

A group learning E-VSM approach for improved environmental, economic and social performance of small suckler cow beef farms in Sweden.

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Abstract: This paper reports on the evaluation of a new advisory concept applied on small suckler cow beef farms in Sweden, where group-based learning was combined with an environmental value stream mapping (E-VSM) approach including environmental, economic and social aspects of sustainability. The E-VSM was carried out by presenting the farmers to blended learning comprising on-line material and assignments in combination with group workshops and meetings on the farms. By the end of the project, farmers were satisfied with the advisory concept and experienced that the E-VSM helped them to identify wasteful activities and implement continuous process improvements.

Keywords: sustainability transition, value-stream mapping, process improvement, lean production

1. Purpose

The importance of suckler cows for beef production has increased due to the declining number of dairy cattle in Sweden. For the same reason, the suckler cow beef production has become increasingly important in the preservation of semi-natural grasslands in agricultural landscapes. However, beef production contributes to climate change, mainly because of the production of methane released during feed digestion, and this emission is difficult to control. But increased efficiency can decrease the negative environmental impact of cattle production and reduce costs to the farmer (Hessle et al. 2017). Therefore, it is crucial to support farmers in identifying and implementing process improvements.

Value stream mapping is a method for visualizing the flow of material and information in processes, identifying wasteful activities, and supporting process improvements in various types of operations. A recent development of this method is the integration of sustainability concepts also known as Environmental Value Stream Mapping (E-VSM). The method has its origins in Lean production and the manufacturing industry but has also been introduced in other sectors, such as the service sector (Abdi, Shavarini, and Hoseini 2006; Piercy and Rich 2009; Swank 2003), administrative processes (Atkinson 2004), healthcare (Brandao de Souza 2009; LaGanga 2011) and public administration (Arlbjørn, Freytag, and de Haas 2011; Pedersen and Huniche 2011). At its core, Lean production consists of a set of management principles that aims at increased productivity and efficiency by eliminating the non-value-added activities or 'waste' in the production processes of a business (Womack and Jones, 1996).

Although previous research showed that VSM may improve the performance of dairy farms, studies on the application of VSM in agriculture are limited (Melin and Barth, 2020). This paper

reports on the co-development with farmers and evaluation by an action research-based study of the Environmental Value Stream Mapping (E-VSM) tool customized to the needs of small suckler cow beef farms in Sweden. The aim is to support elimination of waste and to improve sustainability outcomes at farm level, as well as implementing a new approach of reflecting upon farm processes by the farmer.

2. Design/Methodology/Approach

The VSM technique developed in this study builds on the visual mapping approach (Rother and Shook, 1998) and Value Stream Management (Hines et al., 1998), which are tools that help the business manager to use the lean principles and build knowledge on the Lean concept. The methodological approach was action-oriented research, which in this case address problem-solving based on recurring cycles of action and reflection. The role of the researchers was to facilitate meetings and provide farmers with coaching and support as well as to evaluate the project outcomes. Data was collected at workshops with farmers and farm advisers and by making observations at the farms. A total of 3 meetings online and 5 on farms were performed from May 2021 to December 2023 with two groups each consisting of 5-6 farmers. The results of the workshops and the farm visits were documented which gave a good idea on how the farmers improved their processes during the course of the project. By the end of the project, six of the participating farmers answered a questionnaire about their experience of participating in the project. The questionnaire comprised of several statements that was valued on a Likert scale 1 to 7. How the farmers answered to some of the statements in the questionnaire is shown in Table 1 as means and min and max values. Only seven of the statements are presented here due to limitation in space.

3. Findings

3.1 Co-development of E-VSM

The project started with a few modules including tools and learning materials developed by the researchers drawing on their previous experience from working with Lean production in different areas and with farm extension. The modules were tested by the farmers in the project and was then further developed by farmers and researchers in collaboration. By the end of the project there were six modules comprising of recorded online webinars, tools, workshop guides and other learning materials (figure 1).

Module 1: Introduction to the modules.

In this module the project was introduced to the farmers at an online webinar, where the purpose of the project, the overall concept and what could be expected from participating in the project were communicated.

Module 2 and 3: Introduction to Lean and VMS.

The principles of lean production were presented in a webinar on-line and farmers were introduced to the concept of value adding and non-value adding activities. The farmers were given a home assignment to do before next meeting, which was to identify and document wastes on their farm by performing a “waste walk” at the production site and to contemplate about the root causes of the identified wastes. The findings were then presented and discussed with the other group members at a follow-up meeting.

