FoodE

D5.1

Classification of business models in CRFS

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List of Abbreviations

AFN	Alternative Food Networks
BIA	Building-Integrated Agriculture
BM	Business model
BMC	Business Model Canvas
CAP	Common Agricultural Policy
CEA	Controlled Environment Agriculture
CRFS	City Region Food System
CRFSi	City Region Food System initiatives
CSA	Community Supported Agriculture
CSF	Community Supporter Fisheries
EU	European Union
IUVF	indoor urban vertical farming
MSC	Marine Stewardship Council
PF	Plant Factory
PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
PUA	Peri-Urban Agriculture
RA	Rooftop Agriculture
RG	Rooftop Greenhouse
SME	Small and medium sized enterprise
SSFC	Short Supply Food Chain
SWOT	Strengths, Weaknesses, Opportunities, Threats
USP	Unique Selling Proposition
VIG	vertically-integrated greenhouses
WP	Work Package
ZFarm	Zero-Acreage-Farming

Executive Summary

The main objective of FoodE's WP5 (Business models and validation) is the classification of CRFS, the validation of the assessment tool, and identification of standard indicators of CRFS sustainability measures. This report (Deliverable 5.1) on CRFSi business models is positioned in continuation of the activities carried out already in WP2 (methodological framework development and case studies sustainability assessment) and WP4 (pilots).

Business model concepts have emerged on a system-level dimension as a relatively new unit. They aim to explain how firms do business holistically. Organizational activities play an important role in the various conceptualizations of business models, which seek to explain how value is created and captured. Business models give a company a good overview of how to generate and collect value, enable business comparisons with competitors, and support knowledge creation and awareness for required changes to keep a competitive advantage or for future innovations. Business models are constantly changing when entering a market; sometimes incrementally, sometimes disruptively, while others are becoming outdated and disappear.

Business Model Canvas (BMC) is a strategic management template suitable in providing an overview of value creation and capture, relationships, success factors and comparisons of the companies. Since a few years, alterations and expansions of the traditional Business Model Canvas are presented and in use to include sustainability issues more powerful into business model thinking.

This Deliverable (Classification of Business Models in City Region Food System) builds mainly on a structured literature review process conducted by the higher education and research partners of the FoodE consortium. To make sure to consider the relevant literature in this working field a systematic literature review (PRISMA method) was carried out. The PRISMA method supported filtering down from more than 3,000 collected papers to 218 papers used in this report. This report focuses on three components: firstly, the classification of business models, secondly the SWOT analysis and finally the description of suitable case study examples – the FoodE pilots.

Within the conducted systematic literature review, most linkages between CRFSi and business models occur for peri-urban agriculture (PUA), short supply food chains (SSFC), Alternative Food Networks (AFN), on-farm diversification, and building-bound food production (rooftop, vertical, indoor). The main findings on their business models are presented in the report before proposing an own business model classification in CRFS.

Based on this structured literature review on business models, subchapter 4.3.2 proposes a new typology of business models for CRFSi. Actually, it is not neglecting existing typologies and classifications of business models and strategies, but building hereon.

CRFS initiatives are diverse and heterogeneous, like Alternative Food Networks, vertical farming, short supply food chain, aquaponics, etc. This is also true for individual entrepreneurial activities, but common features can be derived based on the above presented structured literature review on main types of CRFSi and business models more general. Four CRFSi business models are proposed – **focusing**, **deepening**, **broadening** and **sharing**. The business model "**focusing**" concentrates on one or very few activities, e.g., one specific food product. In urban and peri-urban settings, focusing CRFSi are concentrating on niches for creating a unique selling proposition, especially as controlled environment agriculture (vertical farming, indoor farming). The "**deepening**" business model adds activities beyond food production into the (business) portfolio. Here, we differentiate between full deepening (whole chain) and partial deepening (only parts of the chain). The business model "**broadening**" diversifies activities in production (product broadening) and/or into non-production activities and services (non-product broadening, non-agricultural diversification). The "**sharing**" business model is community-

