and analysis</i>	Participatory based assessment: a high degree of involvement is asked to the end user since data collection, analysis and reflection is in farmer's hand for his own good. Questions need to be simple and clear, and the analysis process easy enough to permit every farmer to be able to conduct all the process alone.

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### 3.2.2 CHOICE OF SUSTAINABILITY FACTORS AND INDICATORS

The researcher decided to select 25 factors, which were in between the most cited factors from diversified vegetable farmers in Maine et Loire. The selection of the factors was made on the assumption that a factor cited by a high number of farmers has a high importance for the overall sustainability of vegetable farms.

The indicators and measurements are derived by literature, especially from the IDEA method, the 'Peasant Agriculture method' and other technical reports from French local institutions, to be the most context dependent possible. The full list of factors and indicators is presented in table 4.

TABLE 4 – LIST OF FACTORS (F) AND INDICATORS (I) CORRESPONDING TO DIFFERENT SUSTAINABILITY PILLARS

Social pillar		Environmental pillar		Economic pillar	
<b>F</b>	<b>Balance work and free time</b>	<b>F</b>	<b>Soil Quality</b>	<b>F</b>	<b>Productivity</b>
I	<ul style="list-style-type: none"> <li>- Days off</li> <li>- Number of hours worked in the week</li> <li>- Perception of the situation</li> </ul>	I	<ul style="list-style-type: none"> <li>- Rotation</li> <li>- Fertility management</li> <li>- Soil life</li> </ul>	I	<ul style="list-style-type: none"> <li>- Efficiency of the productive process.</li> <li>- Rentability of the production of the farm compared to regional average.</li> </ul>
<b>F</b>	<b>Mental well-being</b>	<b>F</b>	<b>Crop diversity</b>	<b>F</b>	<b>Investment</b>
I	<ul style="list-style-type: none"> <li>- Auto-estimation</li> <li>- Work intensity</li> </ul>	<b>F</b>	<b>Climate change</b>	I	<ul style="list-style-type: none"> <li>- Investment performance</li> <li>- Debt level</li> </ul>
<b>F</b>	<b>Technical amelioration</b>	<b>F</b>	<b>Conservation agriculture</b>	<b>F</b>	<b>Participation to local economic life</b>
I	<ul style="list-style-type: none"> <li>- Implementation of new technique</li> <li>- Participation to formations</li> <li>- Sharing knowledge</li> </ul>	I	<ul style="list-style-type: none"> <li>- Soil work practices</li> <li>- Soil cover</li> </ul>	I	<ul style="list-style-type: none"> <li>- Input bought locally</li> <li>- Product consumed locally</li> </ul>
<b>F</b>	<b>Quality product</b>	<b>F</b>	<b>Hedgerow</b>	<b>F</b>	<b>Working force security</b>
I	<ul style="list-style-type: none"> <li>- Certification</li> <li>- Transparency</li> </ul>	I	<ul style="list-style-type: none"> <li>- Size of the hedgerow</li> <li>- Maintenance of the hedgerow</li> </ul>		<ul style="list-style-type: none"> <li>- Amount of free labour</li> <li>- Stability of free labour.</li> </ul>
<b>F</b>	<b>Social relationship</b>	<b>F</b>	<b>Seeds and plants auto-production</b>	<b>F</b>	<b>Economic security</b>
I	<ul style="list-style-type: none"> <li>- Farmer network and exchange</li> <li>- Exchange and mutual assistance between farmer</li> <li>- Partnership and cooperation</li> </ul>	<b>F</b>	<b>Water access and use</b>	I	<ul style="list-style-type: none"> <li>- Financial dependency</li> <li>- Subsidy dependency</li> </ul>
<b>F</b>	<b>Physical tiredness</b>	I	<ul style="list-style-type: none"> <li>- Water origin</li> <li>- Volume of water consumed per hectare</li> <li>- Preserving water quality</li> </ul>	<b>F</b>	<b>Income</b>

I	- Health and musculo-skeletal disorders	F	<b>Biodiversity</b>	I	- Ability to create an income - Income satisfaction
F	<b>Motivation at work</b>	I	- Ecological regulation area - Biodiversity niches	F	<b>Administration</b>
F	<b>Autonomy and independence</b>			I	- Time dedicate to administration - Feeling regarding the time dedicated to administration
I	- Strategical choice - Technical choice				

The indicators will be measured by the farmers, according to their experiences and knowledge. The objective of the auto assessment is to give sovereignty to the farmers and empower them in the evaluation of their farms.

On the economic side, data will be easy to gather since is compulsory for farmers to do accountancy evaluation every year. They all have the same document recorded and approved by a centre of accountancy.

For the social sustainability qualitative questions are asked to the farmer regarding his/her quality of life. Those questions have a high degree of subjectivity. That is why they are complete with tangible and measurable questions such as the amount of time passed to extra work activity, the quality of life, etc.

Regarding environmental sustainability, mainly qualitative data or approximation of data are considered. This is due to the fact that quantitative test on the field such as soil assessment, biodiversity count, etc. are taking too much time and many time are representative of few elements. Since the tool aim to make a global diagnostic, indicators will be as much as possible based on the knowledge and practices of farmers.

The scoring for each factor is made by giving score with indicators. The weight of each indicator cans variate. Based on the literature, some indicators can have a higher importance. In general indicators coming from farmer perceptions are considered in this work as more important. This is due to the importance that we give to the subjectivity of the farmers. For example, a farmer that work 70 hours a week can perceive it as supportable while another farmer could work 50 hours and perceive it as unsustainable. The one that perceive it as unsustainable will score lower because the workload is problematic for him/her and not for the other. This choice was made since the tool is supposed to help farmers understanding which are their weaknesses and strengths, and what choices they can make to improve their systems.

### 3.2.3 EXPERT CHECK

Before testing it, the tool was presented to the expert interviewed, Kaspar Poter, to confirm the coherence of the tool and to possibly change indicators.

On the economic side, Kaspar Poter argued that it was important to measure farmer's satisfaction about their revenues. Some farmers have an income above the average but they might not be satisfied at all, while others might have a small income but it is sufficient for them. This perception can highly influence farmer's decision to continue or to abandon their business.

Regarding the environmental pillars, one important indicator that was not considered before the meeting with Kaspar Poter was the number of time they do use treatments on the plant ("*Indicateur de Fréquence de Traitements phytosanitaires*" - Phytosanitary treatment frequency). Even in organic production some phytosanitary treatments are allowed, but they can be highly toxic for the environment and human health (eg. Spinosad). Kaspar advise to ask if they were using these kinds of treatments as curative or preventive way. The plan of fertilisation is also a necessary point of ecological externality to study. Most of the diversified vegetable farmers do not count their input in term of nitrogen unit. In this sense it is possible that they do not respect the legislation about manure input. Kaspar advised me to add an indicator to ask if they were calculating their input and if they have a plan for it.

For the social pillars, Kaspar referred again to the most important factor for him, which are the working hours. It has sense for him to check if farmers put in place a strategy in order to be more efficient, to work less and gain free hours. Other important factor for social sustainability, according to the expert, is the fact of having the same employee over the years. For him, it is a sign that the employee feels committed to the farm, know to work independently and permit to discharge farmers from a part of their mental charge.

In figure 4, is presented an extract of the tool as should be use.

1	Pilier sociale	Max	Ref.	
1.1	Balance temps de travail et temps libre			Pillar of sustainability
1.1.1	Jours de repos			Sustainability factor
	Période basse: Plus 3j/s: 1 pt; 3j/s: 0.75pts; 2j/s: 0.5pt; 1j/s: 0.25pt; 0j/s: 0pt  Période haute: Plus 3j/s: 1 pt; 3j/s: 0.75pts; 2j/s: 0.5pt; 1j/s: 0.25pt; 0j/s: 0pt	1	Peden (2017)	Sustainability indicator
1.1.2	Nombre d'heures travaillées par semaine	1	Agrobio Basse-Normandie (2017)	References for the chosen indicators
	Période basse: Moins 35h/s: 1pt; entre 35 et 40h/s: 0.75pt; 40 et 45h/s: 0.5pt; 45 et 50h/s: 0.25pt; 50 et 55h/s: 0pt;  Période haute: Moins 40h/s: 1pt; entre 40 et 45h/s: 0.75pt; entre 45 et 55h/s: 0.5pts; entre 55 et 70: 0.25 pt; plus 70 h/s: 0pt.	1		Cumulative score for each indicator
1.1.3	Perception de la situation			Scale or point system to evaluate score per indicator
	Comment percevez-vous votre charge de travail? 0 peu intense 3 très intense	3		
	Comment ressentez-vous votre charge de travail? 3 Non durable 0 agréable.	3		
		T:10		Total score for the factor "Balance between work and free time"
<b>Pourquoi cet indicateur?</b> La balance entre le temps de libre et le temps de travail est le facteur de durabilité le plus cité par les maraîchers. Le jour de repos permet de se reposer, de réduire le stress, de passer du temps avec sa famille ses amis... Aussi l'entourage du maraîcher peut ne pas partager son rythme de vie, cela peut entraîner des situations où la vie professionnel devient un frein à la vie familial. Il arrive que des maraîchers arrêtent leurs activités par une charge de travail trop importante. Il convient alors de repenser son système et de voire ou des économies de temps pourrait être réalisé. Soit en mécanisation certaine tâches, en s'associant ou en améliorant ses itinéraires techniques afin de gagner en efficacité.				Section about importance of the factor and indicators
<b>Questions à se poser:</b> Est-ce que j'arrive à trouver du temps pour moi? Pour faire ceux que j'aime? Est-ce que je consacre le temps que j'aimerais à ma famille, mes amis? Comment eux le ressentent? Comment est reparti mon temps de travail? Ou je pourrais gagner du temps? Mon système de vente est-il efficace ou est-ce que je passe trop de temps sur certaine ventes? Pourrais-je mettre en place des itinéraires techniques plus efficaces en terme de temps?				Section including open-ended questions for farmer's self-reflection

FIGURE 4 - AN EXTRACT OF THE ASSESSMENT TOOL TO SHOW ITS STRUCTURE

## 4. TESTING

The testing of the tool was made on two farms, one situated in the north-west of Angers and the other one in the east of Angers. Both farmers participated in the online survey and accepted to take part of the testing of the tool at first contact. In the next two sections are presented the results of the testing on their farms and the considerations that can be made on their systems strengths and weaknesses. First the farms will be presented with their characteristics and secondly the performances for each pillars of sustainability will be presented and explained.

