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Assessing Sustainability of Smallholder Beef Cattle Farming in Indonesia: A Case Study Using the FAO SAFA Framework

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Abstract

This article aims to assess the sustainability of smallholder beef cattle farms in Indonesia, where there is a national goal to improve the country's beef self-sufficiency, and to explore and discuss potential improvement limitations and solutions. This article presents a sustainability assessment based on the FAO SAFA (Sustainability Assessment of Food and Agriculture Systems) of six selected family farms representing three types of family farming systems (with only family labour; with hired labour; and with hired labour and a 'middleman in marketing system'). Individual structured interviews based on the SAFA guidelines were conducted and the results analysed with the *SAFA Tool* software. The results showed that the SAFA sustainability performance generally scored better in the farming system with relatively more resources and hired labour, and the household head also working as middleman, as compared to the other two farming systems with some or no hired labour. These results indicate that the larger room for sustainability improvement relies in the farming systems with only family labour. Lack of information, training and economical resources showed to be two main drivers that explain part of these differences. These results suggest that the government's role in increasing awareness, providing information and training and facilitating sustainable development practices is critical.

Keywords: sustainability, Indonesian Smallholder Beef Cattle Farming, the FAO SAFA Framework

1. Introduction

Indonesia's so-called Beef Self Sufficiency Programme (BSSP) was introduced in 2004 by the Indonesian government through the Ministry of Agriculture with the aim of reducing Indonesia's dependency on cattle and beef imports, and more specifically to achieve 90 per cent self-sufficiency by 2014. An additional objective of the BSSP was to improve the national beef cattle marketing system, smallholder farm management and the income of the smallholder farmers. The Indonesian cattle population was planned to increase to 14.6 million by 2014 as part of BSSP's outcome (Indonesian Government Regulation No. 19 year 2010). In 2012, 35 per cent of the national beef consumption was still supplied from imports of live animals and frozen meat from Australia and New Zealand (Setianto, Cameron, & Gaughan, 2014). Setianto et al. (2014) showed that the Indonesian beef cattle production had difficulties to reach independency from beef import and could not reach the 2014 goals.

Most of the beef cattle farming in Indonesia are based on smallholder farming systems (Hadi, Ilham, Thahar, Winarso, Vincent, & Quirke, 2002). A previous study involving Indonesian smallholder beef cattle farmers (Gayatri & Vaarst, 2015) showed how the farmers faced many challenges related to improving beef cattle farming practices. Furthermore, it showed that farmers were mostly unaware of the existing government policies on BSSP. The continuity of small family farms is a key point when discussing the sustainability of livestock farming systems (Bernués, Ruiz, Olaizola, Villalba, & Casasús, 2011), including the capacity of a smallholder farming system to contribute to the local economic systems through their contribution to foster employment and increase family income (Food and Agriculture Organization [FAO], 2013a). Moreover, the capacity of smallholder farming systems to adjust to less local challenges, such as in relation to climate change, resource allocation, ecosystems degradation, as well as their tradeoffs, is also fundamental in order to become more sustainable (Bernués et al., 2011; Permani, 2013). This could raise questions about how to reach the long-term goals of becoming self-sufficient in beef production in a sustainable manner.

One of the most used definitions of sustainable development is "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on

Environment and Development [WCED], 1987). The concept of sustainable development traditionally encompassed environmental, social and economic dimensions, sometimes referred to as the "triple bottom lines of sustainability" (Hacking & Guthrie, 2008). The United Nations Commission on Sustainable Development (CSD) formally introduced governance as the fourth dimension of sustainable development (Spangenberg, 2002).

The development of tools to assess sustainability has become a rapidly developing area (Binder, Feola, & Steinberger, 2010). Sustainability assessment has been viewed as "a tool that can help decision-makers to decide what actions they should take and should not take in an attempt to make society more sustainable" (Devuyst, 2001); or a tool to ensure that plans and activities make an optimal contribution to sustainable development by referring to the four dimensions of sustainability (Binder et al., 2010).

A number of context-generic frameworks have been developed for assessing sustainability of agricultural systems, which can be applicable to a diversity of contexts and, compared with more context-specific frameworks, require a lower amount of resources (Gasso, 2014). It is the case, for example, of the recently developed "Sustainability Assessment of Food and Agriculture Systems" (SAFA) (FAO, 2013a), "The Response-Inducing Sustainability Evaluation" (RISE) (Häni, 2003), and "The Committee on Sustainability Assessment Tool" (COSA) (International Institute for Sustainable Development [IISD], 2008). The three frameworks have a global geographic applicability, but differ in terms of sector applicability, sustainability perspective and targeted stakeholders (Gasso, Oudshoorn, De Olde, & Sørensen, 2014; Gasso, 2014). Specifically, SAFA covers a wider range of industries (cropping, livestock husbandry, forestry, fisheries and aquaculture) and a wider range of sustainability dimensions and aspects – especially in relation to the governance dimension – and it targets a diversity of stakeholders (e.g. supply chain stakeholders, policy makers and non-governmental organizations) (Gasso et al., 2014; Gasso, 2014).

