

COLLABORATIVE SUSTAINABLE BUSINESS MODEL ARCHETYPES IN THE AGRI-FOOD SECTOR

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ABSTRACT

Farmers are put under pressure to produce more and higher quality food at a lower cost in an environmentally and socially sustainable manner. However, farmers might struggle to benefit from implementing socially and environmentally sustainable practices. Collaborative sustainable business models (CSBMs) offer a promising avenue to overcome these struggles by developing a value creation and value delivery systems together with other value chain actors instead of by the farmer independently. Based on the analysis of the CSBMs of 290 sustainable agri-food start-ups and thirteen interviews, we identify six CSBM archetypes and twelve CSBM sub-archetypes. The developed archetypes provide practical guidance and stimulates thinking for practitioners who can mimic the archetypes within their own organizations and value chains. The practical relevance is highlighted by the use of the CSBM archetypes in twenty-six value chains in a Horizon2020 research project. In terms of theoretical relevance, this research adds a new perspective to (sustainable) business model literature and the archetypes can serve as a reference point for future research.

Keywords: *Business model innovation, collaborative business models, sustainable business models, business model archetypes, agri-food.*

1. THEORETICAL AND EMPIRICAL BACKGROUND AND RELEVANCE

The agri-food sector is responsible for a third of global anthropogenic green house gas emissions (Crippa et al., 2021). Unfortunately, despite the existence of sustainable farming practices (Rosenzweig et al., 2020) and despite the intrinsic motivation of many farmers to adopt such practices (Barth et al., 2017), the actual uptake of sustainable practices leaves ample room for improvement (Tell et al., 2016). The limited uptake can, at least partly, be contributed to the severe price pressures which farmers face and, consequently, to the limited financial room they have to invest in sustainable farming practices (Stanco et al., 2020). Collaboration between multiple value chain actors to valorise sustainable practices can help farmers to economically benefit from sustainable farming practices (Adams et al., 2016; Bankvall et al., 2017; Rohrbeck et al., 2013). However, as firms try to act rationally, each involved actor needs to benefit from the collaboration. Hence, a business model for the collaboration is needed to enable sustainable agriculture.

1.1 SUSTAINABLE BUSINESS MODELS

Most practitioners and academics use business models to answer questions like “what is the underlying economic logic that explains how firms create and deliver value”, “how does a firm create, grow and retain their business” and “how do the activities of a firm strategically fit together” (Chung et al., 2004; Osterwalder and Pigneur, 2010; Teece, 2010). Despite the lack of a clear definition, definitions in literature convert around four

elements, namely value proposition, value creation, value delivery and value capture. The value proposition is the “starting point for any business model” (Bouwman et al., 2008, p. 36). As the value proposition reflects the firm’s core strategy (Kaplan and Norton, 2001) it is, in essence, the promise of the benefits offered to the customer (Bocken et al., 2014; Richardson, 2011). The value creation refers to the activities and resources needed to create the value. The value delivery describes the relationships and channels needed to reach the target customer. Finally, the value capture describes the cost and revenue structure of the business model (Bocken et al., 2016; Osterwalder and Pigneur, 2010; Zott et al., 2011).

Based on Geissdoerfer et al. (2016) and Boons and Lüdeke-Freund (2013), we define sustainable business models (SBMs) as “*business models that propose, create and deliver and capture social and/or environmental value in an economically viable way*”. As such, SBMs aim to achieve environmentally and/or socially sustainable value propositions besides the traditional economic value propositions (Patala et al., 2016). In terms of the value capture, SBMs still capture economic value (e.g., through reduced costs and increased revenues) but also sustainable value through, for instance, enhanced environmental performance, natural resource preservation, social performance and societal wellbeing both in the long and short-term (Geissdoerfer et al., 2018).