### 4.1 CASE STUDY 1: “LE CHAMP DES TREULS”

“Le champ des Treuls” is a farm situated at 50 km in the north of Angers in the city of Châtellais, department of Maine-et-Loire.

There are three associates working on the farm, which install in 2013. They bought the lands, the building and the machineries when they install which allow them a certain security and autonomy. During the summer they are welcoming WWOOFERS, until five at the top of the season. Two of the farmers followed basic study of one year which is compulsory in order to receive the help from the region when installing (nowadays can reach 33.000€ per associate). The three of them also had field experiences before starting.

The farm account on a total surface of 7 ha, but the surface cultivated is 3.5 ha. The remaining ha are borrowed to a neighbours to be used as pasture for sheep. The farmers produce organically more than 30 vegetables. Some experiences are made to implement conservation agriculture on 1 ha of land and in the greenhouse. They are not able yet to produce all their vegetables according to conservation agriculture practices so they produce the rest in “conventional organic”.

The soil is mainly clay sandy, which is one of the reason that motivate them to stop working the soil. Due to a sloppy area there is great variation in soil texture. The farmers are trying to rotate the vegetable production and the practices in function of the soil structure.

The water for the irrigation is coming from a pond and a drilling. The irrigation system are aspersion and drop by drop. The important mulch practices with straw and green manure allow them important water economy.

The vegetable are sold both in direct selling and to wholesalers. They sell their vegetable in direct through local producer market, farm shop and 50 weekly box schemes to customers in Paris. In addition they also sell a part of their production to local shop. One of their strength is to be three associates. This allow them to alternate for the delivery in Paris, market channel that is for them very high time demanding. Since they are install since only three years, their farming system is not finish to be set up. Today they are not satisfied of their income (600€ each per month).

## Social sustainability

Social Pillar	
Balance work and free time	3,5
Mental well-being	5
Technical improvement	4
Quality product	8
Social relationship	7
Farmer network and exchange	7,5
Physical tiredness	7
Health	7,5
work motivation	6

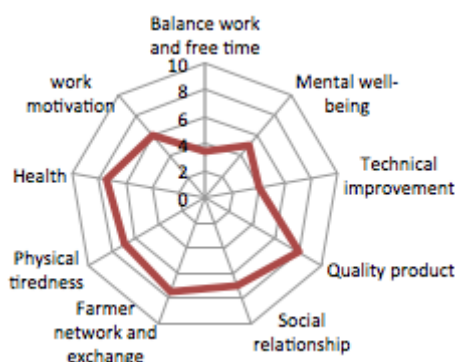


FIGURE 5 - SOCIAL PERFORMANCE OF CASE STUDY 1

**Strengths:** They have a good score in product quality due to their practices (transparency, official recognition) and to the presentation of their products. The farm is open to public every Saturday morning and they easily speak to the customers about their practices. In terms of farmer's networks and exchanges they actively participate to the organic farmer syndicate in order to develop the local organic sector. Regarding social relationships, an association was created to propose festival, shows and lectures on the farm.

**Weaknesses:** Due to their quite recent date of installation, they have a high workload. This heavy workload at the beginning of the installation can question many new farmers on the fact that they choose this profession. It is the case for some of the associates: the intense working periods raised some questions on the continuity of the project. Those intense period have strong effect on the work motivation, the health and the physical tiredness. We could observe in between the associates a strong difference in term of point of views. It was interesting to see that the one that was the less motivated was the one that was the more committed and was working the most. This could be explained by the fact that he has an important financial pressure due to his debt to buy the habitation on the farm. The fact that he was living on the farm made him also responsible for the irrigation in case of extreme weather condition (frost, wind) and keeps on him a continuous pressure. The other two associates were instead able to disconnect from the farm once leaving home. It will be important for them to discuss about those in order to not arrive to a breaking point.

## Economic sustainability

Economic Pillar	
Productivity	8
Investment	7
Economic security	8
Income	2
Participation to local economy	5
Administration	6
Working force security	1,5

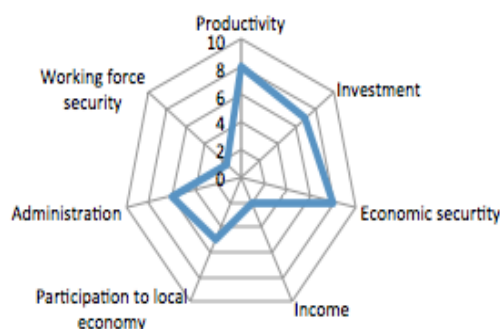


FIGURE 6 - ECONOMIC PERFORMANCE OF CASE STUDY 1

**Strengths:** They started the farm with a small loan, so the annual repayment is not too heavy to take in charge. Moreover, subsidies represent less than 20% of their total income. Regarding the productivity of the farm, their score is high mainly because they try to reduce at the maximum the costs by auto-producing. They do not have external workforce or annual employees, which for many farmers represent often the higher cost. Regarding administration, the time passed on it per week (3 hours) is considered low for the literature (Agrobio basse normandie; 2017). Nevertheless, for farmers that amount of time is perceived as insufficient to satisfy to their needs.

**Weaknesses:** As show before the farm have a really low score on the factor 'income'. This is due to the fact that they started since only three years. There system is not established yet. Adopting a low investments profile, the farmers needed some time before having all the necessary production materials at a good level. This can explain their incapability to make a decent revenue for themselves. Another possible weakness of their farming system is the labour. According to the farmers, they can have up to five WWOOFERS during the high season, but if one season they don't, they think that they would have some difficulties to do all the works without them. This working force is too unpredictable and unstable to be used as a base. It could put them in difficulty if the law about WWOOFING is changing, if the government facilitate agricultural employment or if one year nobody decide to come. The fact to deliver a part of their production to Paris as the advantage to be a big selling point, they deliver 50 boxes of 15 euros every week. But it is time demanding, is expensive in term of gasoline, have a negative impact on the participation to local economy. A market study around Angers to try to set up and AMAP (CSA) or to participate to a market with many consumer could resolve this situation.

### Environmental sustainability

Ecological Pillar	
Soil quality	9
Crop diversity	10
Climate change	10
Conservation agriculture	8
Hedgerow	10
Auto-production of seeds and plants	6
Water access and use	7
Biodiversity	8

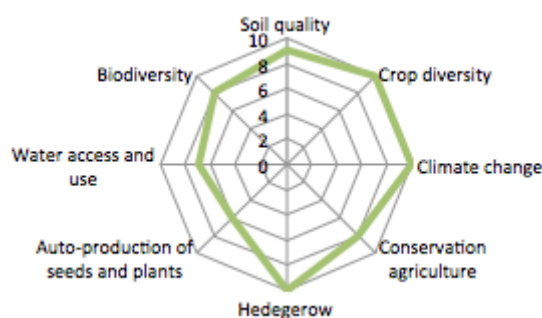


FIGURE 7 - ENVIRONMENTAL PERFORMANCE OF CASE STUDY 1

**Strengths:** Soil quality preservation through the adoption of conservation agriculture practices is a primordial objective for them. This explain the high score in conservation agriculture and soil quality. They had the chance to buy a farm where the nature was conserve: they estimate the age of their hedgerows to more than hundred years old. Also they benefit from diverse natural elements on the farm such as pond, humid area, slopes and pastures that enable them to have an important biodiversity.

**Weaknesses:** In general their performances are positive for these indicators. The only point that could be improved is the auto-production of seeds and plants but they already plan to develop it since they finish to build the plant nursery this year.

#### 4.2 CASE STUDY 2: “LE PAS-SAGE OBLIGÉ”

The farm “Le pas-sage obligé” is located at Longué-en-Jumelles, at 40 km from Angers. The farm is situated at four km from the river Loire, meaning the soil of the farm is very sandy. The farmer is installed since 2013, and his wife associate with him in 2015. They both followed a master's degree at ESA, the agricultural university in Angers. The farmer worked for two seasons in vegetable production and the wife worked as a technical assistant before installing.

They made the choice to start with important investment (100.000€ each) in order to be able reach quickly the cruising speed.

They are producing on 3.5 ha, and they have 5000m2 of greenhouse. The farming system has the particularity to be labour intensive. They are two associates and one employee working full time, two seasonal workers during the high season, one apprentice working part time. In addition, they have a trainees working full time all year long.

The particularity of their system is the time dedicated to the commercialisation of vegetables, which is demanding a full time job filled by Julia, the associate of the farm. They are selling vegetables in the farm shop and delivering to restaurants, organic shop and to consumers that pre-order on Internet their box of vegetables. This last point is asking them a lots of time to prepare the boxes, which are all different in products and quantities, and to deliver them to each household.

Another particularity of their system is to produce a large variety of crops in order to differentiate from other vegetable producers. They produce more than 50 vegetables and 150 different varieties. After three years they succeed to pay themselves 840€ per month. They are not satisfied of this revenue.

