EIP-AGRI FOCUS GROUP BENCHMARKING OF FARM PRODUCTIVITY AND SUSTAINABILITY PERFORMANCE:

How can farmers and advisers use benchmarking data and process to improve productivity and sustainability performance?

DISCUSSION PAPER

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1. Introduction

Benchmarking can support farmers to improve their productivity and sustainability performance. At its simplest, benchmarking is defined as improving the performance, of for example a farm, by learning from others. From benchmarking valuable lessons can be drawn by raising the subsequent questions: why are others better?, how are others better?, what can be learnt?, and how can the farm catch up? It is believed that, although benchmarking has been established in agriculture, the full potential has not been exploited yet by the farming community.

The European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI) aims to stimulate innovation and seek practical solutions to on–farm problems by bridging the gap between practise and science. A Focus Group on Benchmarking of farm productivity and sustainability performance has been established by EIP-AGRI. This Focus Group has to address the question: *How can farmers and advisers use benchmarking data and process to improve productivity and sustainability performance?* The specific objective of this EIP-AGRI Focus Group are:

- Make an inventory of existing farm assessment tools and benchmarking systems, including private ones and covering different types of farming, to describe and evaluate their characteristics and objectives and to map their use by farmers and others in different member states and organisations.

- Review how farmers and businesses in the food value chain make use of benchmark indicators and assessment tools for decision making, for improving farm productivity and sustainability performance. In particular the usability and accessibility of individual data to the farmer and his advisers (for example on-line via computer or via smartphone). Looking into innovative ways that allow farmers to actually use relevant data for "day-to-day" management and more strategic decisions.

- Analyse the use of farm performance benchmarking by advisory systems (including use of ICT, coaching, strategic management) and the evolving best practices in the use of farmers' own data to improve the effectiveness of advisory services (for example use in one-to-one consultations, use in group meetings, training and education, use of branding and marketing).

- Identify the main problems and issues in farm benchmarking related to collection, processing, access and usability of data on the different levels (farm level, advisory and policy information support) and the operational solutions and innovative actions to tackle these issues, including how the different systems can be integrated with each other at higher levels.

The Focus Group on Benchmarking will address the aforementioned tasks during its first meeting in Spain 9-10 December 2015. This current starting paper (also known as discussion paper) for the first Focus Group meeting identifies points of discussion. The objective of this paper is to:

- Establish a common understanding about the purpose of the Focus Group on Benchmarking;

- Provide information on benchmarking of farm productivity and sustainability performance;

- Provide an overview of current and potential benchmark future strategies at farm level for improving the use of benchmarking;

- Identify key questions to be discussed at the first Focus Group meeting.

In addition, a survey is conducted among panel members to map the current state of affairs in their country or region. The results of the survey are not yet included in this document. The topics in this paper are to be further elaborated in mini-papers by the participants of the Focus Group and formalised by the coordinating expert in the final discussion paper.

2. Agriculture and benchmarking

2.1 Benchmarking

Benchmarking is not particularly radical for a farm manager to improve farm performance (Franks 2003). Alternative and complementing definitions are used in the literature to describe the objectives of benchmarking. For example, Spendolini (1992) defines benchmarking as the comparison of performance with the performance of others engaged in a similar activity and learning from the lessons that these comparisons throw up. Slavin (1994) complements it by stating that it involves the action of continuously measuring and assessing products and services and practices against those of world-class businesses or top competitors. In summary, it involves borrowing good ideas from others about how to improve (Brown 1995).

Although the number of steps in the process may vary from organization to organisation, and from definition to definition, three subsequent steps contain the core features (Figure 1). Firstly, actual performance is measured and compared against others. Secondly, performance gaps are identified and understood. Thirdly, outstanding practices found are incorporated to fill the gaps to improve performance.

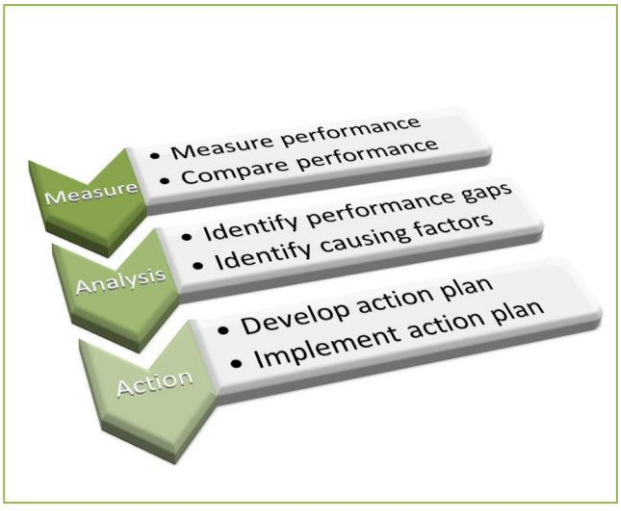

Figure 1: Benchmarking process.