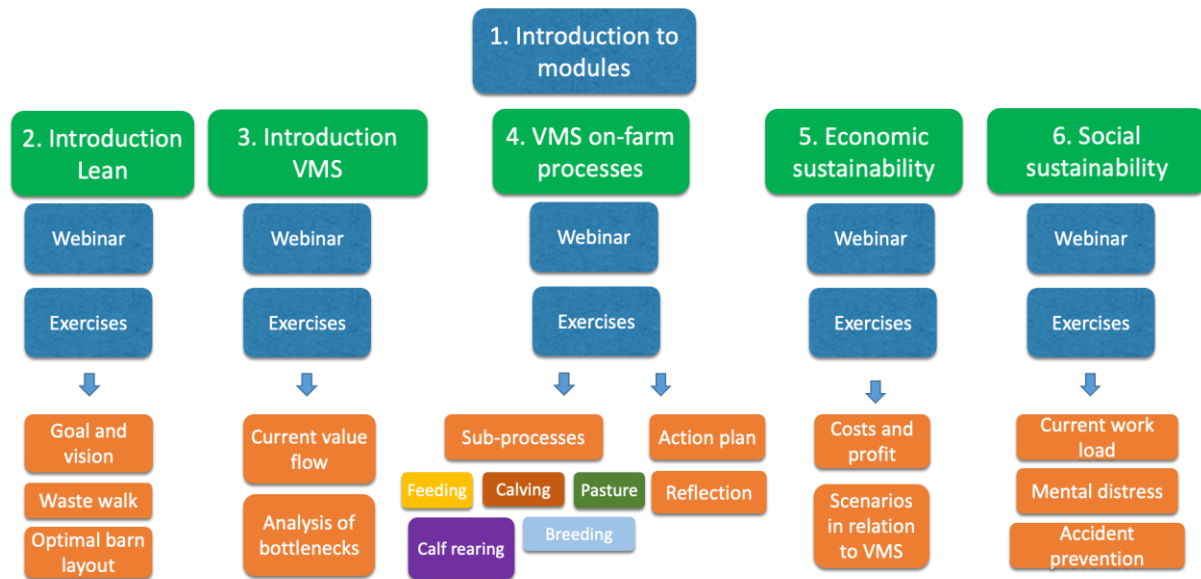


Figure 1. The different modules (green boxes), educational content and workshop guides (blue boxes) and tools (orange boxes) of the learning approach.

In a second webinar, farmers were shown how to map the total value flow of the beef production process of their farms. Identification of sub-processes and useful key performance indicators were done by the researchers and farmers together. The idea with this mapping activity was to facilitate the identification of waste and other factors that creates problems in the value flow. The maps were printed and discussed at a follow-up meeting. This activity resulted in a tool that guides the user in describing the value stream, identify wasteful activities and document the improvement work, which can be used by other farmers and advisors who would like to engage in the same exercise. When it comes to the feeding process, farmers discussed the most optimal place to store silage bales and other feedstuffs to minimize the distance that machines had to be used for transport. In the calf rearing module, discussions concerned for example, improved management routines such as new regimes for feeding, weighing, and marking of the young calves. At some farm visits, the farmers wanted to discuss their plans on building a new barn or enlarging the current one and received feedback and suggestions from the other farmers in the group.

Module 4: Value stream mapping in farm sub-processes

In this module, the value streams of the most critical sub-process were mapped. This activity was done at three subsequent workshops on the farms where the farmers were guided through the mapping of one sub-process at a time (calf rearing, grazing management and feeding). There were plans to also map the calving and breeding process but it was not done due to lack of time in the project. The researchers' role was to present an unbiased, external perspective on the production processes and to support the farmers in picturing the value flows, identify its problems, and to help come up with improvements.

Module 5: Assessment of the economic sustainability of suckler cow beef production

In this part of the project, an agricultural economist analysed the final accounts of the suckler cow beef production of each farm. The purpose was to give the farmers an opportunity to reflect on profit and costs in relation to the outcomes of the value stream mapping and the improvement work. The analysis was done for each individual farm and the compiled results were discussed at the group meetings.

Module 6: Social sustainability, lean and the working environment

The purpose of this module is to make sure that the focus on Lean and efficiency don't have negative effects on the farmers working environment. A tool was tested and further developed to support the group discussion on the farmers' psychosocial work environment. The result showed that farmers experienced heavy workload and mental distress at different times of the year. Also mapping of risks and hazards in the work environment is included in this module but was not brought up due to time limitations in the project.