#### Social sustainability

Social Pillar	
Balance work and free time	7
Mental well-being	10
Technical improvement	1
Quality product	7
Social relationship	4
Farmer network and exchange	1,5
Physical tiredness	9
Health	6
work motivation	10

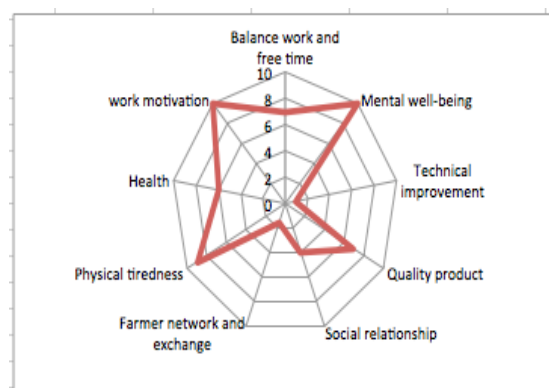


FIGURE 8 - SOCIAL PERFORMANCE OF CASE STUDY 2

**Strengths:** The farm has an important amount of employees for his size, this permit to enhance rural dynamic and employment. One of the characteristics of the farm is to offer products of high quality, which satisfy their clients, which are also restaurateurs. In order to have a higher amount of sugar and dry matter they limit the watering and insure a good fertilisation of



the soil via high amount of compost of 50t/ha. The farmer is happy of his daily activity and his motivation is at the top, and this could be one of the most important criteria.

**Weaknesses:** The farmer has a good technical knowledge due to his master degree and his year of experience but since he is install he did not found the time to participate to any formation and neither to take the time to visit other farms. During the interview he complain several time about his lack of techniques but he doesn't succeed to take time to improve it. Going to see other farms, participating to a group of farmers could enable him to find new techniques in order to gain in efficiency. In addition, the farmer define sarcastically himself as 'asocial'. He is adding to it the fact that he doesn't have the time to participate to social activities. He affirms to not have good relationship with farmers around him and do not have any type of contact with them.

### Economic sustainability

Economic Pillar	
Productivity	9
Investment	6
Economic security	8
Income	4
Participation to local economy	8
Administration	8
Working force security	3

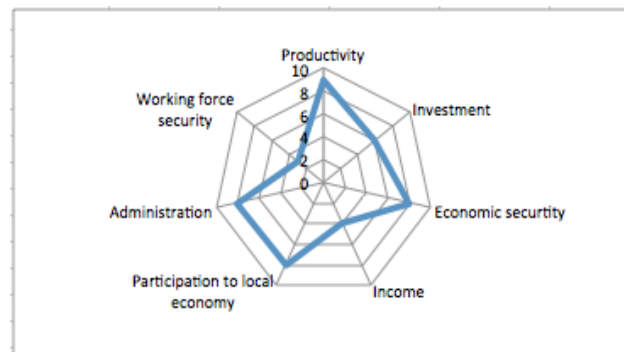


FIGURE 9 - ECONOMIC PERFORMANCE OF CASE STUDY 2

**Strengths:** The farm performs well in term of participation to local economy, since all of their products are sold locally within a radius of 50km. The farm has a positive local impact since it maintain relationships with consumers and create employment: one full time all year long, two seasonal workers for 6 months and one apprentice. The farmer do not feel pressure from the administration: Since he is not asking for the European subsidies he doesn't have so much paper work. Not asking subsidies makes the farmer autonomous and independent from political fluctuations.

**Weaknesses:** The reason why the factor 'income' is scoring low is mainly due to low farmer satisfaction. They are now install since three years and they are able to generate 850€ of income each. It is not a lot comparing to the amount of hours working but regarding the recent installation it is understandable. The farmer is mostly not happy about the return in term of money from all the efforts he is putting in the farm. Free labour from trainees is representing 1 worker full time all year long. They benefit from a high flow of trainees since they are close by a centre of formation for vegetable producers. The farmer considers this working force not so stable and think he could hardly do without. This could be a possible danger for the company if one day the centre of formation doesn't want to work with them any more since he would not be able to pay another worker. The farmer investments are considerable. He made the choice to invest in good equipment from the beginning in order to gain in productivity for the rest of his career. They invest for the installation of him and his wife was of 200.000€.

## Environmental sustainability

Ecological Pillar	
Soil quality	8
Crop diversity	9
Climate change	4,5
Conservation agriculture	7
Hedgerow	9
Auto-production of seeds and plant	0
Water access and use	10
Biodiversity	0

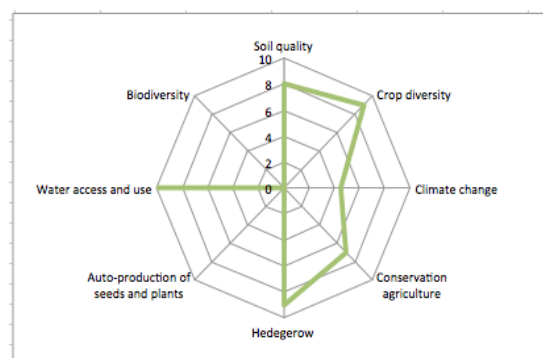


FIGURE 10 - ENVIRONMENTAL PERFORMANCE OF CASE STUDY 2

**Strengths:** The farmer score high in water access and use since he gets his water from an alimented river. It's mean that is not a water point that is consider restricted. Moreover, his water consumption is way under the regional average (3500m<sup>3</sup>/ha field, 13000m<sup>3</sup>/ha greenhouse). He is consuming 6000m<sup>3</sup> for the total of the 3 ha and for 0,5 ha of greenhouse. He justify it by the fact that he doesn't want to water too much in order to increase the percentage of sugar and dry matter in the vegetables, considered as a criteria of quality. Regarding the ecological impact of the farm, the farmer planted hedgerows for a total length of 700 m.

**Weaknesses:** The farm has a low score in biodiversity since there is not any place of the farm left for natural area. The farm had a natural pasture last year but he decided to expand his vegetable production area. Moreover, the farmer is highly dependent from external companies for the production of plants. He is buying 100% of his plants and seeds to companies located at 600 km. He estimates that to produce them is asking too much time and knowledge. Also he made the calculus and it show that paying someone all year long to take care of it will cost him as much money that to buy them. In the same time he has the guarantee of the quality of the plant and of the seeds. But to do not produce your own seeds and plants makes you more dependent from the producing company for the choice of the variety. Often, these types of varieties do not adapt to the local pedoclimatic context as well as local varieties.

### 4.3 RESULTS OF THE TOOL AND ITS EFFICIENCY

Following the first assessment and farmer's feedbacks, the tool has received many modifications. Different points in the assessment were seen as weak or not relevant. The needed changes can be divided in two categories: minor changes which refer more to details and major changes referring to important modifications of the tool.

#### Minor changes

We could observe great disparities regarding the qualitative questions, dependent from the different human perceptions of the three farmers of case study 1, which participated to the assessment together. In case of association, is suggested that each of the associate of the farm fulfil the qualitative parts of the tool alone first, to then discuss with the others associates of the scores obtain in each section. It will permit to create the space for discussion to a wide range of problematic and to highlight some subject that could be problematic for ones and not for others. Secondly we could observe important disparities

in term of sustainability performance regarding the years of experiences. It is important to express it to the farmers that will use the tool to contextualise his result in terms of experiences and seniority in the field.

### **Major changes**

During this first assessment the tool was deliver to the farmers with only the indicators and the way to assess them. The farmers were fulfilling them but not really understanding the meaning behind the indicators. It was decided to include in the tool, after each indicator, a section to explain why the indicator was chosen and its importance for overall farm sustainability. Moreover, being the tool based only on questions with a range of close-ended answers, farmers were just responding in an automatic way to the question of the tool, without focusing very much on the general meaning of a question. It was decided to add another part under each indicator with a list of open-ended question to lead farmers to reflect.

## **DISCUSSION**

The objective of this research was to create an adapted tool for assessing sustainability of diversified vegetable farmers in France. The leading criteria in the research process were a participatory approach to respond to farmer's needs and the context-dependency of the tool, to better-fit geographical, political and economic circumstances.

In order to better understand farmers needs and perceptions concerning a tool for sustainability assessment of their farming system, an online survey was created and sent to local producers. The low respondent rate of this survey (=13) can be interpreted in different ways: either vegetable producers were not interested to participate in the research because they did not feel the need for such an investigation; or they did not found the time to participate to the survey because of their high working load, which oblige them to give priority to production. Another possibility that can explain the low rate of participation stands in the format of the survey: proposed online, it implied a computer or smartphone possession, the familiarity with this type of technology, and an Internet connection. Even though 'off-grid' farmers might not be so numerous, there could be some of them that were left over from this survey because of lack of access to technology.

Because of these characteristics, the survey might have excluded all those farmers that did not comply with the above-cited criteria. This last factor could explain why the population of the sample was composed by young farmers with a high educational level. This could be an important bias of the study, that could hide an 'old fashioned' population of farmers which might be interested - or not - in such a tool and that might have a different opinions about its possible format and content. Moreover, with hindsight, the questionnaire of the survey was too focus on collecting data on farms and farmers characteristics rather than tool format and characteristics, which was the central interest of this research.

Regarding the testing phase, a limit of the sustainability assessment of the two case study was the imbalance between researcher objectives - to be able to test the tool on a real farm to assess the tool pertinence - and the interest of the farmers that participated in the study - to receive a feedback on their practices rather than improve the tool itself.

Nevertheless, the fact that the researcher positioned himself more as a creator of a service rather than a consultant, permitted to extrapolate important feedback from the case studies in order to improve the tool and adapt it for future uses.