The main advantage of benchmarking is that it is an effective and efficient approach to make improvements because it involves imitation and adaptation rather than pure invention, and thus eliminating to a certain extend the adverse effects of trials and errors. Yet, the impact hinges on the availability of farm-specific benchmarks to guide to meaningful use and targets, since farm and site-specific characteristics, outside the control of the farmer, influence economic, environmental and societal performance.

Farmers need to identify which benchmark to take as being representative of their industry performance (Franks 2003). Benchmarking can be conducted on the basis of internal or external farm data (Figure 2). Internal benchmarks can be derived from historical performance or similar on-farm activities. External empirical benchmarks can range from a generic approach (e.g. average performance of all other farms in the country or county, or individual data of other farms in the county), up to best in class (e.g. average performance of the best 25% of other farms), or even best of the best. Alternatively, a more normative approach can be followed whereby the target is derived from best practices issued by for example the competent advisory service or relevant research station performances. Moreover, a tailor-made benchmark can be estimated to account for the structural characteristics of the farm (e.g. parametric and stochastic frontier analysis SFA or the non-parametric data envelopment analysis DEA). Essential for all approaches is that farm-specific benchmarks are used which account for factors that are beyond the farmer's control.

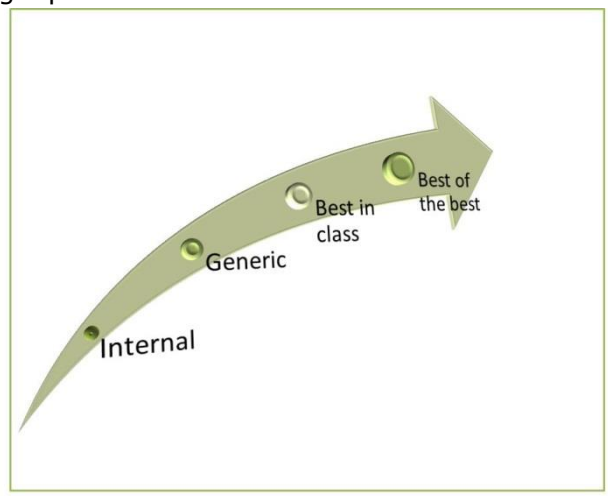

Figure 2: Categories of "who" is being compared.

Timeliness of the analysis and reporting is typically done with annual data, or moving averages of annual data, since most agricultural activities depend on the growing season. For specific agricultural activities a more frequent approach can be followed (e.g. 6 weeks for broilers).

2.2 Key Performance Indicators

Benchmarking is used to measure performance using specific indicators resulting in a metric of performance that is then compared to others. Benchmarking thus requires quantitative measures of selected key performance indicators (KPIs) which describe the competitive performance achieved. Note that benchmarks are goals to aim for, while KPIs are specific measurements used to gauge performance. KPIs represent a set of measures focusing on those aspects of organizational performance that are the most critical for the current and future success of the organization (e.g., productivity per unit of measure and cost per unit of measure).

In farming, KPIs per agricultural activity in general focus on quantities like yields (e.g., kg wheat/ha or piglets/sow), process or production practices (e.g. use of pesticides or fertilizer per crop), and economic performance (e.g., gross margin per crop and type of animals). At farm level, more aggregated KPIs are used (e.g., profit and loss accounts of farms, balance sheets of farms, and cash flow statements of farms. More recently, sustainability KPIs are gaining interests too (Iribarren 2011).

3. Bottlenecks and future strategies in benchmarking

We propose to identify five key issues in farm benchmarking (i.e., stakeholders, dissemination KPIs, ICT, small and semi-subsistence farms). These issues, where we see the main bottlenecks, are related to collection, processing, access and usability. Operational solutions and innovative actions to tackle them are discussed for each key issue.

3.1 Stakeholders providing benchmarks

National agricultural extension systems tend to have an eminent role in the early phase of benchmarking diffusion. Extension services are usually organized predominantly either by central or regional governments, or by agricultural colleges, mostly in close association with experimental stations, or by farmers' organizations (agricultural societies, cooperatives, farmers' unions, or chambers of agriculture), or combinations of these parent bodies (Jones and Garforth 1997). Public extension managers at various levels require relevant information accessibility in order to support decision making at farm level. The starting point is thus public data gathering, for instance via the FADN (Farm Accountancy Data Network). The public implemented databases offer the possibility to overview farm production and economics based on diverse indicators to identify areas for improvement or action. In the absence of such information, extension officers act only on the basis of their intuition and past experience (Ramesh Babu 1997).