This article aims to assess the sustainability of smallholder beef cattle farms in Indonesia, where there is a national goal to improve the country's beef self-sufficiency, and to explore and discuss potential improvement limitations and solutions. This article presents and discusses the results of a FAO SAFA sustainability assessment carried out at six private smallholder farms.

2. Methodology

2.1 The Sustainability Assessment Approach

The "Sustainability Assessment of Food and Agriculture Systems" (SAFA) framework (FAO, 2013a) was selected for this study due to its wide sustainability dimensions scope, its applicability to smallholder livestock farms (FAO, 2013a), and its lower design and implementation time and resource requirements, when compared with more context-specific frameworks (Gasso et al., 2014). The assessment was conducted in accordance with the SAFA guidelines version 2 (FAO, 2013b) and the reporting was adapted to the updated guidelines version 3 (FAO, 2013a). The level of assessment used was the farm level.

The SAFA framework is structured according to several hierarchical or aggregation levels (i.e. dimensions, themes and indicators). The most general level comprises sustainability dimensions. At the intermediate level, each dimension comprises a number of themes and subthemes that are the elements associated with specific sustainability goals and objectives. At the most specific level, each subtheme comprises indicators that are measureable and verifiable factors based on a five-scale performance rating (i.e. best performance, intermediate performances with room for improvement, and unacceptable performance) (FAO, 2013a). The SAFA framework comprises four dimensions (i.e. governance, environmental integrity, economic resilience and social well-being) and twenty-one sustainability themes, which are defined by fifty-eight subthemes with 116 indicators. The SAFA indicators focus on performance rather than management systems, however alternatives indicators, i.e. target-based and practice-based indicators, are proposed by SAFA for contexts where performance-based indicators are not measurable.

2.2 Contextualisation and Selection of Indicators

The SAFA contextualisation and indicator selection steps allow specific assessment framework modifications for small-scale producers, because these farmers face certain assessment challenges, including limited existing data and relevance of global indicators (FAO, 2013a). The assessor can (i) omit some specific sustainability themes that are irrelevant for their context and (ii) avoid the use of performance-based indicators that measurements are not accessible, and use instead practice-based indicators (FAO, 2013a). A group of sustainability themes were identified as being irrelevant to the operation of smallholder beef cattle farming systems in Indonesia and therefore excluded (Table 1). Moreover, a group of performance-based indicators where measurements were not

accessible was substituted by the practice-based indicators proposed by SAFA (Table 1).

Table 1. List of sustainability sub-themes excluded for being irrelevant within the assessment context and list of sub-themes where performance-based indicators were substituted by the practice-based indicators proposed by SAFA.

Excluded sub-themes due to their irrelevance for the assessment context.	• Mission explicitness; Mission driven; and Due diligence (which form the Corporate Ethics theme) - irrelevant for smallholder producers. • Holistic audits; Responsibility; and Transparency (which form the Accountability theme) - irrelevant for smallholder producers. • Sustainability management plan; and Full-cost accounting (which form the Holistic Management theme) - irrelevant for smallholder producers. • Indigenous Knowledge (which form part of the Cultural Diversity theme) - no indigenous groups were present in the assessed districts. • Employment relations; Forced Labor; and Freedom of association and right to bargain (which form part of the Labor Rights theme) - excluded only for farming system without hired labour.
Sub-themes where performance-based indicators were substituted by practice based indicators proposed by SAFA.	• Greenhouse gases; and Air quality (which form the Atmosphere theme). • Water withdrawals; and Water quality (which form the Water theme). • Soil quality; and Land degradation (which form the Land theme). • Ecosystem diversity; Species diversity; and Genetic diversity (which form the Biodiversity theme). • Materials use; and Energy use; and Waste reduction and disposal (which form the Materials and Energy theme). • Animal stress (which form the Animal welfare theme)

2.3 Data Collection and Participants

Data were collected in December 2013–January 2014 in Semarang Regency, Central Java Province, Indonesia. Two districts, Bawen (district A) and Ungaran Barat (district B), were selected based on the biggest and the lowest population of beef cattle. Together with the head of the Central Java Province Livestock and Fishery Office, which was approached as a key informant, the first author has chosen two villages, Ungaran village and Polosiri village, based on the biggest population of beef cattle in both districts.