The triangulation of research methods - expert interview, literature review, online questionnaire and case study assessment - permitted to tackle the subject from different perspectives and to finally elaborate a product - the tool - that was considered by the farmers as a positive asset.

According to the data collected through the survey, 75% of diversified vegetable farmers think often about the sustainability of their farming system and, even more of them, feel the need to make a global assessment of their farm. Moreover, they feel the need to assess their farm with a tool that has been shaped on their peculiar system characteristics. Farmers would be ready to dedicate a full day of work to perform the assessment and find interesting to perform the assessment year after year to evaluate the changes in performance and to share them with their peers. For farmers qualitative and quantitative data are both important to be able to have a complete vision of their situation.

The choice to base the 25 sustainability factors from the thesis work of Ciaghi (2017) can be seen both as an advantage and a limitation for the tool. An advantage since the factors are highly context-related and reflect clearly the main preoccupation of French diversified vegetable farmers when speaking about their business sustainability. On the other side, the factor listed in Ciaghi work reflects mainly the vision of diversified vegetable farmers selling directly to consumers. The same factors might not be as important for farmers that sell to wholesalers and that have a more specialized production. Moreover, the focus is on farmer's preoccupation to sustain themselves as a business, and do not take into account factors that overcome the farm boundaries and that are important at societal level (eg. waste management practices). Some indicators derived from the 25 sustainability factors are therefore limited in assessing farm sustainability in a wider societal context. This approach is therefore different from many other tools, which focus more on the impact that a farm has at societal level than its capacity to sustain itself (Van Cauwenbergh et al., 2007; FAO, 2014).

The choice to inspire many of the indicators from two French tools (FADEAR method and IDEA) was important to base the tool for vegetable farmers on a proven expertise of French farm assessment and French context knowledge.

All things considered, the researcher approach was enough dynamic to change more than one the design of the tool according to expert suggestions and farmers impressions. This redesign process helped to create a tool that respond to local needs and that can be easily understandable in the farming world and not only in the academic one.

One of the most important changes in the redesign of the tool was the inclusion of reflection questions at the end of each factor. In fact, the main objective of the tool is to bring farmers to reflect on their practices and life experiences. This in order to double check if their farms are still "viable, liveable, transferable and reproducible" (Landais, 1998). In this sense, the questions play a bit the role of a consultant, which role is not to indicate the way for changes but to guide towards self-reflection for farmers empowerment and improvement.

# CONCLUSIONS

The aim of this study was to permit diversified vegetable farmers to monitor their farm sustainability in an independent, costless, and time saving way through the creation of an assessment tool adapted to their professional, geographical and economic context.

The research questions have been answered completely thanks to the multidimensional approach used to study the subject of investigation.

The triangulation of data was a fundamental base for the creation of the tool, binding together field observations and academic expertise. The adaptation of the tool to diversified vegetable farmers situations was not only the response to a knowledge gap but also the reply to local farmer's needs, as highlighted by the survey.

The choice of basing the tool on the three sustainability pillars was considered as convenient since most of the farmers have familiarity with the words used to evaluate the different sustainability dimensions - social, economic, environmental - since they are highly 'vulgarised'. This approach was consciously chosen to avoid using complicated jargon more familiar to the academic world rather to the farming one. This is the case for many studies that used the MESMIS approach and that did not integrated in their assessment process the 7 attributes of sustainability because of their complicated integration to farmers realities (Speelman et al., 2007).

Testing the tool to get the feedbacks of the farmers give some positive results. The first case study was useful to understand that indicators and points are not enough to assure a critical evaluation. Inserting in open ended "reflection questions" after the indicators was an important step for the improvement of the tool. In this way, performances are not only measured and evaluated in a quantitative way. Farmers are also lead to reflect upon their open-ended answers and maybe questioned their practices.

Last but not least, the research process helped to develop a tool for assessing sustainability in a costless, easy, time saving and participatory way.

Costless because there is no need to employ an external expert or consultant to assess the farm. External consultant can ask an important contribution for their work, that farmers can often not afford. Moreover, being the tool based on data collected in a qualitative way, no extra costs are related to do expensive sampling and laboratory analysis. The tool is based on farmer's knowledge, experiences and perceptions, which are still, luckily, for free.

Secondly, the set-up of the tool makes it easy to understand and to use. Each factors has a section in which is explained to the farmer why it is important to evaluate that specific aspect in the framework of a sustainability assessment. Simple indicators permit to evaluate directly in which aspects of their daily life farmers need to improve. On the contrary, aggregate scores, which give one score per sustainability pillar, might have hide points for reflection. In terms of material for the evaluation, farmers just need a computer with installed excel to complete the point system sheet to have results in the form of the AMOEBA graph. This is the kind of material that every farmer should already have to be able to manage farm accountancy, orders, planning, etc. They can also do it by hand if they print the excel sheet.

The assessment is time saving. Compared to other methods (IDEA, FADEAR) which often takes a couple of days to assess the farm and return the results to the farmer, it has been proven in the field that the tool created with this research takes maximum an afternoon to the farmers.

To conclude, the method is participatory because farmers are fully responsible for the assessment of their farm. They need to collect their data, insert them in the excel file, interpret the graphs of results, reflect on the opens questions. All this in order to see if some changes are needed in terms of practices towards sustainability. This is a big advantage in terms of empowerment but can imply some disadvantages. For example, a possible lack of objectivity and zoom out in case of a difficult economic or personal situation. In this case, a suggestion for the farmers could be to find a peer that live in the close by territory and mutually assess the farmer of the other or their own farm but in presence of somebody else. In this sense, the peer can give some constructive external feedbacks seeing the situation from outside, not being influenced by internal stakes.

Many tools claim to assess sustainability at farm but many times the frontier between global level and farm level is difficult to do. Some of the indicators that make a farm sustainable can be in contradiction with the sustainability at the level of society. For example to improve the performance of work efficiency, a farmer might decide to use plastic mulch to reduce weeding time. But in the other hand by using plastic mulch they might have a negative grade at the societal level due to creation of waste, reducing the rural employment and the use of fossil fuel energy to produce the plastic. In this sense there might be a conflict between farm sustainability and society sustainability that should be taken into account in further researches.

In addition the tendency of sustainability tools promoters to claim the adaptability of their tool to very different geographical context and farming system is considered by the researcher as inappropriate. Farming systems are very different according to their production, scale, geographical and economic situation, which is what might be considered, as an indicator of sustainability for one system might not be the same for another farm. In this sense, there should be more effort to adapt sustainability assessment to different farming contexts, even if maybe maintaining a core of common baselines. In this sense, different stakeholders from different horizons, research institutes, policy makers, farmers and citizenships in different countries should work together on building common limits and objectives.

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# APPENDICES

## APPENDIX 1 - LITERATURE REVIEW ON SUSTAINABILITY ASSESSMENT TOOLS

Tool name	Promoter(s)	Sustainability definition	Functioning	Scale & end users	stakeholders
<b>SAFE</b> (Van Cauwenbergh et al., 2007; Sauvenier et al., 2005)	Université catholique de Louvain, Katholieke universiteit Leuven, Belgium	Environmental, economic and social aspects	<ul style="list-style-type: none"> <li>- From principles, to criteria, to indicators with reference values to compare to national averages;</li> <li>- Mainly quantitative;</li> <li>- Presentation of result through Amoeba graph</li> <li>- Need of an external mediator to conduct the assessment</li> </ul>	<ul style="list-style-type: none"> <li>- Product life cycle at farm level</li> <li>- Specific for Belgium farmers, but claim to be adaptable to other geographical regions.</li> <li>- All type of production sector are concerned</li> </ul>	Farmers, policy makers, researchers
<b>MESMIS</b> (Lopez Ridaura et al., 2000)	GIRA, Interdisciplinary Group for Appropriate Rural Technology, Mexico	7 attributes of sustainability: <ul style="list-style-type: none"> <li>- Productivity</li> <li>- Stability</li> <li>- Resilience</li> <li>- Reliability</li> <li>- Adaptability</li> <li>- Equity</li> <li>- Self-Reliance</li> </ul> - Evaluation of economic, social and environmental aspects	<ul style="list-style-type: none"> <li>- From attributes of sustainability, to Diagnostic criteria, to Critical points, to Indicators</li> <li>- Qualitative and quantitative indicators</li> <li>- Presentation of result through Amoeba graph</li> <li>- Six-steps assessment cycles which include the participation of end users in the definition of indicators</li> <li>- Need of an external mediator to conduct the assessment</li> </ul>	<ul style="list-style-type: none"> <li>- management system</li> <li>- agricultural, forestry and /or livestock production systems</li> <li>- family-based production systems</li> </ul>	inter-disciplinary team, mix of 'outsiders' experts and local participants
<b>SAFA tool</b> (FAO, 2014)	FAO	Social, economic, environmental and governance aspects	<ul style="list-style-type: none"> <li>- From mapping, to contextualization, to indicators</li> <li>- Qualitative and quantitative indicators</li> <li>- Presentation of result through Amoeba graph</li> <li>- The tool is freely downloadable from</li> </ul>	<ul style="list-style-type: none"> <li>- Enterprise level</li> <li>- Small scale producers</li> </ul>	Enterprise assessors, Independent assessors, Small scale producers

			internet; - No need of an external mediator to conduct the assessment		
<b>RISE (Grenz and Sereke, 2017)</b>	School of Agricultural, Forest and Food Sciences, Bern University of Applied Sciences	Social, economic, environmental and governance aspects	- Each indicator get a score that then is combined and can reach an optimum of 100, meaning a fully sustainable production. - Presentation of result through Amoeba graph - Need of an external mediator to conduct the assessment and to process the data of the assessment	- Farm scale	Farmers, Policy makers
<b>IDEA (Vilain, 2008)</b>	General Board for Education and Research of the French Ministry of Agriculture	Economic, Socio-territorial, Agri-Environmental aspects	- From dimensions, to components, to indicators - Each indicator is based on a point system; the points are added to possibly reach a 100% of the dimension; - Presentation of result through Amoeba graph - The tool need to be bought from internet, - need of an external mediator to process the data of the assessment	- Plot of farm level - All type of production sector are concerned	Farmers, Policy makers
<b>Peasant farming manual</b>	FADEAR	- 6 principles of the peasant agriculture: Working with nature, Quality products, Local development and rural dynamic, Autonomy, Sharing volume and production means, Transmission of the farm. - Principles,	- From theme to indicators; - Each indicator is based on a point system; the points are added to possibly reach a 100% of the principle; - Qualitative and quantitative indicators; - The assessment if for free but there is need of an external	- Farm scale - All kind of farming system - Specific to French context	Farmers

	criteria, group of indicators and indicators	mediator to conduct the assessment
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## APPENDIX 2 – FARMER’S SURVEY QUESTIONS