In varies ways MSs have established public databases on agricultural production and economics to support policy decision making and this information can also be used to support stakeholders (be they professional organisations or individual farmers) in comparing their situation with that of others. The Farm Accountancy Data Network (FADN) was created in 1965 to support the Common Agricultural Policy (CAP). To measure European farm incomes and to conduct farm business analyses, FADN collects and analyses annual data from around 80,000 farms. In many MSs, the data are also used to create detailed benchmarks for this purpose. For example, farmers can benchmark how their farm structure and performance compare with others in the sector or region, or whether their input costs are competitive (FADN 2015).

In many member states farmers, or at least the larger ones, pay taxes on a real basis (and not on a forfait), which implies the obligation to keep books. In addition to extension services, specialised agricultural accounting offices are active in offering farm comparisons and create benchmarks. Such financial service providers have valuable benchmarking information. However, in many MSs (smaller) farms make little use of accounting or use a minimal system driven by taxation rules (e.g. in depreciation) and until now have been largely excluded from the scope of accounting standards and benchmarking.

Since approximately the eighties privately developed Management Information Systems (MISs) have emerged to support decision making. Specialised record-keeping software has become available for all main sectors in agriculture provided by mainly private and specialised software companies. The MISs are enabling benchmarking with other adopters. Although numerous reporting on insufficient adoption rate of MISs by farmers, its diffusion has grown steadily in the past decades (Kuhlmann 2001). By now, the industry is still growing in some EU regions, while it is has grown into a mature market in other EU regions.

More recent benchmarking developments result from innovation in information exchange, and use of information and knowledge, between diverse private actors in the agricultural value chain. Food processors (like slaughterhouses or sugar companies), and to a lesser extend suppliers, provide data exchange services to benchmark against other farmers.

In general, the use of supplier and processor-based as well as accounting-based information can significantly improve benchmarking activities.

In general, research on mapping of existing farm benchmarking systems, either public or private ones, is fragmented. Level of adoption varies between MSs and farming systems. Traditionally, benchmarks are more used in homogeneous sectors (i.e., livestock production and arable production) where farmers are not direct competitors and mutually benefit from cooperation. Current available benchmarking systems are provided by numerous stakeholders, ranging from public advisory services, research institutes and experimental stations, farmers' organisations, accounting offices, private consultants, input industries and food processors (including cooperatives), as well as ICT companies providing farm management software systems.

Discussion questions:

- Which stakeholders can target farmers most efficiently and effectively now and in the future, and what is their competitive advantage?
- What is the public role in supporting benchmarking by private stakeholders?

3.2 Indicator use and dissemination of benchmarks

The set of representative KPIs should capture those aspects of operational as well as strategic performance that are the most critical for the current as well as future success of the farm. Benchmarking therefore focuses on the key variables influencing productivity, profitability, liquidity and solvency (Wilson, Charry et al. 2005). Sustainability (in the profit-people-planet meaning of the word) should be added to that list. Common complementary productivity indicators tend to focus on measures associated with input use and yield per unit of measurement, but may not reveal much information on the longer-term farm sustainability. While profitability measures (e.g., gross margin, net income per labour unit, and return to capital) often seem to proliferate without any clear guidelines as to which parameters are more critical for farm

performance (Wilson, Charry et al. 2005). Solvency related KPIs, to capture the degree to which the current farm assets exceed the current liabilities, are often represented by the total farm assets and equity as a % of total assets. Interestingly, according to Wilson et al (2005), provision of any significant focus on the farm's ability to meet its short term financial commitments (i.e., liquidity) is generally limited in benchmarking. That suggests that risk management is not a main topic of benchmarking.