With the help of two informants at each of the two local livestock offices, three different beef cattle farming systems were included in the study:

- Family farming systems with only family labour (system 1);
- Farming systems with hired labour (system 2);
- Farming systems with hired labour and where the husband in the household was also a "middleman" in the local marketing system (system 3).

The first author and key informants were able to identify a number of farms of each type, and selected three of these farms in each district using a stratified random number system. We divided the beef cattle farmers' population into three smaller groups, each representing a type of farming system. Next, we randomly selected one participant from each of these groups. This approach was chosen to cover a range of farming systems and

explore how they differ in terms of sustainability performance according to SAFA. At the end of this process, six farms were selected: 1A, 1B, 2A, 2B, 3A, 3B, where the number represents the farming system and the letter the district of the farm. The farm characteristic is presented in Table 2.

Table 2. The farm characteristic is presented in

Farm no.	Cattle no.	Employees no.	Family No.	Cultivated land (m^2)	How do they produce their feed for the cows
District Bawen (District A)					
1A	2	0	4	6.000	Collected from village surroundings and bought from a neighbouring village, especially during the dry season
2A	9	1	6	10.000	Collected from village surroundings and bought from a neighbouring village, especially during the dry season
3A	45	2	4	80.000	Cultivated from their own land and bought from feed suppliers
District Ungaran (District B)					
1B	3	0	3	6.000	Collected from village surroundings
2B	12	1	5	12.000	Collected from village surroundings and bought from a neighbouring village, especially during the dry season
3B	30	1	5	50.000	Cultivated from their own land and bought from feed suppliers

Structured interviews (90–120 minutes of duration) aiming at filling a questionnaire based on the SAFA indicators (FAO, 2013a) were conducted in the six selected farms. There were few open-ended questions, e.g. regarding the choice of practices. The questions were translated into Bahasa Indonesia language by the first author. The results of the six interviews were entered into the *SAFA Tool* software developed by FAO (FAO, 2014).

3. Results

Figures 1 to 3 present the sustainability performance polygons produced by the *SAFA Tool* for each of the six participating farms. The performance polygons fall into a range from green (illustrating "good performance"), to yellow/orange (illustrating "need for improvements"), or red (named "unacceptable performance"). The white colour represents the excluded themes. The numbers near the themes mean the data quality and accuracy score, where 0 represents excluded themes, 1 represents low data quality (data based on estimation), 2 represents moderate quality data (data based on secondary data), 3 represents high quality data (data based on primary current data, not later than two years old). In this study most of the themes presented a high quality data score and all data were based on current data.

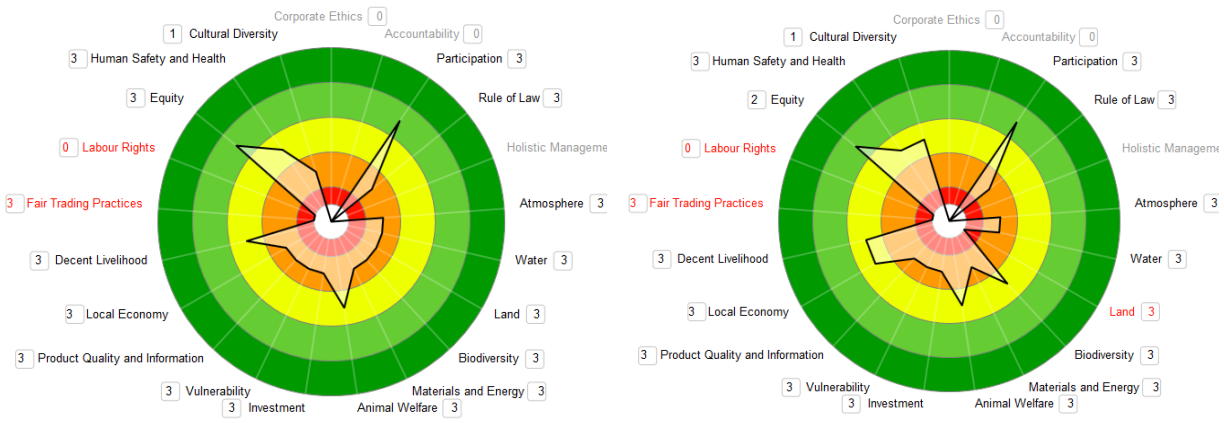

Figure 1. SAFA Result in farming system 1

None of the analysed smallholder family farms (system 1) scored dark green in any theme, but scored green for Equity and Participation. On the other hand, there were red scores in Fair trading practices, Labour rights and Land (Fig.1).