1.2 COLLABORATIVE SBMs

So far, (sustainable) business model literature mainly took a firm-level perspective. However, Zott et al. (2011) suggest that business models cannot be reduced to issues in the focal firm. Likewise, Bankvall et al. (2017) argues that business models are embedded in the network in which a firm operates as changes in the business model may not only affect the focal firm, but is likely to affect a number of firms in the network. Despite these considerations, only few business model scholars transcended the boundaries of the focal firm. Based on the definitions of business models which go beyond firm boundaries (see Table 1 for an overview) as well as on the SBM literature presented in the previous section, we define collaborative sustainable business models (CSBMs) as “*business models which create and deliver sustainable value on (part of) a value creation and delivery system level involving the long-term collaboration between two or more actors*”. Note that, in our view, CSBMs have an overarching nature and should be seen together with firm-level business models: the CSBM builds upon (parts of) multiple firm-level (sustainable) business models. Moreover, the collaboration in CSBMs supersedes the transactional relationships between the partners.

| Concept | Definition (emphasis added) | Reference |
|---------------------------------|--|--------------------------------------|
| Open business model | An open business model examines the creation of value between a stakeholder , rather than simply considering the value created within the boundaries of a single firm | Coombes and Nicholson (2013, p. 658) |
| Dynamic business model | [A dynamic business model is] the emergent outcomes of preconceived network structures built through the development of routines that guide problem solving | Mason and Leek (2008, p. 774) |
| Network embedded business model | A network embedded business model relies on network level value creation processes and business exchange patterns that are not clearly aligned | Bankvall et al. (2017, p. 201) |

| | | |
|------------------------------|--|------------------------------|
| Collaborative business model | [Collaborative business modelling] is an activity where multiple organisations that might differ in type (industry, public research and non-profit), their position in the value chain (manufacturing, service, etc.) and industry (energy, ICT, etc.) work together to create a value creation system . In some cases, they will also attempt jointly to create the value capture system. | Rohrbeck et al. (2013, p. 8) |
| Networked business model | [A networked business model provides] goods and services working collaboratively with other providers of goods and services as networked business partners. | Chung et al. (2004, p. 274) |
| Extended enterprise | [An extended enterprise is] a set of firms within a value chain or production network that collaborate to produce a finished product. | Dyer (2000, p. 8) |

Table 1. Definitions of collaborative business models

2. RESEARCH OBJECTIVES, PROBLEM AND/OR HYPOTHESES

Literature on CSBMs is still relatively unexplored. Indeed, existing literature on SBM innovation – e.g., Bocken et al. (2014), Lüdeke-Freund et al. (2019) and Yip and Bocken (2018) – takes a firm-centric approach. Hence, the collaborative aspect is largely missing in business model innovation literature. Massa et al. (2017) recognizes that descriptive business model archetypes are helpful to understand how firms do business in a similar way. Likewise, Al-Debei and Avison (2010) argue that business model archetypes allow other organizations to mimic or configure their business models towards a business model archetype. Following this logic, this research sets out to develop a taxonomy of CSBM archetypes to guide farmers and other value chain actors in the agri-food sector.

3. RESEARCH DESIGN

To build a taxonomy of CSBM archetypes, we analysed the CSBMs of agri-food start-ups. Start-ups are typically among the first to commercialise new business models such as CSBMs, hence justifying our choice to focus on start-ups (Kurpjuweit et al., 2021; Wagner, 2021). We relied upon secondary data as “elements of business models are often quite transparent” (Teece, 2010, p. 179). This allows us to collect data on virtually every start-up as such reducing biases related to sample selection and low response rates. In fact, previous research on business models relied on secondary data of start-ups too, see for example Hartmann et al. (2016) and Prozman and Cagliano (2022).

3.1 DATA COLLECTION AND DATA ANALYSIS

To collect data, through a keyword-based query we extracted the organizational data of 20.666 agri-food start-ups from Crunchbase, the world’s largest start-up database with more than 650.000 entries. A team of researchers manually checked if the start-ups were actually operating in the agri-food sector by reading their organizational description and visiting their websites and social media pages. This first screening reduced the sample to 7.122 agri-food start-ups. Next, following Yi et al. (2021), we coded the start-ups on the SDGs 1 (zero hunger), 6 (clean water and sanitation), 8 (decent work and economic growth), 12 (responsible consumption and production) and 15 (life on land) to classify them as sustainable and non-sustainable start-ups. The selected SDGs are deemed

particularly relevant for the agri-food sector (Yi et al., 2021). The coding was performed automatically in Excel using 625 key words in Excel. The coding of the sustainable start-ups was manually verified and, if needed, corrected by a team of researchers. As a result, a total of 1.701 sustainable agri-food start-ups were identified. As a final step in the sample selection, we only included start-ups who had a business model based on at least one of the following types of collaboration:

- Horizontal collaboration: collaboration between farmers;
- Vertical collaboration: collaboration between farmers and different actors within the agri-food supply chain;
- Diagonal collaboration: collaboration between farmers and actors external to the core agri-food supply chain.