Table 1. Results from a questionnaire on how farmers (n=6) experienced their participation in the E-VSM program presented as mean, min and max values of a likert scale (1=do not agree at all, 7=fully agree).

Module - question	Mean likert value	Min-Max likert value
Introduction to Lean – I would recommend my farmer colleagues to do waste walks on their farms	6.5	5-7
Value stream analyses – Value stream mapping helped me to see my production process in a new light	5.8	4-7
VSM feeding – VSM helped me to identify wastes in the feeding process that I hadn't noticed before	5.4	4-7
VSM calving and calf rearing – VSM helped me to identify wastes in calf rearing that I hadn't noticed before	5.6	4-7
VSM grazing – VSM helped me to identify wastes in the grazing management that I hadn't noticed before	5.3	4-7
Farm economy - To analyse the final accounts gave me new insights in my business	6.5	5-7
Social sustainability - The workshop where we discussed workload and mental distress in different parts of life (the farm, private, outside the farm) was useful for me	6.3	4-7

3.2 Evaluation of the advisory concept

Overall, the farmers were satisfied with the project and in the questionnaire the separate modules were rated between 5.6 to 6.5 on average out of maximum seven. The waste walk exercise in module 2 helped them to identify wastes in the processes, and one of the farmers said: "We had observed them (the wastes) before but now they became very clear to us. Clear enough we actually did something about them." Examples on wasteful activities identified by the farmers were weak calves due to suboptimal routines in management of the newborn calf and bad on-farm logistics by placing silage bales far away from the barn. The Value stream mapping exercise in module 2 made the farmers see their farm in a new perspective. One farmer said: "This is a totally new way to look at my production. It makes you realise that every little part can have a big influence. Everything from the choice of grass variety to harvest and weaning of calves."

To break down the daily work into sub-processes and activities was new to the farmers and made them reflect on what they did on their farms and why and if they could do it in another way. The farmers thought it was worthwhile to engage in this exercise and it resulted in that all farmers who answered the questionnaire identified wasteful activities, and by the end of the project most of them had set new goals for the production and had implemented improved routines.

All farmers thought the economic analysis was valuable and gave them new insights in their business. For some of them it led to changes in business strategies and investment decisions. Because Swedish suckler beef farms are rather small and are often run part time the economic analysis is often neglected, which makes this kind of analysis valuable for this kind of farmers.

The farmers said it was difficult to discuss social issues like mental stress and workload and that this was something they usually don't talk about with others. To get the opportunity to share their thoughts with other farmers in a similar situation was new to them but it was meaningful, and they realized that they were not alone in sometimes feeling a lot of distress. They thought the exercise where they mapped the workload in relation to different work processes was valuable and it resulted in ideas on how they could improve the situation, e.g by hiring a co-worker, prioritizing among assignments and planning their duties better.

4. Practical Implications

The project resulted in five modules comprising workshop guides, learning materials and tools that can be used by other farmers and advisers who would like to apply E-VSM. The content in these modules will be published on-line and is available for anyone to use. After more than two years in the project, the farmers were satisfied with the method and thought the learning materials and the E-VSM supported them to become better at identifying wasteful activities and finding out where improvements could be implemented.

5. Theoretical Implications

Previous research on implementation of Lean principles and value stream mapping in agricultural firms has until now focused on bigger farm operations where the farmer and the employees have formed an improvement group that received external lean coaching. This is similar to how implementation of lean usually is organised in the manufacturing industry. With support from a national Lean program, several Swedish farmers have begun to implement Lean principles and methods on their farms to become more efficient (Melin and Barth, 2018). The farms that participated in this program were all large operations, which contrasted with the typical Swedish suckler cow beef farm that is family owned and managed by the farmer, sometimes as a part-time occupation. This paper is to our knowledge the first to report on a concept customized to the needs of small agricultural firms where five to six farmers have supported each other in the improvement of production processes. This paper also shows how all three aspects of sustainability (i.e. the environmental, economic and social) can be included in the mapping of value streams of a farm. More research could be done to further develop E-VSM to a process improvement tool for small farms with other types of production as well as quantifying the effects of implemented improvements. The implementation of Lean in agriculture is not a straightforward process and barriers to change may be encountered on several levels in a firm (Barth and Melin, 2018)

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