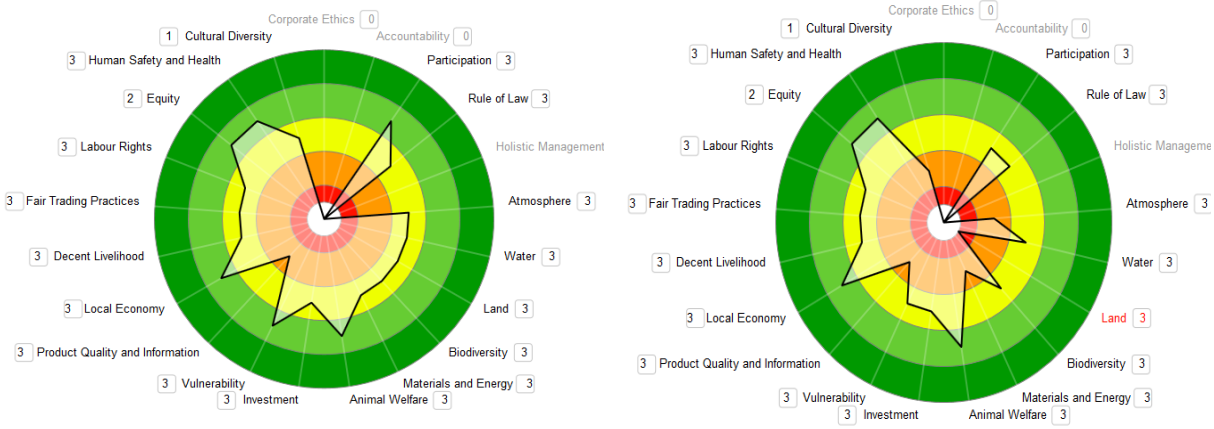

Figure 2. SAFA Result in farming system 2

The two farms in the farming system 2 scored generally yellow and green, except Product quality and information, and Materials and energy that scored orange, and Land for the 2B farm that scored red (Fig. 2).

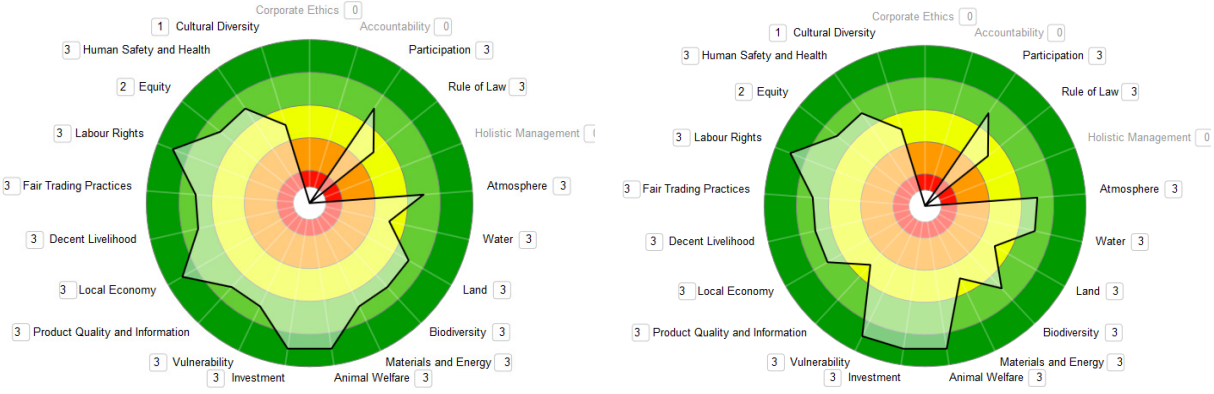

Figure 3. SAFA Result in farming system 3

The two farms in the farming system 3 scored generally green and dark green, except for Cultural diversity and Rule of law for both farms; and Water, Land, Materials and energy and Product quality and information for some farms that scored yellow. None of the analysed farms in system 3 scored any orange or red (Fig 3).

3.1 Good Governance Dimension

3.1.1 Participation

This theme refers to ensuring involvement of the stakeholders and the farmer's ability for conflict resolution in relation to other parties potentially affected by the farm activities. Whilst five farms scored green, farm 2B scored yellow, due to conflicts over manure smell with a neighbour farm. The participants from farming systems 3 explained that they had commitment to engage in dialogue whenever the community and other stakeholders were affected by the farm activities. For example, they entered into dialogue when the farm activities had affected a part of the road in the middle of the village. The farms 3A and 3B donated for road reconstruction. The owner of farm 3B said that trust and communication played an important part in solving conflicts with other stakeholders related to the farming systems, for example feed suppliers.

3.1.2 Rule of Law

This theme aims to ensure that the farm is committed to fairness, legitimacy and protection of the Rule of law.