based with a strong civic empowerment, like Community Supported Agriculture (CSA). When CRFSi concentrate on the focusing business models, the involvement of community is low, compared to the other three business models deepening, broadening, and especially sharing. Innovations in the business model focusing mainly take place with regard to technological and/or product innovation. Peri-urban farmers who focus on high-value crops, but also efficient building-integrated production types (vertical farming, indoor farming, and aquaponics) represent examples of the focusing business models. Contrarily, the sharing business model is per se inherent or at least strongly interwoven with social innovation and strong community involvement, by aiming for food sovereignty and food democracy. This is also referred to as civic agriculture. Community Supported Agriculture and other types of Alternative Food Networks are prominent and relevant examples of the sharing business model. In between focusing and sharing, the two business models of deepening and broadening are more indifferent when it comes to community involvement and type of innovativeness. However, the CRFSi belonging to the deepening and broadening business models tend to focus on social innovations over technological/product innovations and encourage community involvement, e.g., in direct sale or pick-your-own arrangements (deepening business model).

Furthermore, a SWOT analysis is presented for the business models and substantiated with case studies, the FoodE pilots, which are grouped into the four proposed CRFSi business models.

1. Introduction

1.1 FoodE in a nutshell

The main objective of the EU HORIZON2020 project FoodE (Food Systems in European Cities) is to involve European Union local initiatives in the design, implementation, and monitoring of an environmentally, economically, and socially sustainable **City Region Food System (CRFS)**. The key challenge of the project is to improve food and nutrition security of European citizens by shaping a sustainable environment able to increase accessibility and availability of affordable, safe, and nutritious food. This challenge will be tackled by setting a co-created mechanism, based on Citizen Science and Responsible Research & Innovation principles, where public authorities, citizens, SMEs, and non-profit organisations can share ideas, tools, best practices, and new models, supporting cities and regions in developing innovative and sustainable food systems. FoodE aims to accelerate the growth of sustainable and resilient citizen-led urban food system initiatives across Europe by engaging citizens, food system start-ups and small businesses operating in the urban food landscape, cities and regional authorities, academia, and schools. The outputs of FoodE will pave the way for job creation, enhance local economies, and enable local communities to contribute to the United Nation's Sustainable Development Goals, whilst increasing the relationships and interlinkages between the different actors of the food chains.

1.2 Business models and validation (WP 5)

FoodE will develop a robust, consistent, and science-based methodological framework to assess CRFS and a dedicated analytical tool to facilitate participatory decision-making for the development of innovative business models and their replication beyond the setting of the project. The main objective of WP5 is the classification of CRFS and validation of the assessment tool and identification of standard indicators of CRFS sustainability measures. It will address a) to identify, validate, and classify innovative business models in CRFS; b) to define a simplified dataset of indicators for defining CRFS sustainability; c) to create a multi-user online survey tool; and d) to create a standard citizen-driven certification scheme (FoodE label).

WP5's four tasks are:

- Task 5.1 CRFSi business models
- Task 5.2 Simplified dataset of indicators
- Task 5.3 Multi-user survey online tool
- Task 5.4 FoodE label

Each of the four tasks results in an own Deliverable synthesizing the main activities and outcomes.

1.3 CRFSi business models positioned in FoodE

The Deliverable 5.1 "Classification of business models in CRFS" is positioned in continuation of the WP2 (Methodological framework development and case studies sustainability assessment) and WP4 (Pilots) activities. WP2 added to their activities a dedicated Deliverable on food bio-economy's business models (Del. 2.8), which complements to the other WP2 activities, like 600+ and subsequent 100+ data collection and inventory, methodological framework development, the sustainability assessment of pilots – namely life cycle assessment, life cycle costing and social life cycle assessment.

This CRFSi business model report is structured as follows. Following a general introduction on business models and existing business model tools and templates, the materials and methods used are presented. The results focus on main types of CRFSi, like peri-urban agriculture, short supply food

chains, alternative food networks, on-farm diversification, and building-integrated food production. Based on the structured literature review a classification of CRFSi business models is proposed and complemented by a SWOT analysis aiming to reveal the strengths, weaknesses, opportunities and threats of each business model identified. The pilot projects serve in this context as good praxis examples for the business models described.