This final coding step rendered a final sample of 290 start-ups.

Finally, to derive the CSBM archetypes, we balanced induction with early structure by relating the CSBMs to the widely adopted SBM archetypes of Bocken et al. (2014). When a CSBM did not fit in any of the archetypes identified by Bocken et al. (2014), we tried to group the CSBM under newly developed archetypes.

To validate and refine the CSBM archetypes, we interviewed thirteen start-ups from the sample using semi-structured interviews with questions covering the start-up's value proposition, -creation, -delivery and -capture and the different collaboration types. Using Excel to manage the coding process in a systematic, transparent and consistent manner further facilitated the reliability of this research.

4. ANALYSIS AND DISCUSSION

As shown in Table 2, we identified six CSBM archetypes and a total of twelve sub-archetypes. Five out of the six archetypes align with the SBM archetypes identified by Bocken et al. (2014). The two remaining archetypes of Bocken et al. (2014), i.e., “*substitute with renewables and natural processes*” and “*encourage sufficiency*”, were not identified in our database. The reliance on individual efforts rather than the need for collaborative efforts for these SBMs might explain their absence. Furthermore, we identified a new archetype which was, to the best of our knowledge, not yet covered in (C)SBM literature, namely “*shorten the value chain*”. This finding aligns with the recent and increasing body of literature on short food supply chains (Paciarotti and Torregiani, 2021).

As evident from Table 2, some archetypes are more prevalent in practice than others. The high number of start-ups adopting a “*shorten the value chain*” model can be explained by the high number of online B2B and B2C marketplaces for farmers. The rise of such business models may have benefited from covid-19 as people prefer to buy online and buy more local and healthy food. The high number of start-ups in the “*maximize material and energy efficiency*” and “*adopt a stewardship role*” archetypes can be explained by the take-off of emerging technologies such as drones, sensors and blockchain in the agri-food industry (Stanco et al., 2020). The next sections present the CSBM archetypes in more detail.

| Archetype | Maximize material and energy efficiency | Create value from waste | Deliver functionality rather than ownership | Adopt a stewardship role | Re-purpose for society | Shorten the value chain |
|---------------|---|---|--|---|---|---|
| Sub-archetype | <ul style="list-style-type: none"> - Aligning supply and demand - Improving through transparency - Data-driven farm optimization | <ul style="list-style-type: none"> - Farming on food waste - Valorizing farm waste - Marketing blemished food and surplus food | <ul style="list-style-type: none"> - Farming equipment as a service - Farming as a service | <ul style="list-style-type: none"> - Transparent farming practices | <ul style="list-style-type: none"> - Payments for ecosystem services | <ul style="list-style-type: none"> - Collaborative food processing - B2B and B2C market place |
| N | 55 | 32 | 18 | 44 | 5 | 136 |

Table 2. CSBM archetypes in the agri-food value chain

4.1 MAXIMIZE MATERIAL AND ENERGY EFFICIENCY

The archetype “*maximize material and energy efficiency*” covers CSBMs which aim to reduce farmer inputs and farm waste through collaboration. Hence, the sub-archetypes presented in this section aim to improve the performance of existing business models rather than adopting new business models.

The first sub-archetype, “*aligning supply and demand*”, creates and delivers value through sharing information on supply (e.g., harvest dates) and demand (e.g., how much food is needed). The information sharing is typically facilitated by a platform provider. The value capture exists less waste generation (lower disposal costs) and increased farmer income by selling a larger proportion of their produce. In addition, the improved alignment allows farmers to sell fresher products, hence opening up opportunities for premium pricing.

Secondly, “*improving through transparency*” enables farmers and other agri-food value chain actors to optimize (parts of) the value chain and to guarantee high quality products by identifying and acting upon weak spots through monitoring the various stages of the supply chain. IoT sensors are often used to measure temperature and humidity and HACCP procedures are digitized and shared through blockchain and platform solutions. The data provides insights into where losses occur. Farmers can capture the value through higher prices due to guaranteeing the quality of their produce. In addition, farmers can obtain lower insurance fees as they can prove whether potential quality issues occur on the farm or elsewhere in the value chain. Additional savings can occur due to more efficient value chains with less waste.