Four of the interviewed farmers (systems 2 and 3) scored yellow, while the two farms from farming system 1 scored orange. Farmers in farming system 1 had more limited access to information and networks, hence a lower awareness in relation to regulations than the farmers in farming systems 2 and 3.

3.2 Environmental Integrity Dimension

3.2.1 Atmosphere

The Atmosphere theme refers to the integrity and preservation of clean air, including green-house gases (GHG) and air quality. The farms in farming system 3 scored green, while farms in farming systems 1 and 2 scored yellow and orange. The farms in system 3 were implementing activities that would reduce GHG emissions, such as manure treatment and mixed-crop livestock systems. The farmers in system 3 knew that these practices affected the soil composition and reduced the environment impact of the farming activities through complementarity between crops and livestock production, e.g. using dry rice straw as forage for the cows, so that it optimizes agricultural waste.

3.2.2 Water

This theme is relevant in a sustainability context because water stress, in addition to pollution and degradation of the world's freshwater sources, is one of today's most severe environmental challenges. Farms in farming system 3 scored green, while farms in farming systems 1 and 2 scored yellow and orange. The farms in farming system 3 had better water management practices, such as avoiding the release of polluted wastewater in surrounding water sources and applying rainwater for harvesting. Based on first author' observation, the stables in farming systems 1 and 2 were located less than ten metres away from the water sources, which could cause some risks, e.g. for human health.

3.2.3 Land

This theme covered the practices to improve soil quality and reduce land degradation. Farm 3A scored green; farms 1A, 2A, 3B scored yellow and orange; while farms 1B and 2B scored red. Some farms scored green because they had done an effort for land conservation and soil rehabilitation, for example with the application of organic fertilizers (compost manure), which enhance soil organic matter content. The farms with red score did not use the manure as fertilizer. The farmers in these farms had a lack of information and guidance about composting manure.

3.2.4 Biodiversity

This theme refers to the conservation of all forms of biodiversity and focuses on the allocation of areas to different uses and diverse species to support food security. Farms in farming system 3 scored green, while farms in farming systems 1 and 2 scored yellow and orange. Farms in system 3 had a more diversified crop production and mixed crop-livestock systems, whereas the farms in farming system 1, which got a lower score, had a monoculture crop production system.

3.2.5 Materials and Energy

This theme refers to minimizing materials and energy through economical and efficient use. The farms in farming system 3 scored green, whilst farms 1A, 1B, 2A and 2B scored yellow and orange. Farms in system 3 were applying practices that according to the SAFA guideline could replace energy-intensive processes by less intensive alternatives, such as better natural air circulation in the stables, efficient electricity use using halogen light bulbs, use of manure as fertilizers and as biogas feedstock, and crop waste-paddy straw to feed the cows.

3.2.6 Animal Welfare

Animal welfare in SAFA has to do with the physical and psychological well-being of the animal. The farms in farming systems 2 and 3 scored dark green, while farms in farming system 1 scored yellow. The farms in farming system 2 and 3 had regular monitoring of animal health, including written records and vaccinations. Their stables had fresh air, sufficient light, and a high score of cleanliness. The owners of these farms attended workshops about animal welfare. On the contrary, in the farms in system 1 no regular vaccination was there, except in periods where they could pay for it.

3.3 Economic Resilience Dimension

3.3.1 Investment

The Investment theme relates to the farms' investment into capital goods, human resources or ecosystems, and includes internal investment, community investment, long-term investment and profitability. The farms in farming system 3 scored dark green. These farms had more resources and hence invested their capital in the last

five years in renovating the stables and in the owner attending workshops about animal welfare. There were no records of negative socio-economic or environmental impacts as a result of the farms' investments. Moreover, the farms in farming system 3 recorded costs per unit of production as well as the break-even point for the products increasing their capacity to manage the farm's profitability. The farms in farming systems 1 and 2 scored yellow and orange. These farms did not have business and investment records and plans.

3.3.2 Vulnerability

The Vulnerability theme relates to the capacity of households or individuals to prevent, mitigate or cope with risk. The farms in farming system 3 and the farm 2A scored green and dark green, while the other farms (1A, 1B and 2B) scored yellow and orange. The farms in farming system 3 were able to identify and evaluate which risks could potentially threaten their business, such as the lack of pasture and feeds, or animal diseases. Moreover, these farmers implemented actions to reduce potential supply risks, for example making hay for the dry season. The farmers in system 3 also applied practices to increase stability of their production, e.g. managing cattle diseases by increasing animal welfare and having regular vaccinations. Farmers of farms 1A, 1B and 2B faced lack of ability to cope with risk, and developed problems such as the scarcity of forage during the dry season.

