Extended Abstract – Like Two Peas in a Pod – Organic and Digital Transformation

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Abstract

Transforming our food system is important to achieving global climate neutrality and food security. Germany has set a national target of reaching a 30% share in organic farming to support the goal. When looking at the transformation process from conventional to organic farming, it becomes apparent that measures need to be taken to reach this anticipated goal. A particular emphasis of this work is placed on finding a digital solution and process improvements to ensure longevity and efficiency. Interviews with actors along the farm-to-fork value chain were conducted to identify central barriers and drivers of organic transformation. The results of the interviews show firstly, that three subsystems need to be distinguished when talking about the farm-to-fork value chain: (1) farmers, (2) intermediaries, and (3) the canteen system. Although all three subsystems can be combined to form a coherent value chain, they rarely act and communicate beyond the boundaries of their subsystem. Secondly, we were able to allocate primary barriers and drivers to each of the subsystems, highlighting the need to include all three in the transformation process and aim for a comprehensive digital solution. This work explores the potential of a network-based platform to improve the current practice of rigid and strictly hierarchical value chains. We focus on deriving user requirements from the interviews to describe the necessary functionality of the platform to address the identified barriers and exploit existing drivers.

Keywords

organic food supply chain, value chain, value network, environmentally reflected system modeling, sustainable food system

1. Introduction

The European organic action plan sets a development target, defining that 25% of the EU's agricultural land shall be cultivated organically by 2030 [1]. The German national goal is even higher: 30% of the land is to be farmed organically by 2030, a goal that was reinforced by the new government in 2021 [2]. The state of Baden-Wuerttemberg is participating in the achievement of this goal and, in line with the federal target, is aiming for a share of organic farming of 30-40% [3]. As of now, the federal state of Baden-Wuerttemberg has had a share of 14,5% organic acreage in 2021, compared to the nationwide 10,9% [4]. Although the numbers are constantly growing, the required increase rate of annually 12% is not achieved nationwide and regularly – Baden-Württemberg has had an increase of 5,4% from 2021 compared to 2020 [4] (0,8pp), nationwide it was a plus of 5,9% [4] (0,6pp). In general, the existing continuous growth shows great potential for improvement but also questions how realistic the achievement of the anticipated goal by 2030 may be [5].

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Public out-of-home catering is a lever with high impact potential as these canteens are organized and paid for by the public sector [6]. With revenue of 1.85 Billion € in 2017 from German employee restaurants, plus an additional approximately 1 Billion € from German hospitals and retirement homes, the market for out-of-home catering is significant [7]. Against this background, the state of Baden-Württemberg has initiated numerous research projects that deal with the ecological transformation of value chains in the out-of-home food supply sector. Some of the research projects, such as the project of the authors *ÖkoTrans [8]*, are also investigating how digital systems can be used to overcome existing transformation barriers in farm-to-fork value chains. The design of such systems should take into account both, the humane criteria for value chains proposed by the FAO [9], as well as their reflection in IT systems [10].

Considering the high relevance of IT systems and the rapid development of new and innovative digital solutions, it is not surprising that many research endeavors go towards designing platforms, developing applications, or discovering new technologies. In recent years, research for the food supply chain from farm to fork has started to increase, especially focusing on digital innovations for various topics along the value chain. These topics include, amongst others, the traceability of food items along the value chain with the help of blockchain technology [11, 12], platforms for farmers to enable value-creation networks [13] or to improve the agricultural processes in general [14], and platforms to facilitate consuming regional food items, for example for the context of tourism [15].

All of these approaches focus specifically on one aspect or actor of the value chain and miss a more holistic approach that includes all stakeholders and relevant technologies with a shared goal. In the context of the organic food value chain, we are facing a special predicament: although the benefits of organic farming are a given, the goal to achieve a 30% share of organic agriculture was set by politics, not the actors of the value chain. Looking at the transformation process so far, it becomes obvious that there are either barriers hampering or drivers missing to support the transformation. Hence, we aim to design a platform draft that empowers the actors along the value chain in a way that minimizes or removes obstacles and exploits potentials to enable organic transformation while also supporting digital transformation.