2. Business models and tools

2.1 Business model thinking

Although through the first appearance dates back to the 1960s, concepts of business models aiming to set-up and analyse enterprises have risen since the mid-1990s (Osterwalder, 2004; Henriksen et al., 2012). However, the wider appearance of the term business model is a relatively young phenomenon that has found its first peak during the web-hype at the beginning of the third millennium (Osterwalder, 2004).

Referring to definitions of the terms 'business' and 'model', Osterwalder concludes 'a representation of how a company buys and sells goods and services and earns money' (Osterwalder, 2004: 14) as a first simple understanding of the term 'business model'. The model – or as he argues representation – aims to support the understanding, description, and prediction of buying and selling goods and services to earn money. Nowadays, a range of different definitions and interpretations exists and is in use. Yet, a common understanding of business models is obvious. Business models explain how companies do businesses (Henriksen et al., 2012). They:

- stand for the 'design of organizational structures to enact a commercial opportunity' (George and Bock, 2011: 83f.),
- describe 'the rationale of how an organization creates, delivers and captures value' (Osterwalder and Pigneur, 2009: 14),
- show 'how a firm is able to earn money from providing products and services' (Boons and Lüdeke-Freund, 2013: 9), and
- explain 'how value is created for the customers and how value is captured for the company and its stakeholders' (Henriksen et al., 2012: 31).

Business model concepts have emerged on a system-level dimension as a relatively new unit. It aims to explain how firms do business holistically. Organizational activities play an important role in the various conceptualizations of business models, which seek to explain how value is created and captured. The identification of the 'who', 'what', and 'how' are essential when analysing business models (Henriksen et al., 2012).

Four generic business model components are the value proposition, supply chain, customer interface, and financial model (Boons and Lüdeke-Freund, 2013). Herein, business models' specific building blocks are for example value creation, revenues, costs, resources, activities, and internal and external relationships and networks. They are suitable for an overview of value creations and captures, relationships, success factors, and comparisons with competitors. They consist of interlocking elements that, taken together, create values; e.g., customer value propositions and profit (Johnson et al., 1996). Business models give a company a good overview of how to create and capture value, enable business comparisons with competitors, and support knowledge creation and awareness for required changes to keep a competitive advantage or for future innovations.

Business models are constantly changing when entering a market; sometimes incrementally, sometimes disruptively, while others are becoming outdated and disappear.

2.2 Business Model Canvas and sustainability enhancements

Business Model Canvas (BMC) is a strategic management template (Osterwalder and Pigneur, 2009). It is suitable in providing an overview of value creation and capture, relationships, success factors and comparisons of the companies. Osterwalder, Pigneur and more than 470 practitioners from 45 countries published the brochure "Business Model Generation", in which the Business Model Canvas is presented in detail. It is named to be simple and understandable for users, while not oversimplifying its entrepreneurial activities. It is a strategic management template to document not only existing, but also to develop and visualise new business model ideas. BMC is a tool, which provides helpful overviews of companies to emphasise key success factors, to detect barriers, to compare competitors, and to generate business ideas and innovations. The BMC's four main components are customers, offer, infrastructure, and financial viability. Additionally, the BMC template allows working on the desirability, feasibility, and viability of business ideas or business developments. The BMC consists of nine basic building blocks; presented in Figure 1.