Thirdly, the sub-archetype “*data-driven farm optimization*” aims to increase insights on how to improve farm performance through reducing inputs and/or maximizing yields. The horizontal collaboration between farmers and service providers enables farmers to optimize their farm performance. The service providers analyse farm data and provide

insights to the farmer to improve farm performance. Data is typically collected through IoT devices. The increased insights on how to improve farm performance can result in lower costs due to lower resource usage while it can simultaneously increase farmer income due to higher crop yields. In addition, increased sustainable performance (e.g. reduced pesticide usage) can allow farmers to request premium prices.

4.2 CREATE VALUE FROM WASTE

The archetype “*create value from waste*” covers CSBMs which aim to reduce waste through collaboration. The “*create value from waste*” CSBMs can be added on top of existing business models but, in contrast with the “*maximize material and energy efficiency*” CSBMs, they are not aimed at incrementally improving the existing business models but, rather, to add new activities to the business model.

The first sub-archetype is “*farming on food waste*” is based upon horizontal collaboration between farmers and food waste producers (e.g., restaurants) to convert food waste into farm inputs. This is often combined with the adoption of novel farming practices such as insect farming. The low cost of food waste reduces the farmers input costs. In some cases, farmers may receive additional income by diverting food waste from landfills.

Secondly, “*valorising food waste*” refers to the horizontal collaboration between farmers and waste processing companies aimed at turning farm waste and by-products into a valuable input for other industries. To do so, the farm waste needs to be homogenous. In this CSBM archetype, farm waste becomes an additional income source for farmers (or at least reduce disposal costs).

Thirdly, “*marketing blemished and surplus food*” builds upon the horizontal collaboration between farmers and platforms to enable farmers to sell blemished and surplus food to a wider audience. As such, disposal costs are converted into additional farmer income.

4.3 DELIVER FUNCTIONALITY RATHER THAN OWNERSHIP

The archetype “*deliver functionality rather than ownership*” refers to using the function of the product rather than the ownership. This results in a better alignment between customer needs and the offer of the producer and has the potential to change consumption patterns (Bocken et al., 2014).

The horizontal collaboration in the “*farming equipment as a service*” sub-archetype between farmers and equipment owners (e.g. other farmers and equipment rental companies) allows farmers to use farming equipment without making capital investments. Farmers capture the value through lower working capital, more flexibility (access to a wider range of machines allows farmers to change crop types more easily), less risk (of machine breakdown) and higher economy of scales as better machinery can be used.

“*Farming as a service*” CSBMs offer the customer the service of farming rather than the output of farming. Vertical collaboration between farmers and consumers (e.g. final consumers, restaurants and retailers) enables farmers not to sell products to consumers but, instead, sell the service of farming on (excess) land where the end-products are

owned by the buyer. This provides farmers with additional and secure income due to upfront payments as well as possibilities for premium pricing due to increased transparency and an improved customer relationships.

4.4 ADOPT A STEWARDSHIP ROLE

The archetype “*adopt a stewardship role*” is about engaging with stakeholders and consumers to ensure their long-term health and well-being (Bocken et al., 2014). In the context of farming and CSBMs, farmers can adopt a stewardship role by providing insights on the food to the buyers, i.e., “*traceable farming practices*”. Examples may include insights into traditional farm practices and pesticide usage. The vertical collaboration between farmers and other value chain actors and the horizontal collaboration with a platform provider is typically enabled by blockchain technology to allow the traceability of food products. Data on the farming production stage is typically automatically generated by IoT devices and shared with all actors until it reaches the final consumer. Farmers benefit from premium prices due to guaranteed quality as well as access to labels and certifications.

4.5 REPURPOSE FOR SOCIETY

The archetype “*repurpose for society*” is about creating social and environmental benefits rather than economic benefits (Bocken et al., 2014). In the context of farming and collaborative business models, the “*payments for eco-services*” sub-archetype shows how farms can repurpose their business model for society through payments for eco-services. Farmers can offer environmental eco-system services such as carbon sequestration, ponds for migrant birds and land strips for bees. The horizontal collaboration between farmers and actors from various value chains as well as governments and citizens, often through a platform, connects farmers with entities who are willing to pay for eco-system services such as carbon sequestration.