A	Farmer’s information
A.1	Age :
A.2	Sex : 1.Male      2.Female      3.Other
A.3	Are you from an agricultural family? 1.Yes      2.No      3.I don’t know
A.4	Date of installation:
A.5	Did you follow agricultural studies? 1.Yes      2.No      3.I don’t know  If yes which degrees of study do you have? 1. Brevet professionnel      2. Baccalaureat      3. BTS      4.Bsc Licence      5. Msc Master      6. Engineer      7. Phd      8. Others
A.6	Do you have associate? 1.Yes      2.No  If yes how many?
A.7	What is the size of you farm? (in hectare)
A.8	What are your channels of distribution? 1.Market      2.AMAP (CSA)      3.Farm shop      4. Canteens 5.Wholesalers      6. Restaurants      7. Box schemes      8. Internet      9. Other
A.9	How many species of vegetable are you producing?
A.10	Are you producing: 1.Under greenhouse      2. Under warmed greenhouse      3. Field
A.11	Do you have other production? 1.Yes      2. No  If Yes, which one? 1. Laying hens      2. Broiler chicken      3. Orchard      4. Processing      5.Ecotorism activity      6.Animal production      7.Cereal      8. Honey      9.Resale      10. Others
A.12	How many hours do you work in average per week? How many during the low season? How many during the high season?
A.13	How do you perceive your workload? 1.Adapted to the work      2.Tolerable      3. Intense      4. Non sustainable
A.14	Do you have employee? 1.Yes      2.No  If yes how many employee do you have?
A.15	Do you have seasonal worker? 1. Yes      2. No  If Yes, during which month?  How many full time job does it represent per year?
A.16	Do you benefit from free labour (family, friends, WWOOFING; internship)? 1. Yes      2. No  If Yes, during which month?  How many full time job does it represent per year?
A.17	How do you qualify your method of production? 1. Biodynamic      2. Organic      3. Reasoned 4.Conventional      5. Close to organic practices but without certification      6. Maraichage sur Sol Vivant

<b>B Perception of sustainability assessment</b>	
<b>B.18</b>	At which frequency do you ask yourself the question of the sustainability of your farm? 1. Not frequently at all 2. Not frequently 3. Frequently 4. Really frequently
<b>B.19</b>	Do you know some farm diagnostic tool? 1. Yes 2. No  If yes, Which one do you know?
<b>B.20</b>	Did you already realise a sustainability assessment of your farm? 1. Yes 2. No
<b>B.21</b>	What is your degree of affirmation with this question?  You feel the need to realise a sustainability assessment of your farm.  1. Don't agree at all 2. Don't agree 3. Agree 4. Strongly agree
<b>B.22</b>	What is your degree of affirmation with this question?  You think that a tool to assess specifically diversify vegetable farm would be useful.  1. Don't agree at all 2. Don't agree 3. Agree 4. Strongly agree
<b>B.23</b>	Would you be interested to use it on your farm?  1. Not interested at all 2. Not interested 3. Interested 4. Strongly interested

<b>C</b>	<b>Desired characteristic of the assessment tool</b>
<b>C.25</b>	How much time would you be ready to dedicate to the assessment ( In hours)?
<b>C.26</b>	Would you prefer that the tool repose on qualitative data from your personal knowledge about the farm, or from quantitative data coming from field measurement?  1. Qualitative data 2. Quantitative data 3. Both
<b>C.27</b>	What is your degree of affirmation with this question?  You would appreciate that the tool would be on a digital format. 1. Don't agree at all 2. Don't agree 3. Agree 4. Strongly agree
<b>C.28</b>	What is your degree of affirmation with this question?  You would appreciate that the tool would be on a numeric format 1. Don't agree at all 2. Don't agree 3. Agree 4. Strongly agree
<b>C.29</b>	What is your degree of affirmation with this question?  You would appreciate to repeat the assessment over the years. 1. Don't agree at all 2. Don't agree 3. Agree 4. Strongly agree  If yes, every how many years? 1. 1 year 2. 2 years 3. 3 years 4. 5 years 5. 10 years

C.30	<p>What is your degree of affirmation with this question?</p> <p>You would be ready to exchange your information with other farmers.</p> <p>1. Don't agree at all 2. Don't agree 3. Agree 4. Strongly agree</p>
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D	Conclusion
D.31	<p>I would like to be inform of the advancement of the research:</p> <p>1. Yes      2. No</p> <p>If yes, please leave your email address.</p>



## APPENDIX 3 –TOOL FOR THE SUSTAINABILITY ASSESSMENT OF DIVERSIFIED VEGETABLE FARMS

Profil de l'exploitant:

Maraîchers:

SAU totale:

Surface plein champs cultivé:

Surface couverte:

Date d'installation:

1	Pilier sociale	Max		Reference
1.1	Balance temps de travail et temps libre			
1.1.1	Jours de repos			
	Période basse: Plus 3j/s: 1 pt; 3j/s: 0.75pts; 2j/s: 0.5pt; 1j/s: 0,25pt; 0j/s: 0pt  Période haute: Plus 3j/s: 1 pt; 3j/s: 0.75pts; 2j/s: 0.5pt; 1j/s: 0.25pt; 0j/s: 0pt	1  1		(Peden, 2017)
1.1.2	Nombre d'heures travaillées par semaine			
	Période basse: Moins 35h/s: 1pt; entre 35 et 40h/s: 0.75pt; 40 et 45h/s 0.5pt; 45 et 50h/s: 0.25pt; 50 et 55h/s: 0pt;  Période haute: Moins 40h/s: 1pt; entre 40 et 45h/s: 0.75pt; entre 45 et 55h/s: 0.5pts; entre 55 et 70: 0.25 pt; plus 70 h/s: 0pt.	1  1		(Agrobio Basse-Normandie, 2017)
1.1.3	Perception de la situation			
	Comment percevez-vous votre charge de travail? 3 peu intense 0 très intense  Comment ressentez-vous votre charge de travail? 3 Non durable 0 agréable.	3  3  T:10		
<p><u>Pourquoi cet indicateur?</u>            La balance entre le temps de libre et le temps de travail est le facteur de durabilité le plus cité par les maraîchers. Le jour de repos permet de se reposer, de réduire le stress, de passer du temps avec sa famille ses amis...            Aussi l'entourage du maraîcher peut ne pas partager son rythme de vie, cela peut entraîner des situations où la vie professionnel devient un frein à la vie familial.            Il arrive que des maraîchers arrêtent leurs activités par une charge de travail trop importante. Il convient alors de repenser son système et de voir où des économies de temps pourrait être réalisé. Soit en mécanisation certaines tâches, en s'associant ou en améliorant ses itinéraires techniques afin de gagner en efficacité.</p>				

<p><u>Questions à se poser:</u>  Est-ce que j'arrive à trouver du temps pour moi? Pour faire ceux que j'aime?  Est-ce que je consacre le temps que j'aimerais à ma famille, mes amis?  Comment eux le ressentent?  Comment est réparti mon temps de travail? Ou je pourrais gagner du temps? Mon système de vente est il efficace ou est-ce que je passe trop de temps sur certaine ventes?  Pourrais-je mettre en place des itinéraires techniques plus efficaces en terme de temps?</p>				
1.2	Bien-être mental			
1.2.1	Auto-estimation			
	À combien estimez-vous votre qualité de vie?  Auto-estimation de 1 à 5pts  1 très mauvaise 5 très bonne	5   t:5		(IDEA, 2008)
1.2.2	Intensité du travail			
	Nombre de semaine par ans le maraîcher se sent dépassé par le travail. ->(10-N)/2	5  t:5 T:10		(IDEA, 2008)
<p><u>Pourquoi cet indicateur:</u>  Le fait que le maraîcher se sente bien dans son travail est primordiale. La qualité de vie résulte d'interactions complexe entre la sphère privée et professionnelle. De cette façon elle n'est pas quantifiable.</p> <p><u>Questions à se poser:</u>  Est-ce que j'aime mon quotidien?  Est-ce que je pense à passer à autre chose?  Mon travail est-il une source de stress? Est-ce que j'arrive à le surmonter?</p>				
1.3	Amélioration technique:			
1.3.1	Implémentation de nouvelles technique			
	L'année passée le maraîcher a-t-il implémenté de nouvelles techniques? Si oui 1pt  Pour gagner du temps? Si oui 1pt  Pour augmenter la qualité des produits? Si oui 1pt  Pour réduire le stress au travail? Si oui 1pt	1  1  1  1 t:4		(Ciaghi, 2017)
1.3.2	Participation à des formations			
	L'année passée le maraîcher a participé à plusieurs journées de formation: 3j: 3pts; 2j: 2pts; 1j: 1pt.	t:3		