3.3.3 Product Quality and Information

This theme targets factors such as food quality and food safety. The farm 3A in farming system 3 scored green, while the other farms scored orange. Farm 3A kept product quality through maintaining a better feed quality together with a regular vaccination, due to having more financial resources. In all six farms, there were no records or observation that the material input and products might potentially cause health effects.

3.3.4 Local Economy

This theme is related to the contribution of the farm's activities to the local economy in terms of local employment and tax and local procurement of resources. The farms in farming systems 2 and 3 scored green or dark green, and a farm in system 1 scored yellow. The farm activities in farming systems 2 and 3, due to their production size, gave more benefits to local economy through the creation of local employment.

3.4 The Dimension of Social Well-Being

3.4.1 Decent Livelihood

Livelihood theme comprises the capabilities, assets (material and social resources) and activities required for a means of living that meets the basic needs to maintain a safe, decent standard of living within the community, with the ability to save for future needs and goals. Farms in system 1 and 2 scored yellow, while farms in farming system 3 scored green. In farming system 3, there was an agreement between the farmers and the employees about overtime payment – fully compensated by the owner of the farm – and farming systems 1 and 2 were not scored on this. Moreover, the farms in farming system 3 could provide training for themselves and their employees, so that their farm practices could improve and become more productive. In contrast farms in farming system 1 and 2 did not have opportunities to join farm management training sessions.

3.4.2 Fair Trading Practices

The theme on 'Fair trading practices' includes legal rights, which allow farmers to have access to markets where fair prices are negotiated. The farms in farming system 3 scored green, the farms in farming system 2 scored yellow and the farms in farming system 1 scored red. Due to lack of resources, the farms in farming system 1 had a low bargaining position in the marketing system, where the price of live cattle was determined by the physical condition of the cows (with weight measured by a guess from the buyer rather than by scales) and the farmers in farming system 1 had no resources to bring their cows to the district cattle market. In contrast, in the farms in farming system 3, the farmer was the middleman himself, therefore their better bargaining position in the marketing system.

3.4.3 Labour Rights

The Labour Rights theme aims at seeking regular employment that is fully compliant with national law and agreements on contractual arrangements, labour and social security. The farms in farming system 3 scored green and the farms in system 2 scored yellow, while the farms in system 1 scored red. The farms in farming system 3 had an agreement that the employee' salary meet the standard salary in their area (Rp 1.000.000 : 1 million rupiah). Whilst in farm 2 the employees were the family relatives, and mainly part time job and the salary lower than standard salary. The husbands in farming systems 1 were leading the farm operation, and the wife also took part in the decision-making. In addition, children helped with the work, and there were no employees. Young children helped on the farm but still had opportunity to attend school.

3.4.4 Equity

Equity involves the degree of fairness and inclusiveness regarding resource distribution, decision making and possibilities for fair working conditions. All six farmers scored green. There was no discrimination between the owner and the employees, each fulfilling their tasks in accordance with the agreements. According to their statements, husbands and wives shared decisions and risks, with a high degree of equity.

3.4.5 Human Health and Safety

This theme is related to the promotion and maintenance of the physical, mental, and social well being of workers. The farms in farming system 2 and 3 scored green, while the farms in farming system 1 scored yellow. Judgement on this theme was based on observation of the farm environment. The farms in farming system 2 and 3 were cleaner and with well-maintained structures, compared to both the farms in farming system 1. In addition, the farms in farming system 2 and 3 had installed shower rooms and had boots available at the farm, which supported health and safety.

3.4.6 Cultural Diversity

The theme of Cultural Diversity relates to the respect for the intellectual property rights of the indigenous community and to the contribution to food sovereignty in the local area. All six farms scored yellow. No group that could be characterized as 'indigenous' was present in the assessed districts. The farmers could buy the cows available on the market, but they did not have full control over the semen of the artificial inseminations sponsored by the government.

4. Discussion

4.1 The SAFA Sustainability Performance of the Analysed Farms

The results of the SAFA Sustainability Performance of the analysed farms suggest that some of the patterns related to sustainability are systematically linked to the type of system, and they can be explained by access to information and knowledge, networks and economic resources.

The farms in farming system 3 (and partially in farming system 2) had better environmental management, related to, for example, the use of a more diversified crop production and mixed crop-livestock systems, utilisation of manure as organic fertiliser or crop waste as feed. The farmers from these systems (system 3 and partially system 2) were also aware of the importance of the environment for the sustainability of their farm and the society. Stakeholders such as local government staff and university staff, who were engaged in activities like policy making and farming training, can be an important tool for increasing their environmental knowledge and awareness, and hence increasing their engagement in sustainable practices (Bernués et al., 2011). The cleanliness and hygiene on the farms, the education of the people working on the farm and the contracts with the farm workers may be explained by better information and access caused by the larger networks that the farming system 3 (and partially the farming system 2) involve. Some of the environmental issues and themes were related to the economic resources availability of the farm. For example, water management and manure treatment practices, production of biogas and regular use of animal vaccinations were all connected to the investments that were possible in the farms of farming system 3 and partially farming system 2, while they were an important limitation in the farms of the farming system 1.