<table>
<tr><td rowspan="2">Key Partnerships</td><td>Key Activities</td><td rowspan="2">Value Proposition</td><td>Customer Relationships</td><td rowspan="2">Customer Segments</td></tr>
<tr><td>Key Resources</td><td>Channels</td></tr>
<tr><td colspan="3">Cost Structure</td><td colspan="2">Revenue Streams</td></tr>
</table>

Figure 1: Business Model Canvas from Osterwalder and Pigneur (2009)

Since a few years, alterations and expansions of the traditional Business Model Canvas are presented and in use to include sustainability issues into business model thinking. Yet, aspects of sustainability and resilience can also be considered in the traditional BMC under value proposition. One expansion is the triple layered Business Model Canvas, one layer for each of the three sustainability dimensions (see Figure 2): economic, environmental, and social (Joyce, Paquin and Pigneur, 2015). The economic layer remains one-to-one the same as the traditional BMC. The environmental and social also keep the same structure of nine blocks. The environmental layer summarizes the environmental negative impacts to the bottom left and positive benefits to the bottom right. To do so, the remaining blocks emphasize on functional values, end-of-life issues, production, materials, etc. Like for the environment, the social negative impacts and positive benefits are considered in the social layer. The social value is positioned in the centre, governance, local communities, and employees to the left side.

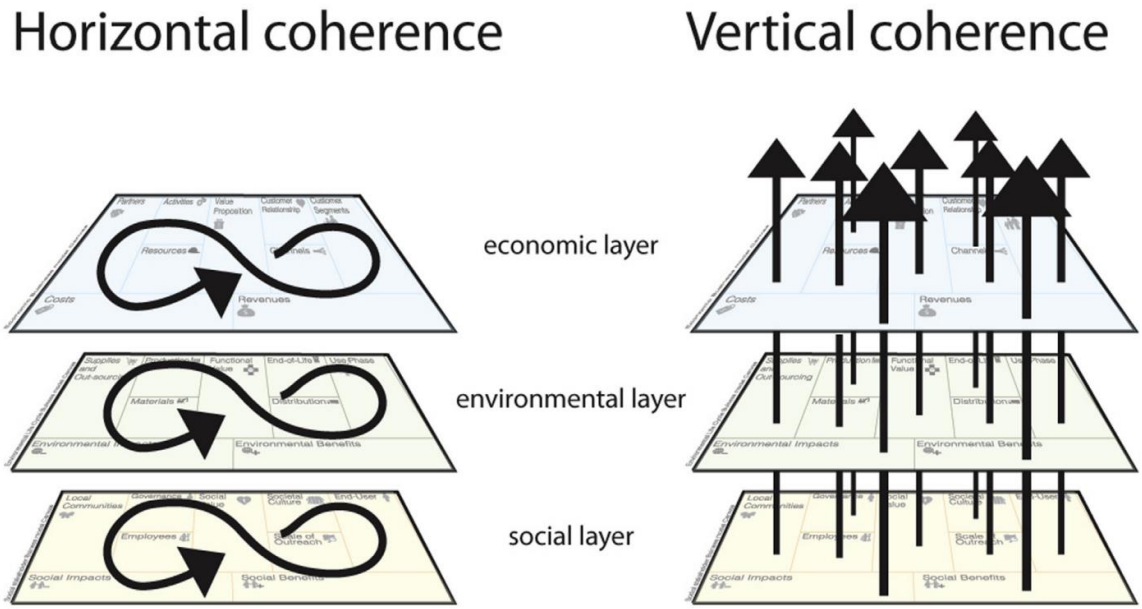

Figure 2: Triple Layer Business Model Canvas from Joyce, Paquin and Pigneur (2015)

Another advancement towards sustainability of the traditional Business Model Canvas is the Sustainable Business Model Canvas proposed by Gerlach (2015) (see Figure 3). This template aims to incentives sustainable product- and business model design through stronger consideration of all aspects relevant for holistic business model design (economical, environmental and sociocultural aspects), thereby adopting a triple-bottom-line approach right from the beginning.