		T:10		
1.3.3	Partage de connaissances			
	Avez-vous visité d'autres exploitation maraîchère dans l'année? (Visite à viser technique) Si oui 1,5pts	1,5		
	Faites-vous partis d'un groupe d'échange de pratiques? (Réseaux Maraîchage Sol Vivant, MABD...) Si oui 1,5pts.	1,5		
		t:3 T:10		
<p><u>Pourquoi cet indicateur?</u>  S'améliorer techniquement permet de gagner du temps sur certaine tâche, améliorer la qualité de ses produits... Les premières années après l'installation les maraîchers ont tendances à rechercher les possible améliorations afin de construire un système de production efficace.  Si le maraîcher perçoit des lacunes dans son système il pourrait chercher à l'améliorer.</p> <p><u>Questions à se poser:</u>  Suis-je totalement satisfait de mon exploitation?  Si non que puis-je faire pour améliorer les points qui me déplaisent?  Ai-je les connaissances pour? D'autre maraîcher ont-ils déjà résolu ce problème? Comment avoir accès à l'information?  J'arrive à trouver du temps pour améliorer mes outils, essayer de nouveaux itinéraires techniques?</p>				
1.4	Qualité du produit			
1.4.1	Reconnaissance officielle via certification			
	Le produit est-il officiellement reconnu par une organisation officielle Demeter, Nature et Progrès, Bio Cohérence 5/5 Label UE agriculture biologique 4/5 AOP 3/5 Indication géographique protégé, spécialité traditionnel garantie 2/5 Certificat de conformité du produit. 1/5	5          t:5		(FADEAR, 2014)
1.4.2	Transparence			
	Quels sont les autres moyens que le maraîcher utilise pour être transparent sur ses techniques de production?  Portes ouvertes sur la ferme 2pts  Accessibilité pour le consommateur sur les lieux de production de transformation et de commercialisation. 1pts  Contrôle de la qualité de vos produits par des analyses nutritionnel ou réfractomètre? 1pt  Passez-vous du temps à expliquer vos méthodes de production/ à échanger avec vos consommateurs? 1pt	   2   1  1  t:5 T:10		(FADEAR, 2014)
<p><u>Pourquoi cet indicateur?</u>  Le système de maraîchage en vente direct est principalement basé sur une production de qualité en</p>				

relation direct avec les consommateurs. La qualité des produits est donc primordiale afin de fidéliser ses clients, valoriser son travail et en être fier.

Questions à se poser:

Mes clients sont-ils fidèles? Ai-je des retours positif sur la qualité de mes légumes?

Est-ce que je mets en place des stratégies afin d'augmenter les taux de sucres?

Quel est l'importance que je donne à la certification?

1.5	Relation sociale			
	-> Participation à une association ou à la vie politique local 3pts	3		(IDEA, 2008)
	-> Prise de responsabilité dans une association ou dans la vie politique local 3pts	3		
	-> La ferme est ouverte à la vente direct ou organise des journées à thème ou des portes ouverte. 3pts	3		
	-> Le maraîcher habite sur l'exploitation 1pt	1		
		T:10		

Pourquoi cet indicateur?

Les agriculteurs sont de moins en moins dans les campagnes, pourtant leurs point de vue et les valeurs qu'ils défendent sont écoutés. La participation à des activités non professionnelle permet de dialoguer et de rencontrer les autres acteurs.

Questions à se poser:

Est-ce que je prends part à la dynamique rurale?

Ai-je des échanges régulier avec mes voisins? Est-ce que je les connais?

Ai-je un rôle dans la dynamique de mon territoire?

1.6	Réseaux d'agriculteurs et échange			
1.6.1	Échanges/ entraide entre agriculteurs.			
	-> Le maraîcher procède-t-il à des échanges de service ou de biens marchands ou non-marchand avec les agriculteurs voisins? Si oui 1.5pts	1,5		(FADEAR, 2014)
	-> Le maraîcher bénéficie-t-il ou aide-t-il d'autres agriculteurs de manière occasionnel? Si oui 1.5pts	1,5		
		T:3		
1.6.2	Partenariat et coopération.			
	->A quel partenariat et coopération le maraîcher participe-t-il?			(FADEAR, 2014)
	Participation à une réalisation microéconomique (AMAP, GFA, partenariat artisan commerçant... ) 1.5pts	1.5		
	Participation à une CUMA, une activité de développement ex: GABB, CIVAM, Fadear... 1.5pts	1.5		
	Prise en charge d'une responsabilité d'une de ces structures 2 pts	2		

	Recherche de relations quotidiennes ou fréquentes avec les consommateurs 2 pts	2		
		T:7		
<p><u>Pourquoi cet indicateur?</u>  Les échanges sur le territoire ne sont pas seulement marchand, les interactions non monétaire participe à la bonne santé économique du territoire. Les partenariats engendre une solidarité entre les acteurs d'un même territoire. Aussi ils permettent d'impulser des dynamiques locales qui fixent une partie de la valeur ajoutée sur le territoire.</p>				
1.7	Fatigue physique			
	->Combien d'heures dormez-vous par jour?  Plus de 8h: 5pts; 7h: 4pts; 6h: 3pts; 5h:2pt; 4h: 0pt  ->Comment percevez-vous ce rythme de sommeil?  5 très convenable 0 Non durable	5         5         T:10		
<p><u>Pourquoi cet indicateur?</u>  Il n'y a pas d'agriculture durable sans agriculteur. Afin de durer dans le temps, il est nécessaire de pouvoir être reposé.</p> <p><u>Questions à se poser:</u>  Est-ce que je dors assez? Est-ce que je me sens régulièrement fatigué? Je me sens surmené régulièrement?</p>				
1.8	Santé/ Trouble musculo-squelettiques			
	-> Durant l'année passée, avez-vous souffert de Trouble Musculo Squelettique? Si non 3 pts  ->Durant l'année passé, avez-vous souffert de TMS grave vous empêchant de travailler? Si non 4 pts  -> Faites-vous attention à l'usage que vous faites de votre corps? (Par exemple en suivant des formation d'ergonomie, en suivant une pratique sportive...) Si oui 3pt.	3         4         3         T:10		(MSA, 2014)
<p><u>Pourquoi cet indicateur?</u>  Les TMS représente plus de 90% des arrêt maladie. Le corps est le premier outil de travail il est nécessaire d'y faire attention.</p> <p><u>Questions à se poser:</u>  Est-ce que je fais régulièrement attention dans mes positions de travail aux muscles qui restent tendus? Je suis conscient des bonnes et mauvaises positions de travail? J'arrive à les respecter? Même en période intense?  Je me sens bien dans mon corps? Je ne force pas si je me sens fatigué?</p>				

Je fais attention à régulièrement changer de tâches? J'adapte mon plan de travail? (table de semis, bureau...)				
1.9	Motivation au travail			
	->Comment estimez-vous votre motivation actuelle pour le métier de maraîcher?  0pt pas du tout motivé 10pt tout à fait motivé	T:10		
Pourquoi cet indicateur? C'est quand le travail n'est plus fait avec plaisir mais avec stress, anxiété... que la plupart des accidents du travail et TMS arrive.  Questions à se poser: Suis-je heureux d'aller travailler chaque matin? Est-ce que j'ai tendance à souvent me plaindre?				
1.10	Autonomie et indépendance			
1.10.1	Choix stratégique			
	->Regardant les choix de productions, quel degré d'autonomie vous estimez avoir?  2 très autonome 0 pas autonome du tout  -> Regardant les choix de distributions, quel degré d'autonomie vous estimez avoir?  2 très autonome 0 pas autonome du tout  -> Regardant les choix d'investissement, quel degré d'autonomie vous estimez avoir?  2 très autonome 0 pas autonome du tout	2   2   2 t:6		(FADEAR, 2014)
1.10.2	Choix technique			
	->Regardant les choix de variétés, quel degré d'autonomie vous estimez avoir?  2 très autonome 0 pas autonome du tout  ->Regardant les choix de technique de production, quel degré d'autonomie vous estimez avoir?  2 très autonome 0 pas autonome du tout	2   2   t:4 T:10		(FADEAR, 2014)
Pourquoi cet indicateur? Choisir ses techniques de production est un gage d'autonomie et d'indépendance envers les aléas économique et politique.				

Questions à se poser:

Est-ce qu'un organisme extérieur réalise un suivi technique de mes cultures? Quelle liberté j'ai dans mes décisions techniques?

Les investissements que j'ai réalisés ne m'emprisonnent pas dans certaines techniques de travail?

Les productions présentes sur votre ferme ont-elles été choisies délibérément ou elles étaient présentes au moment de l'installation?

Aimeriez-vous faire d'autres choix de production que vous ne pouvez pas réaliser concernant votre système?

Quels sont les raisons de votre schéma de commercialisation?

Ces productions vous rendent-elles dépendant de certains fournisseurs ou clients?

2	Pilier écologique			
2.1	Qualité du sol			
2.1.1	Rotation			
	-> Quel est le temps moyen de rotation? Moins de 1 an: 0pt; entre 1 et 3 ans: 1pt; entre 3 et 5 ans: 2pt Plus de 5 ans: 3 pts	2 t:3		(FADEAR, 2014)
2.1.2	Raisonnement de la fertilité			
	->Comment est raisonné la fertilisation?  Nourrir la plante avec des fertilisants chimiques 0pt Nourrir le sol par l'utilisation d'amendement organique? 2pts  -> Si utilisation d'amendement organique, de quelle nature sont-ils?  Broyat de déchets verts, BRF 1pt Compost, fumier composté 1pt Engrais vert 1pt	2    1 1 1  t:5		(FADEAR, 2014)
2.1.3	Vie du sol			
	->Quelle pratique est utilisée pour respecter la vie du sol?  Incorporation des résidus de cultures 1pt  Mesure régulière des taux d'humus 1pt	1  1 t:2 T:10		(FADEAR, 2014)
<p><u>Pourquoi cet indicateur?</u></p> <p>La qualité du sol est le premier facteur influençant la durabilité écologique selon les maraîchers interviewés.</p> <p>Le sol est le support de la culture, il en va de soi qu'un sol en mauvais état ne sera pas propice au bon développement de la plante. D'autant plus qu'en agriculture biologique les intrants permettant de pallier à la qualité du sol sont plus limités.</p>				

L'indicateur sert de piste afin de mener une réflexion sur le management de votre sol.