In the economic resilience dimension, the farms in farming system 3 (and partially in farming system 2) also scored better. Their higher economic capacity is indicated, for example, by the level of their investments, and their lower vulnerability to risks related to production instability, animal diseases and feed self-sufficiency. However, better economic records and management could be applied independently of the economic capacity and help to increase the farm economic resilience. For example, appropriate learning and the creation of accurate business records will help the farmers to develop a business plan, and allocate resources to generate and increase profits in the long term (FAO, 2013a). Also, farmers can use business records to determine what the efficiencies and the inefficiencies are, measure progress of the business and plan for the future. The better bargaining position of the farming system 3 is probably caused by the existence of the middleman within the farm.

The higher economic resources also influence the social well-being dimension, for example showed in the differences regarding providing certain types of farming equipment to the workers, which was possible in farming system 3 farms.

In the good governance dimension, the difference between systems in the *Rule of Law* scores can be explained by a better access, of the systems 3 (and partially 2), to information and networks, e.g. in the local cattle markets, which potentially gave them a better understanding of beef cattle policies, regulations, taxes and laws. Therefore,

access to information and networks provides management guidance especially for smallholder farmers to make a decision and take ownership of their farming practices and government policies (White, 2014), such as the BSSP. Boström (2012) suggested that the improvement of social sustainability can be done through strengthening the farmers' participation and empowerment process at the farmers' organization in order to improve collaboration and communication among farmers and workers. This study points to the relevance of encouraging farmers to contribute to the planning and/or to the development of their own farm. It is important for a farmer to have the overview over a governmental policy in order to be creative and innovative in the policy implementation, like the BSSP.

The results of the analysed farms show that the SAFA Sustainability Performance was better for the farming system 3 (hired labour with the farmer as a middleman); it was average for the farming system 2 (hired labour); and it was worst for the farming system 1 (family farming). These results may mislead to the conclusion that 'the bigger the better'. However, this study suggests that it can be more an issue of access to resources. The access to economical resources appears to be lower for the smaller farms (family farms), however, once a certain level of economic resources is reached, the sustainability performance may not have significant increases. This can be observed in the farms of the farming system 3, which were still classified as small-scale systems, but already scored relatively well, despite some specific themes, where some improvement measures could be applied. These results suggest that the larger room for sustainability improvement relies in the family farming systems (system 1), followed by the farming system with hired labour but not marketing activities (system 2).

On an overall level, two main drivers seem to explain some differences in performance between the analysed systems: information/training and economical resources access. Therefore, it is critical to develop practices and processes to improve efficiency, while reducing the environmental and social impacts by increasing awareness, information and training, and facilitating sustainability-related investments by, for instance, finding and supporting suitable and economical solutions, as proposed by Steinfeld, Gerber, Wassenaar, Castel, Rosales, & de Haan (2006).

4.2 Potentials and Limitations of SAFA for Analyzing and Improving the Sustainability of Indonesian Smallholders Beef Cattle Faming

SAFA can be used as a training tool used by both farmers (e.g. by voluntary uptake) and the government agricultural institutions, such as the Livestock and Fishery Offices, which aim at assisting smallholder farmers with little resources to improve their production and performance in terms of sustainability. This framework can potentially motivate the farmers to learn and improve their farm management. Furthermore, it can help the farmers to become aware of more global sustainability issues and of other issues in need of future risk management (FAO, 2013a; Gasso et al., 2014**)**. There might be a potential to use it as indicating future relevant focus areas in terms of sustainability for the local government to improve rules and regulations, as well as risk management. Moreover, it may help to create synergies between the practices required to meet their needs and the concerns of a wide range of stakeholders, from farmers to policy-makers.

Conducting the SAFA assessment in this study was complex, it required a long period of time, and not all the themes utilised were relevant. The use of more context-specific assessment frameworks (e.g. Reed, Fraser, & Dougill, 2006; Binder et al., 2010; van Zeijl-Rozema & Martens, 2010) would help focus on the specific context in which the sustainability assessment is embedded, because they are based on themes and indicators that are applicable within exactly the specific context (Gasso et al., 2014). However, these more context-specific frameworks may reduce the possibilities of benchmarking across different systems, and they can be especially more time- and resource-demanding due to the need for the design of the framework components (Gasso et al., 2014). In these regions in Indonesia, sustainability assessments were not systematically conducted on smallholder farms and were not part of a legal requirement. A context-generic assessment framework like SAFA can be a first step to involve farmers, decision-makers and policy makers in deciding which issues can be relevant in their context and which actions can be taken or not, in order to make agriculture practices more sustainable (Gasso, 2014; Pope, Annandale, & Morrison-Saunders, 2004).