Positive Impact (Maximise)

*What are positive **2nd and 3rd order** effects of your product on planet, society, the economy or your organisation (e.g. brand)? How can these effects be **maximised** along the complete product life cycle?*

You can use the left side of the Threebility Sustainability Impact Canvas to generate the input for this section

Negative Impact (Minimise)

*What are negative **1st, 2nd and 3rd order** effects, and how can these be **minimised**? Is harmful waste generated that requires expensive disposal? Are there **rebound effects** or new **technological risks**?*

You can use the right side of the Threebility Sustainability Impact Canvas to generate the input for this section

Sustainable Partners

*Who are possible **partners** in becoming more sustainable?*

*How can we make the whole supply chain sustainable, transparent and **circular**?*

*Can we **cooperate** with partners from other industries to form an industrial symbiosis?*

*Can we shape anticipated environmental regulations by partnering and cooperating with **relevant regulatory bodies**?*

Sustainable Value Creation

*Which are our **key activities**? How can we adjust them (e.g. **manufacturing**) to ensure sustainability?*

*Which **enabling sustainable technologies** can be used?*

Sustainable Tech & Resources

*Which 1) **natural**, 2) **energy** and 3) **technical** resources do we need?*

*Can we **substitute** any for more sustainable resources?*

Sustainable Value Proposition

*Which **problem** do we solve, which **value** do we create?*

*What are **function** & **form** of our product or service?*

Can we solve our customers' problems more sustainably?

Can we transform sustainability into customer value?

Is ownership necessary or is the product as a service model applicable?

*Can we extend the **product life cycle**?*

Sustainable Customer Relation

*Which customer relationships satisfy customer expectations **and are sustainable**?*

*How can we make **current relationships** more sustainable?*

Sust. Channels

*How can we make our distribution channel more sustainable and **circular**?*

How do we best communicate the sustainable aspect of our product / service?

Responsible customers

*Who are our customers? How can we **enable** them to act sustainably?*

*Which target customers may help to **promote our sustainable solution**?*

End of Life

*What happens at the end of the **product life cycle**?*

*Can the product be **profitably recycled**, upcycled, reused, refurbished?*

Cost Structure & Additional Costs

What are the required costs and investments for my endeavour?

*Which resources / activities are the least sustainable? Do **sustainable alternatives exist**? Is switching economically reasonable?*

Subsidisation

*Do **tax bonuses & subsidies** or **3rd party funding** exist for my endeavour?*

Revenue & Sustainability Premium

Which are existing and possible revenue sources?

*Are customers willing to pay a **premium for sustainability**?*

*Can we create a **unique advantage** due to sustainable proposition elements?*

*Do **price structures exist that incentivize** sustainable customer behaviour?*

Figure 3: Sustainable Business Model Canvas from Gerlach (2015)

3. Material and Methods

This classification of food initiatives' business models in CRFS, named CRFSi, builds mainly on a structured literature review process conducted by the higher education and research partners of the FoodE consortium.

To make sure to consider the relevant literature in this working field a systematic literature review (PRISMA method) was carried out. PRISMA is the acronym for **p**referred **r**eporting **i**tems **f**or **s**yste**m**atic **r**eviews and meta-analyses. The method aims for a systematic way to identify suitable literature by naming criteria for eligibility and exclusion for papers (Page *et al.*, 2021: 1; Wadumestrige Dona, Mohan and Fukushi, 2021: 2; Buscaroli *et al.*, 2021). The papers were selected according to the illustrated procedure in figure 4 by employing the literature database Web of Science.

For this, a key word list, consisting of eleven main search terms and eleven subordinated search terms was elaborated, leading to 121 search combinations (see step 1). In order to keep the number of results manageable, the search was subdivided. Each main search term was combined with the eleven subordinated search terms to form an individual result table. In this way, the literature review yielded in 11 result tables, listing 3,111 papers (see table 1). Each result table was treated equally, following the procedure of the PRISMA method, in order to reduce the amount of hits:

1.) exclusion of duplications,
2.) screening of the titles with regard to the criteria for exclusion (see figure 4),
3.) delete results that did not meet the criteria,
4.) screening of the abstracts according to the criteria set up,
5.) clear unsuited results.