4.6 SHORTEN THE SUPPLY CHAIN

The “*shorten the supply chain*” archetype is a new archetype which was, to the best of our knowledge, previously uncovered in business model archetype literature. The “*shorten the supply chain*” archetype covers business models which aim to improve the economic position of farmers and which increase transparency for the buyers by removing actors from the supply chain.

First, the “*collaborative food processing*” sub-archetype refers to farmers who process their harvest themselves. This archetype often relies on horizontal collaboration between farmers to open and run a facility to process their raw products such as opening up a peanut butter factory by peanut farmers. The farmers benefit from higher prices and gain more control over the prices due to controlling a larger part of the value chain. This may result in a better position to monetize sustainable efforts, for example through branding.

Second, “*B2B and B2C marketplaces*” connects farmers with markets and offers buyers transparency of their food. Horizontal collaboration between farmers, (online) platform providers and buyers enables farmers to sell their produce to a wider audience such as retailers, HoReCa and final consumers. The shortened supply chain increases

transparency. The use of B2B and B2C marketplaces increases market access and transparency which enables farms to obtain better prices for their produce and their sustainable practices.

5. CONTRIBUTION

The next sections elaborate on the practical and theoretical relevance of this paper as well as directions for further research and the limitations of this work.

5.1 PRACTICAL RELEVANCE

In terms of the practical contribution, our findings provide a set of CSBMs which practitioners can mimic in their own organizations (Al-Debei and Avison, 2010). The practical relevance is demonstrated by the application of the CSBM archetypes in the Horizon2020 Ploutos project. Twenty-six agri-food value chains used the CSBM archetypes developed in this research to make their value chains more sustainable and more inclusive for farmers. The wide range of agri-food value chains in the Ploutos project (e.g., horticulture, arable and viticulture), the wide range of practices (e.g., precision farming and traceability) and the wide range of actors (e.g., farmers, food processors, retailers, research institutes and cooperatives) suggest that the CSBM archetypes can be adopted in a wide range of contexts. Likewise, the CSBM archetypes were positively received by industrial partners, such as large food processors and catering companies, of the Food Sustainability Observatory and the Smart Agri-Food Observatory of Politecnico di Milano, as such further indicating the practical relevance of this research. In addition, insights into the frequency of the CSBMs archetypes in practice may provide clues to managers about which CSBMs are the most promising.

5.2 THEORETICAL RELEVANCE AND FURTHER RESEARCH

Our findings contribute to literature by adding the collaborative aspect to the body of literature on SBMs through an exploratory and descriptive study. In doing so, we offer the scientific community six CSBM archetypes and twelve CSBM sub-archetypes. This work can act as a reference point for future research in several ways. First, the CSBM archetypes can form the basis for further theory building by subjecting the archetypes to rigorous empirical testing and further refinement (Doty and Glick, 1994). Research on the evolutionary paths of adopting CSBMs may shed light on important elements of CSBM adoption. Furthermore, research into the combination of several CSBM archetypes could be beneficial too. In addition, future research could adopt a more theoretical lens. In particular, the ambidexterity literature seems to provide a promising lens to study how to run CSBMs or a combination of CSBMs on top of potentially conflicting firm-level business models (Markides, 2013).

5.3 LIMITATIONS

This research is not without limitations. A major limitation is the reliance on start-ups. Practices which are relevant for small firms are not necessarily the most important levers for incumbent firms (Taylor and Taylor, 2014). Moreover, whereas start-ups do not risk devaluating existing business activities and can fully focus on a given CSBM, this is often not the case for incumbent firms who operate in existing supply networks. As such, managers should not just rely on the CSBMs identified in this research, but evaluate them in light of the firm's wider context, corporate strategy and the firm's competitive landscape. A second major limitation is the reliance on secondary data. The reliance on

secondary data limited the level of detail of our study and exposed us to relying on outdated and inaccurate data. Although we tried to minimize this limitation by using multiple data sources and by performing thirteen interviews with the start-ups to validate our findings, we cannot completely dismiss this limitation. Nevertheless, we believe that, despite these limitations, our findings provide useful insights for CSBM literature.

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