Questions à se poser:

Suis-je satisfait de la qualité de mon sol?

De quel manière réagit en fonction des aléas climatique?

Que puis-je faire pour améliorer sa qualité?

2.2	Diversité de culture			
	->Y a-t-il sur la ferme des variétés rustique et local ainsi que des méthodes de sélection paysanne? 2pts	2		(FADEAR, 2014)
	->Combien d'espèces sont produites sur l'exploitation?	4		
	Moins de 10 espèces: 0pt; entre 10 et 20 espèces: 2 pts; plus 20: 4 pts.			
	->Y a-t-il plusieurs variétés par légumes? Si oui 2pts	2		
	-> Quand cela est-il possible favorisez-vous le mélange d'espèce sur la même parcelle? Si oui 2pts	2		
		T:10		

Pourquoi cet indicateur?

La diversité des cultures est importante afin de pouvoir d'attirer et de fidéliser la clientèle durant l'année. Aussi Le fait de multiplier les différentes espèces et variétés permet de sécuriser la production en cas de maladie, mauvais rendement...

En 100 ans on estime avoir perdu 75% de nos variétés de fruits et légumes. Le maraîcher a un rôle important à jouer regardant sa conservation.

Questions à se poser:

Est-ce que je cherche à avoir une grande diversité de culture ou je favorise celles que je sais contrôler?

Quelle autres cultures je pourrais mettre en place?

Suis-je satisfait de la répartition de mes cultures sur l'année?

2.3	Changement climatique			
	->Une attention particulière est porté aux lieux reconnu officiellement écologiquement sensible? Si oui 3pts	3		(FADEAR, 2014)
	-> Participation aux opération de collecte de déchet? 1pt	1		
	Utilisation de produit recyclé? 1pt	1		
	-> Une stratégie est mise en place afin de pallier aux effets du dérèglement climatique?			
	Augmentation des surfaces couvertes? Si oui 2,5pts			
	Augmentation de la surface irrigable? Si oui 2,5pts	2,5		
		2,5		
		T:10		

Pourquoi cet indicateur?

Le changement climatique est une réalité que les maraîchers expériences de plus en plus. Le climats est



de plus en plus instable.

Face à cela nous pouvons faire deux choses: nous équiper pour pallier à ses effets et faire en sorte que cela n'augmente pas.

Questions à se poser:

Suis-je conscient de mon impacte sur le changement climatique?

Quelles stratégies je mets en place pour lutter contre?

2.4	Agriculture de conservation			
2.4.1	Travail du sol			
	Utilisation du labour. Si non 1pts Utilisation du cultivateur. Si non 1pts  Pour la gestion des adventices: Paillage 2pts Herse étrille 1pts Binage 0pt  Essais d'application d'itinéraire techniques en non-travail du sol. 2pts	1 1  2  2 t:6		
2.4.2	Couverture du sol			
	Quelle est le pourcentage de terrain couvert avec un engrais vert après la récolte?  -> (Hectare planté en engrais vert/ nombre total d'hectare)*100= % de sol couvert  Plus de 70: 4pts; entre 50 et 70%: 3pts; entre 30 et 50%: 2pts; entre 10 et 30% 1pt; sous 10%: 0pt	4   t:4 T:10		(Argouarc'h et al, 2008)
<p><u>Pourquoi cet indicateur?</u> Les techniques d'agriculture de conservation ont été identifiées comme un facteur de durabilité. Les trois principes de l'agriculture de conservation sont un abandon du travail du sol, une couverture permanente du sol et une rotation et diversification importante des cultures. L'engrais vert est cité comme un facteur important de durabilité pour plusieurs raisons: Il permet de garder une couverture du sol durant toute l'année, de fertiliser le sol en lui apportant de la matière organique, de travailler le sol par l'action des racines de l'engrais verts...</p> <p><u>Questions à se poser:</u> Est-ce que je connais les grands principes de l'agriculture de conservation? Est-ce que j'y vois un intérêt? Comment le mettre en place dans mon système? Est-ce que je connais les différents types d'engrais verts? Leur bienfait pour le sol et les cultures? Est-ce que je sais le mettre en place? Comment le détruire en fonction de l'effet attendu?</p>				
2.5	Présence de haies			
2.5.1	Dimensions des haies			
	-> Présence de structure linéaire (Haies fossés, lisières, bords de	5		(Ochsenbein,

	champs...) pouvant servir de refuges pour la biodiversité:  Moins de 20m/ha: 0 pt; plus 20m/ha: 1pt; plus de 40m/ha: 2pts; plus 60m/ha: 3pts; plus de 80m/ha: 4pts; plus de 100m/ha: 5pts	t:5		2006)
2.5.2	Entretien des haies			
	Haies plantées sur bâches tissé/ bâches plastique? Si non 1pt  Haies taillées environ tous les 10 ans pour qu'elles repartent? Si oui 1pt  La haie contient de grands arbres? Si oui 1pt La haie n'est pas coupé latéralement elle peut s'étendre. Si oui 1pt  Des arbustes indigènes sont plantés dans le troues des haies? Si oui 1pt	1  1  1  1  1 t:5 T:10		
	<u>Pourquoi cet indicateur?</u> Les haies ont de multiples bénéfices, elles sont des niches de biodiversité pour les auxiliaires, permettent de protéger du vent et de l'érosion...  <u>Questions à se poser:</u> Quel est l'intérêt des haies sur mon exploitation? En ai-je assez? Me rendent elles les services désiré?			
2.6	Autoproduction de graines et de plants			
	Quelle est la proportion de plant acheté sur la quantité totale de plant utilisées (en surfaces)?  Entre 0 et 50%: 5 pts; entre 50 et 70%: 4pts; plus de 70% mais le greffage et les plants sont "personnalisés" par le fournisseur: 3pts; 100% mais les plants sont rustiques et locaux: 2pts; 100% et les plants et semences sont standards: 0pt  Quelle est la proportion de semence acheté sur la quantité totale de semence utilisées (en surfaces)?  Entre 0 et 50%: 5 pts; entre 50 et 70%: 4pts; entre 70% et 90%: 3pts; 100%: mais les semences sont rustiques et locales: 2pts; 100% et les semences sont standards: 0pt	5		(FADEAR, 2014)
<u>Pourquoi cet indicateur?</u> Auto production de graines et de plant permet d'avoir une plus grande autonomie. Aussi produire ses graines et ses plants soi-même permet d'avoir un plus large choix de variétés. Pour finir le fait de refaire ses propres semences permet que la variété s'adapte au terrain et aux conditions locales.  <u>Questions à se poser:</u> Quel est-ce que j'ai à gagner et à perdre à faire mes propres plants et semences? Lesquelles je pourrais facilement réaliser moi-même? Lesquelles non? Quelles connaissances me font défaut et comment je pourrais les avoir?				

2.7	Accès à l'eau et son utilisation			
2.7.1	Provenance de l'eau			
	-> Quel type de prélèvement de l'eau?  Prélèvement individuel dans les eaux souterraines et dans les cours d'eau non alimentés. Zone déficitaire 0/2 Z N Déficitaire 1/2 Prélèvement individuel ou collectif sur retenue collinaire ou sur rivière réalimentée 1/2; 2/2 Les deux: 0,5/2; 1/2	2          T:2		(FADEAR, 2014)
2.7.2	Volume d'eau consommé à l'hectare			
	Quel est le volume d'eau consommé à l'hectare?  En plein champs: Moins de 3000m3/ha/ans 3 points Entre 3000 et 4000 m3/ha/ans 2 points Plus de 4000 m3/ha/ans 0 point  Sous tunnel Moins de 10000m3/ha/ans 3 points Entre 10000 et 16000 m3/ha/ans 2 points Plus 16000 m3/ha/ans 0 point  Si ne sait pas 0pt	3          3          T:6		
2.7.3	Attention apporté à préserver la qualité de l'eau			
	-> Si il y a une zone humide, de captage, de bord de rivière présent sur le territoire de la ferme, le maraîcher y porte-t-il une attention particulière?  Pas d'épandage ni de traitement autour ou à proximité de ces zones 1pt Pas de drainage récent des zones humides 1pt	1 1          T:2 T:10		(FADEAR, 2014)
Pourquoi cet indicateur? L'eau est pour certain une ressource limitée, il faut alors savoir la préserver de bonne qualité et l'utiliser à bonne escient.  Questions à se poser: Est-ce que je porte une attention particulière à ma consommation d'eau? Je connais le débit de mon arrosage? Je le contrôle régulièrement? Je connais la qualité de mon eau?				
2.8	Biodiversité			
	Zone de régulation écologique: -> 0.25 pt par % de la surface total dédié aux zones de régulation	5		(IDEA, 2008)