2. Method

The main objective of this work is to gather insights gained by the design process of an artifact to achieve essential environmental, humanitarian, and economic goals in farm-to-fork value chains. Hence, this work follows the Design Science Research Methodology [16]. To gain an in-depth understanding of the problem, we first performed desk research regarding the supply and value chains from farm to fork, to identify the important actors for our use case (e.g. [17]) and to create an interview guide with relevant questions. We then conducted semi-standardized interviews with 38 different food supply chain actors in the State of Baden-Wuerttemberg, categorized as follows (the interviewee groups presented in this chapter base on the results of the interviews, where separate sub-systems were identified): 11 farmers, 8 intermediaries, 18 canteen representatives, and 3 further stakeholders. Each interviewee group received different questions, specifically designed for their fields of work:

(1) Farmers were asked about the drivers and barriers to organic conversion regarding the actual farming processes, the marketing and pricing of their products, digitization potential, and their professional opinion about the certification requirements for their produce.

(2) Intermediaries were asked about the drivers and barriers to purchasing, processing, marketing, and selling organic products, the IT systems they use and what other digital benefits they offer for their customers, and their business experiences with canteens in particular.

(3) The canteens were asked about the drivers and barriers to purchasing, processing, and selling organic products; the general specifications, guidelines, and restrictions they receive (from all stakeholders); what an ideal IT system would look like and what features it would offer; and the current development of food trends in the canteen context.

(4) The other stakeholders were asked about their position in the value chain, the drivers and barriers they perceive, and the digital opportunities they are aware of.

The results were used to refine our understanding of the as-is farm-to-fork value chain and to model a desired target state. The identified drivers and barriers were used to understand the situation and

challenges of each actor in the value chain to draft a beneficial digital solution. On the one hand, the platform design aims to address challenges and potentials directly related to organic conversion. But on the other hand, it is furthermore important to directly take general user requirements and potentials for digitalization into consideration.

3. Preliminary Results

The interviews show that the as-is state of the farm-to-fork value chain is sequential and includes a varying number of intermediaries, depending on the convenience level of the product purchased by the end consumer. In the context of canteen meals, the number of intermediate steps is assumed to be above average, firstly because caterers often rely heavily on convenience products, and secondly because the prepared meal is another value-adding processing step itself. Furthermore, the chain can be divided into sections, resulting in three subsystems that primarily act independently from each other and rarely communicate or act beyond the borders of their subsystem. The three subsystems we identified are (1) farmers, (2) intermediaries, and (3) the canteen system. A further important player that connects the subsystems to form a value chain is the logistics, often organized by one of the actors for certain steps of the chain.

Each subsystem has very specific needs, especially in terms of requirements for a digital solution that enables them to produce or offer more organic food items. One barrier that applies to all actors is, when organic and conventional products pass through the same value chain, this means that they are competing in the same market and their primary comparison criterion is the price. What is not visible in this conventional value chain are the other quality criteria and benefits organic products hold, these could be sustainability indicators as they are currently developed, like the Planet Score [18] that evaluates the usage of pesticides or the impact on biodiversity and climate of a product, or the Eco-Score [18] that also performs a life-cycle analysis of the product based on the Product Environmental Footprint [19] that additionally includes a bonus/malus system regarding further environmental performance indicators. Another key issue is the disconnection of producers and end-consumers, resulting in a shift in the supply-demand mechanism. Firstly, choosing suitable distribution channels is a key task for farmers as well as planning their production according to enabling/restricting conditions and customer needs. Before a product reaches end-consumers though, especially in the value chain of out-of-home catering, it passes a variety of intermediaries, diluting and shaping the market pull that comes from those end-consumers. Furthermore, caterers rely on varying levels of preprocessed food items, making processing intermediaries somewhat indispensable. The worth of value creation and the influence they have on what is offered to caterers and sold by farmers puts intermediaries in a very powerful position, a position that is further strengthened by the non-transparency of those intermediary steps. As a result, the push-pull market dynamics of demand and supply influencing each other [20] are brought out of balance, as their effect on one another is weakened by the power intermediaries hold.

This results in two important base functionalities a digital platform needs to address:

1. The platform must enable the tracking and measuring of quality criteria beyond the price to define a product's worth to make the value chain more transparent and bring out the benefits of organic products.
2. The platform must empower all actors equally by enabling a value *network* instead of realizing or supporting a value *chain*.

In addition to these general criteria, the platform must fulfill other subsystem-specific (user) requirements to not only enable organic transformation but also to prove generally useful for their business and work processes.

This research and its results offer the ICT4S community the opportunity to discuss the positive and transformative impact IT solutions can have on the food supply chain. We strongly believe in the benefits organic agriculture proposes and agree with the initiative to have such a framework. At the same time, the sustainability of the food supply holds many more dimensions, like food security, system sustainability, and packing and processing, to only name a few.

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