KPIs presented properly will aid stakeholders in analysing situations and to make more informed decisions (Ramesh Babu 1997). Thus dissemination of relevant KPIs together with advice to farmers is crucial. In practice, different types of extension programmes are developed to pursue such knowledge transfer and human resource development. The most effective allocation of resources for dissemination is context-specific (Nagel 1997). In the past most large-scale agricultural programmes were ministry-based general extension work for reaching large numbers of farmers. However, government extension services have been forced to rethink their top-down approach as the private sector is more and more complementing and substituting formerly public tasks. So next to public-based extension, private-based extension is more frequently used for dissemination purposes. Mainly extension officers of input suppliers and processors provide benchmarks to farmers of their own clientele in one-to-one consultations. Moreover, there is an considerable interest in participatory Farmer-led Extension (FLE) approaches in the recent decades (Scarborough, Killough et al. 1997) as shown in European projects like FarmPaths, Solinsa, Pro-AKIS and Impresa. Farmers are encouraged via FLEs in sharing their experiences and creating an opportunity for learning on the part of those during group meetings. Preferable in all dissemination approaches MIS plays an eminent role in providing KPIs and benchmarks that serve as a basis for coaching by farm advisors or peers.

Discussion questions:

- Which benchmarks are most useful: normative budgeted KPIs, average KPIs, KPIs of the best 25%, farm-adjusted KPIs (controlling for farm size and stocking rates or the use of certain processes and machinery), comparing KPIs with other individual farms in the proximity?
- How are KPIs best presented: only main KPIs or all indicators?, with narrative or not?, with graphs or not?, interactive via for example games?
- How are benchmarks best used by / discussed with farmers: individual advisory and coaching, group discussions with farm visits (the advisor being more a process manager), in planning the activities for next year?
- What is the public role in dissemination of benchmarks?

3.3 Benchmarking sustainability indicators

The existing tools for benchmarking productivity are more recently widened to capture also sustainability performance. Despite enthusiastic support in general, diffusion of these indicator frameworks is in its early stages. To date, various frameworks,

approaches, methods and indicators have been developed to appraise how much corporations (farms and firm in the food production chain) contribute to sustainability. These attempts monitor (partially) sustainability in agriculture with a Triple P approach of Profit, People and Planet (Elkington 1997). The European project FLINT has made an inventory of such indicator systems, that include industry standards like SAI and TSC.

One of the early refinements was the emerging of nutrient accounting systems for livestock and crop farms in parts of Europe. These KPI's are analogous to financial accounting KPI's in the sense that they can be audited to insure that nutrient losses to water and air, fall within legal bounds. Bookkeeping of inputs and outputs at the level of individual farms control nutrient use and formed the basis for taxing nutrient surpluses in agriculture. At the same time, nutrient accounting presents important management information. The relationship of the nutrient accounting system with the obligatory financial accounting is discussed and evaluated in literature as crucial, for auditing purposes and for advise. The establishment of conformity of financial and nutrient accounts is considered as an important audit instrument of the nutrient system as a policy instrument (Breembroek, Koole et al. 1996).

More recently, other sustainability KPIs are gaining interests too (Iribarren (2011). Environmental indicators can be derived from a cradle-to-farm-gate life cycle assessment, such as land occupation, non-renewable energy use, global warming potential, acidification potential, eutrophication potential and soil quality. Societal indicators are for example payments for agri-environmental measures and grazing hours in case of dairy farming.

The long list of potential farm-level indicators with at the same time a limited availability of data underscores the problems to establish a data-infrastructure of on farm-level indicators (FLINT 2015). This will hamper sustainability-specific benchmarking (e.g., segments of producers which are aiming to reduce their environmental impact). Furthermore, there is a need for a sound benchmark assessing the effect of claims on economic, environmental and societal performance of adopters compared with those applying conventional practices (Dolman 2014). Statistical matching methodologies for determination of net impacts and establishment of counterfactuals are required for measuring the impact of adoption (i.e., truly resulted from aiming at improving sustainability, and not from differences in farm structure).

Discussion questions:

- Which are the main sustainability KPIs used in MSs and are they used frequently?
- How do sustainability programs and quality schemes like GlobalGap/BRC relate to benchmarking and advisory services?

3.4 ICT and benchmarks

Innovations in information and communication technology (ICT) have opened a window of opportunities for on-line benchmarking via computer or via smartphone (Kaloxylos 2014). The sector will move away from a situation characterised by a low level of integration of data. Attempts are made at different speeds in MSs to develop and adopt information exchange in the agricultural sector.

Specific key elements for electronic data exchange in benchmarking are coordination and standardisation with respect to the formats used (e.g. EDI, XBRL, Agro-XML) of KPI's. Those information systems implemented or being developed should be aligned to meet the standard exchange formats. A standardised gateway for data exchange and communication is essential for several reasons; registration of identical data is avoided, simplified, and availability is enhanced. Yet, data security transfer of privacy-sensitive data has to be guaranteed. It should be noted that data analysis and exchange is not restricted to benchmarking purposes only, the main driver of this innovation is enhanced traceability to secure food quality.