STEP 1: Definition of key words for the search in Web of Science

No.	X (main search term)	Y (subordinated search term)
1	CRFS	Business Model*
2	City Region Food System*	Business Strateg*
3	Urban Food System*	Business Concept*
4	Regional Food System*	CANVAS
5	Periurban Food System*	Business Ontolog*
6	short food value chain*	Business classification*
7	short food supply chain*	Financ*
8	Urban Farm*	Incom*
9	Urban Agricultur*	entrepren*
10	Metropolitan Agricultur*	economic*
11	City Farm*	Business*

STEP 2: Provision of the key word search

The search in Web of Science gained 3,111 hits

STEP 3: Defining Criteria for exclusion of papers

Papers should …	Papers should not …
✓ be in English language ✓ deal with: ○ agriculture in peri-urban or urban settings ○ urban agriculture ✓ have a focus on: ○ food production ○ business models ○ challenges and opportunities ✓ have a geographical context on countries of the EU or regions with comparable conditions	– deal with: ○ energy production ○ forestry ○ logistics – contain knowledge to very specific individual aspects, that are not expedient. – have a focus on ○ developing countries

STEP 4: Reduction of results through the PRISMA method

Reduction step	Number
Initial search	3,111
Without duplications	2,215
After title screening	1,072
After abstract screening	645
Further scanning of papers	218

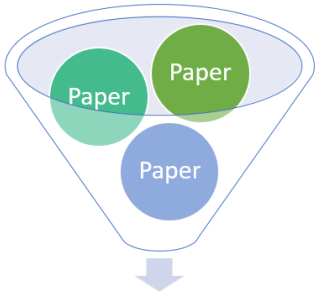

Figure 4: PRISMA approach for classifying and analysing CRFSi business models

The single reduction steps and the decline in the number of hits is shown in the following table 1. The PRISMA method supported in filtering down from more than 3,000 collected papers to 2,215 (without duplications), 1,072 (after title screening) to 645 after the screening of papers' abstracts.

Table 1: Paper reduction process during PRISMA method.

search terms	key words		number of results			
	x	y	in search	without duplications	after title screening	after abstract screening
1	CRFS		113	100	14	5
2	City Region Food System*		13	7	7	7
3	Urban Food System*		160	114	82	60
4	Regional Food System*		120	88	54	42
5	Periurban Food System*		0	0	0	0
6	short food value chain*		3	1	1	1
7	short food supply chain*		238	141	116	109
8	Urban Farm*		543	358	189	106
9	Urban Agricultur*		1869	1377	594	306
10	Metropolitan Agricultur*		4	4	4	4
11	City Farm*		48	25	11	5
sum			**3111**	**2215**	**1072**	**645**

Afterwards the 11 result tables were merged to a "list of preliminary results" consisting of 645 papers. This list was again subjected to the procedure described (deleting duplicates, screening titles and abstracts according to the criteria for eligibility and exclusion). Next, each paper was undertaken a critical judgment, to what extent it contributes to the task or touch the topic merely in a broader way (see table 2):

Table 2: Step-wise list of preliminary results

list	number of results			
	in search	without duplications	after title screening and abstract screening	critical judgement
list of preliminary results	645	545	228	218

The remaining 218 papers were considered for the classification and analysis of CRFSi business models. These 218 papers were uploaded into a protected Mendeley folder with access for all contributing project partners to allow easy access and documentation.

T5.1 consisted of three subtasks, in which the described literature research feeds into. Firstly, the classification of business models, secondly the SWOT analysis and finally the description of suitable examples. The papers were used to generate a classification of CRFSi business models (see figure 5). Moreover, the papers provided inputs for conducting SWOT analyses for the developed business models. Based on the body of literature, each business model identified was analysed according to possible strengths, weaknesses as well as opportunities and threats that could support or endanger the business. In order to ensure a practical relevance of the results, each business model was complemented by practical examples. These practical examples derive from the pilot projects of WP 4. In this way the pilot projects serve two different proposes. By sorting them in the classification it will be controlled, if the developed classification is able to cover real existing businesses. In this way the pilot projects are meant to be used as a practical test. Moreover, the pilots can gain strategic benefits, when

knowing which business model fits their company best. In this way they can take advantage of the results from the SWOT-Analysis to adapt their business for a better exploitation of chances or to develop strategies against imminent dangers.