	<p>écologique. (limité à 5 pts)</p> <p>-&gt; Point d'eau, zone humide: 1 pt</p> <p>-&gt; Pâturage permanente en zone inondable: 1pt</p> <p>-&gt;Terrace mur en pierre 1 pt</p> <p>-&gt; Carte localisant les principaux points d'attention écologique sur la ferme? 1 pt</p> <p>-&gt; Présence de ruches sur l'exploitation pour améliorer la pollinisation? 1pt</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>T:10</p>		
<p><u>Pourquoi cet indicateur?</u></p> <p>Plus un système est divers plus il sera résistant aux attaques de ravageurs. Le fait d'avoir des habitats divers et variés permet d'augmenter la biodiversité.</p> <p><u>Questions à se poser:</u></p> <p>Quels serait l'intérêt d'augmenter la biodiversité sur ma ferme?</p> <p>Suis-je prêt à sacrifier de l'espace de culture afin de créer des habitats de biodiversité?</p> <p>Est-ce que j'observe la vie sous toute ses formes dans mes cultures? (insecte, plante, animaux...)</p> <p>Est-ce que j'ai des problèmes de ravageurs qui pourrait être réglé par une plus grande population d'auxiliaire?</p>				

3	Pilier économique			
3.1	Productivité			
3.1.1	Efficacité du processus productif.			
	<p>-&gt; Efficacité= ((produit-Intrant)/ produit)*100 (CA- Charges opérationnelle)/ CA*100 EBE/CA*100</p> <p>Moins de 10%: 0pt; Entre 10 et 20%: 1pt; Entre 30 et 40%: 3pts; Entre 40 et 60%: 4pts; entre 60 et 80%: 6pts (Julien Jouanneau (2010))</p>	t:6		(IDEA, 2008)
3.1.2	Rentabilité des productions de la ferme comparé à la moyenne régional.			
	<p>-&gt; (Marge nette/CA)/ (marge nette moyenne régionale/ CA moyen régional)</p> <p>CA moyen régional: 29000/UTH€; 25900€/ha 36000/UTH; 32000€/ha</p> <p>Moins 80%: 0pt; entre 80 et 110% 1pt; entre 110 et 125% 2pts; entre 125% et 140: 3 pts; plus de 140: 4pt</p>	t:4 T:10		(FADEAR, 2014) (Agrobio basse normandie 2014) (Jousseau, 2010)
<p><u>Pourquoi cet indicateur?</u></p> <p>Traduction en terme économique d'une efficacité technique. Cet indicateur montre aussi la dépendance de l'exploitation aux intrants et sa capacité à les valoriser. Aussi il permet de se comparer à d'autres structures similaires dans la région.</p> <p><u>Questions à se poser:</u></p> <p>Quels sont les postes de charges que je pourrais diminuer?</p> <p>Quels sont les productions les plus rentables? Les moins rentables?</p>				

3.2	Investissement			
	-> Performance économique des investissements ainsi que l'endettement de l'exploitation.  -> Annuités/EBE  Moins de 10%: 10 pts; entre 10 et 15%: 8 pts; entre 15 et 30% 6 pts; entre 30 et 45% 4pts; entre 45 et 60% 2pts; plus de 60% 0pt.	T:10		(Jouanneau, 2010)
<u>Pourquoi cet indicateur?</u> Permet d'appréhender le poids de la dette ainsi que l'efficacité des investissements.				
3.3	Sécurité économique			
3.3.1	Dépendance financière			
	-> $DF = (\sum \text{annuités} + \text{coût financier à court terme}) / \text{EBE}$  Moins de 20%: 6 pts; entre 20 et 25%: 4pts; entre 25 et 30: 3pts; entre 30 et 35%: 2pts; plus de 35% 0pt.	t:6		(IDEA, 2008)
3.3.2	Dépendance aux subventions			
	-> $(\text{Subventions} / \text{Revenu disponible}) * 100$  Moins de 25%: 4pts; entre 25 et 30%: 2pts; entre 50 et 75%: 1pt; plus de 75%: 0pt.	t:4 T:10		(FADEAR, 2014)
<u>Pourquoi cet indicateur?</u> Les subventions sont instables, elles sont fortement dépendante des conjonctures politiques. Le maraîcher ne peut pas baser son revenu sur l'accord de subvention car c'est trop instable.  <u>Questions à se poser:</u> Si les subventions ne me sont pas versé à temps, cela met il mon exploitation en péril? Et si je ne les reçois pas du tout?				
3.4	Revenu			
3.4.1	Capacité à dégager un revenu			
	Capacité de l'exploitation à créer un revenu décent pour l'exploitant. -> Revenu horaire par UTA familiale : $(\text{Revenu disponible} / \text{UTAF} / \text{Total d'heures annuel}) / (\text{Smic horaire brut})$ Moins de 0,4 smic/h: 0pt; entre 0,4 et 0,7 smic/h: 2pt; entre 0.7 et 1 smic/h 3pts; entre 1 et 1,3 smic/h: 4pts; plus de 1,3 smic/h: 5 pts.	t:5		(FADEAR, 2014)
3.4.2	Satisfaction par rapport au revenu			
	Êtes-vous satisfait de votre revenue?	t:5		
	Opt pas satisfait du tout 5pt très satisfait	T:10		
	<u>Pourquoi cet indicateur?</u>			

	<p>Il est important de regarder la satisfaction par rapport au revenu. Un maraîcher peut gagner que peu d'argent mais il n'a pas d'emprunt à rembourser, sa voiture est au nom de l'entreprise, il décide de gonfler sa trésorerie... Aussi tous n'ont pas le mêmes mode de consommation.</p> <p>Questions à se poser:  Suis-je satisfait de mon revenu? Mon entourage est-il aussi satisfait?  Quels sont mes attentes dans l'avenir?  Me suis-je fixé des objectifs d'évolutions?  Quels sont les moyens que je peux mettre en œuvre pour augmenter mon revenu?  Quelle est la marge d'augmentation de ma production? De mes déboucher?</p>			
3.5	Participation à la vie économique local			
3.5.1	Achat des intrants localement			
	<p>-&gt; Le maraîcher donne-t-il la priorité à la ville la plus proche dans ses approvisionnement d'intrants?</p> <p>Plus de 75% en volume financier: 5pts; entre 75 et 50%: 4pt; entre 50 et 25%: 3pt; entre 25 et 10%: 2pt; moins de 10%: 0pt.</p>	5 t:5		(FADEAR, 2014)
3.5.2	Produit consommé localement			
	<p>-&gt; Quelle est la proportion des produits consommé localement dans un rayon de 100km?</p> <p>Plus de 75%: 5pts; entre 75 et 50%: 4pts; entre 50 et 25%: 3pts; entre 25 et 10%: 2pts; moins de 10%: 0pt.</p>	5 t:5 T:10		(FADEAR, 2014)
<p><u>Pourquoi cet indicateur?</u>  Le maraîcher participe à la vie économique local, aux dynamisme rurale de par son ancrage sur le territoire en vendant mais aussi en achetant des biens et des services.</p> <p><u>Questions à se poser:</u>  Est-ce que je connais mes consommateurs? Vivent ils autour de la ferme?  Suis-je satisfait de mes débouchées?  Pourrais-je privilégier des entreprises local dans l'achat de mes intrants? Si oui pour lesquelles? Cela me coûterait plus cher? Combien? Les retombés serait positive?</p>				
3.6	Bureaucratie			
3.6.1	Temps dédié à la gestion administrative			
	<p>Combien de temps par semaine passez-vous à la gestion administrative de votre exploitation? (Mail, téléphone, commande de fourniture, de semences, comptabilité...)</p> <p>Entre 1h et 5h par semaine: 5pts; entre 5 et 7h/s: 4pts; entre 7h et 10h/s 3pts; entre 10 et 12: 2pts; plus de 12h/s: 0pts.</p>	5  t:5		(AgroBio Basse Normandie, 2017)
3.6.2	Ressentis par rapport au temps passé à la gestion administrative			

	<p>Comment percevez-vous le temps que vous passez à la gestion administrative? De 1 à 5</p> <p>5pt tout à fait convenable 1pt trop long, non durable.</p>	<p>5</p> <p>t:5</p> <p>T:10</p>		
<p><u>Pourquoi cet indicateur?</u>          Le temps dédié à la gestion administrative peut être perçu comme très lourd pour certain maraîcher et devenir une cause d'arrêt.</p> <p><u>Questions à se poser:</u>          Comment pourrais-je passer moins de temps à l'administration?          Suis-je prêt à le déléguer même si cela a un coût?          Quels sont les bénéfices d'être à jour et bien organisé dans mon administration?</p>				
3.7	Sécurité de main d'œuvre			
	<p>-&gt;La main d'œuvre gratuite représente combien de d'UTA par an?          (Famille, WWOOFer, Stagiaire...)</p> <p>0: 5pt, 0,25: 4pt; 0,5: 3; 0,75: 2; 1:1; plus de 1:0 pt.</p> <p>-&gt;Qualifiez-vous cette main d'œuvre de stable?</p> <p>2pts très stable 0pt pas stable du tout</p> <p>-&gt;Pensez-vous que vous pourriez faire sans?:          3pts tout à fait 0pt pas du tout</p>	<p>5</p> <p>2</p> <p>3</p> <p>T:10</p>		
<p><u>Pourquoi cette indicateur?</u>          La stabilité de la main d'œuvre est essentiel sur une exploitation maraîchère. Le fait d'avoir de nouvelle personne venant régulièrement travailler sur la ferme demande beaucoup d'énergie pour les former et leurs apprendre à travailler. Aussi un employé qui reste plus d'un an ou un associé s'impliquera davantage et fera plus attention à la qualité de son travail, à l'entretien du matériel...</p> <p><u>Questions à se poser:</u>          Si la main d'œuvre gratuite me fait défaut une saison, pourrais-je faire sans?          Pourrais-je employer un salarié ou m'associer? Quelles modifications de mon exploitation cela demanderait?          Quel gain cela engendrerait?</p>				