Future internet investments propose new concepts for data exchange (Poppe et al, 2013). An innovative, cloud-based, file-sharing service based on a platform for data-transfer with cloud-technology may be the way forward. Cloud technology (that gives persons access to their data from different devices and places) makes sharing of data easier. Open data (in which governments or others share their data free of charge) is an example of sharing data. Together with the Internet of Things (using data from sensors, machines and other devices) this contributes to the era of big data. In such an architecture farm records can be matched with administrative and GIS data. Moreover, software and reports can be developed with which the indicators are reported back to farmers and added to their "dashboard" for monitoring their farm compared to others (Poppe 2013).

It is expected that the food chain will become much more data-driven. Several actors in the food chain make already advanced use of ICT and experiment with new developments. The exchange of data will also make it possible to add more (computer) intelligence to the chain, including monitoring, problem notification, deviation management, planning and optimisation. However this is just the start of what could become a revolution in agriculture. Despite these development trends, electronic communication in food supply chains is currently still in its infancy and mainly restricted to providing online access or to email transmission of delivery characteristics (Theuvsen 2010). Typical examples are cooperative processors of milk or meat and in livestock production, and processors of potatoes or wheat in arable production industries, who are starting to report on-line information of quantity and quality of produce delivered (and offering the service of benchmarking information of cooperative members).

Discussion questions:

- Do ICT innovations allow farmers to actually use relevant benchmarking data for: 1) "day-to-day" management support; and 2) strategic decision support?
- Is lack of standardisation of KPIs hampering ICT benchmarking developments and big data analysis?

- Which stakeholders can and should pool electronic data to improve benchmarking?
- How is collaboration between (public) advisory services and farm management software organised?

3.5 Benchmarking small and semi-subsistence farms (SSFs)

A one size fits all approach in benchmarking is not foreseen because of the heterogeneity of the existing farming systems. Specialised producers are because of economies of scale more likely to be targeted for benchmarking purposes by private stakeholders. Especially small and semi-subsistence farms (SSFs) have to be outreached differently for benchmarking purposes. SSFs account for almost half of all agricultural holdings in the EU (i.e., 5.8 million in 2010) of which 86% are in the NMSs (Davidova 2013). These SSFs play a number of socio-economic roles. They maintain rural welfare, keep rural areas populated, contribute to the rural non-farm economy, and provide environmental public goods such as attractive landscapes (Davidova and Bailey 2014).

Implementing and upscaling of benchmarking is faced with challenges in MSs in which there are a large number of SSFs. For example, SSF's generally keep limited records and therefore their performance is difficult to be benchmarked with their non-organised peers. Furthermore, it is questionable whether it is worth the effort to include SSFs in benchmarking systems, based on economic arguments only, since incentives to motivate adoption are limited. Moreover, the extension programme to reach these hard to reach farmers is confronted with inherent challenges. Rather than trying to reach all farmers directly, and thus preprogramming constant failure, the extension service in providing benchmarks should concentrate on contacting farmers expected to pass information on to fellow farmers with similar problems (Nagel 1997). Alternative, media as TV or radio with large outreach can provide basic extension of benchmarks.

Despite drawbacks, a gradual introduction of benchmarking with numerous modalities of such system appears to be sound. It offers the prospect of improvement in the use of benchmarking over time. Therefore, a tailor-made and flexible system adapted to SSF's needs should be established without increasing the administrative burden. A first step could be that processors report their performance relative to other SSF's each time a delivery is made (e.g., milk content and somatic cell count in dairy farming, average slaughter weight and lean meat percentage in fattening pig farming). However, those SSFs only side-selling directly to the market are inherently hard to be reached.

Discussion questions:

- Which are the main limitations of benchmarking adoptions by SSF's?
- Is benchmarking the first priority in extension to SSF's ?
- Is public support essential for a gradual uptake of benchmarking by SSF's?

4. Concluding remarks and discussion

The diffusion of benchmark adoption differs in pace between MS's and farming systems. Research on mapping of existing farm benchmarking systems, either public or private ones, is currently fragmented. This holds for relevant benchmark data for "day-to-day" management and more strategic decisions. A more in-depth mapping of benchmarking adoption was outside the scope of the current research. Moreover, the impact of benchmarking is inherently difficult to measure from observational data because of self-selection.

However, the current high-level analysis reveals that farmers are becoming more aware of the benefits that benchmarking can generate in order to improve productivity and sustainability performance. Also suppliers and food processors are becoming more interested to share information bringing advantages to all participating.

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