4.3 Moving towards a More Sustainable and Self-Sufficient Sector

The Indonesian beef cattle farmers faced many challenges in their daily lives as well as scarcity of resources in terms of land, capital and feed resources (Permani, 2013). Previous studies showed that the smallholder farmers in these particular districts also faced these challenges (Gayatri &Vaarst (2015). Setianto et al., (2014) also found there has been continuous import of beef cattle after the BSSP had been running for ten years. This obviously means that the Indonesian beef sector had difficulties in meeting the Self-Sufficiency goal. Part of the challenges of meeting this goal had to do with the beef cattle production under challenged farming conditions, as explained

above, and where the farmers (especially in farming systems 1 and 2 in this study) had not been fully aware that the government had initiated a programme which had these aims. This suggests that effective and respectful communication should be prioritised to create harmony between national goals and the capacity and priorities on farming systems and farming sector levels (Othman & Muhammad (2011). Pope and co-authors (2004) emphasised that good communication with the farmers will help improve plans and activities to make an optimal contribution to sustainable agriculture.

This study aimed at investigating aspects of sustainability on the farms that were expected to contribute to fulfilling this national goal. This leads to the question that we wanted to raise in this study: how to become beef self-sufficient in a sustainable manner, taking the starting point in the smallholder farms. We view 'sustainable practices' as practices that allow the future generations to be able to sustain their livelihoods in dignity. Current farmers' transformation to such practices may need governmental support, in terms of knowledge generation and resources to implement practices – such as better integrated crop-livestock farming, composting manure for crop fertilizer, being self-sufficient in feed, or implementing local, regional or national marketing systems. The result of the SAFA assessment showed that farmers with better resources scored higher. Based on these findings, we suggest that more research is needed to explore these findings and the potentials to improve the sector, since most of the beef cattle farmers in Indonesia are smallholder farmer families with little resources and lack of education in cattle farming, as well as little insight into aspects of sustainability. FAO states that smallholder farmers need a sustainability-oriented governance structure that includes the process of decision-making in order to take ownership of their farm, and ensure equitable access to vital resources and equity to the law and regulations (FAO, 2013a). Graeun, Chappell, Wittman, Ledermann, Kerr, & Gemmill-Herren (2015) suggested that governments should harmonize long-term policies to improve the contribution of family farming to food security in a sustainable manner.

Sustainable agriculture combines the governance, social, economic and environmental dimensions (Valentin & Spangenberg, 2000). A focus on only one dimension at the expense of others may be risky (Yunlong & Smit, 1994). For example, agricultural production systems cannot be regarded as sustainable if they neither can produce an adequate food supply nor provide sufficient economic rewards to farmers, even if they maintain environmental quality. Similarly, agricultural systems that maintain relatively high levels of production, but employ increasing amounts of inputs to offset the yield or having impacts of environmental degradation, would be viewed as less than sustainable (Yunlong & Smit, 1994). Beyond that, sustainable agriculture might set an example that would help to open new doors to a more socially equitable society (Schaller, 1993).

This article presents and discusses the results of a sustainability assessment carried out at six private smallholder farms in Indonesia using the SAFA assessment developed by FAO. The authors realised that it is needed to assess more respondents and to cover a larger geographical area in Indonesia in order to get more overview and a new perspective of Indonesian beef cattle farmers regarding sustainable practices. Further research is important to validate the findings of the study, such as individual interviews to get an insight of the perception of Indonesian beef cattle farmers about the sustainability concept. Moreover, more research is also needed on how to increase the farmers' participation and implementation of improved sustainable practices in order to support the Indonesian government to achieve a long-term sustainable beef production.

5. Conclusion

The result of the study provides information on how different farming system would influence the performance in sustainability. These results suggest that the larger room for sustainability improvement relies in the family farming systems (system 1), followed by the farming system with hired labour but not marketing activities (system 2). The main drivers that explain a lower sustainability performance between the analysed systems seem to be related with limitations in access to information and knowledge, networks and economic resources. The assessment results can be a motivation for internal improvements, but also an important tool to give recommendation for the local government, in which themes of sustainability need to be improved in the future. SAFA framework can be beneficial to government institutions and existing sector sustainability concerns and concerns about the farmer's needs, especially smallholder farmers with little resources to improve their sustainability performance. We argue that it is therefore important for the government to focus on sustainable development within their policies as well as on identifying alternative approaches for empowering the farmers and the industry to create a sustainable technological and social advancement.

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