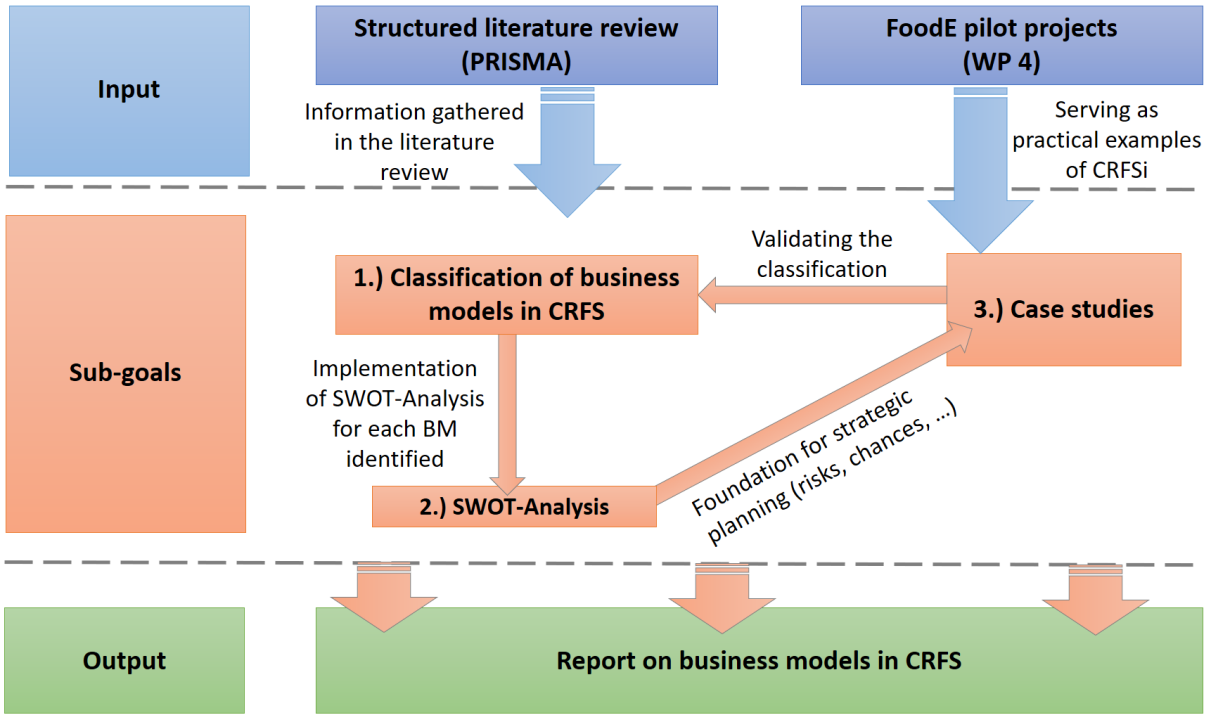

Figure 5: Presentation of sub-goals of Task 5.1, their input sources, and interconnectedness

For the first two subtasks “classification of business models” and “SWOT analysis” the papers were divided in two groups. The first group of papers focusing on business strategies and models were used to perform the classification of business models. The second group of papers was exploited for the business model specific SWOT analyses (s. below).

3.1 Classification of business models

The classification of CRFSi business models is based on literature consulted for this purpose. Therefore, in chapter 4.2 the main types of CRFSi are described, which could be derived from the papers. The description and denomination of these main types of CRFSi is the first working step in the development of the classification. In this context common characteristics incl. matches and distinctions on business approaches and strategies of CRFSi were used for finding clusters of similar business concepts. Rooted in the business model knowledge (see chapter 1), a research team from SWUAS tried different types of classifications. A special focus is placed on the innovativeness and the filed in which it shows the strongest expression (social innovation, innovation in production or technological innovation). Moreover, the level of community involvement in CRFSi is taken into consideration (see Figure 6). Although social and technological/product innovations do not exclude each other per se, the scientific literature shows that for most cases only one type of innovation dominates the activity.

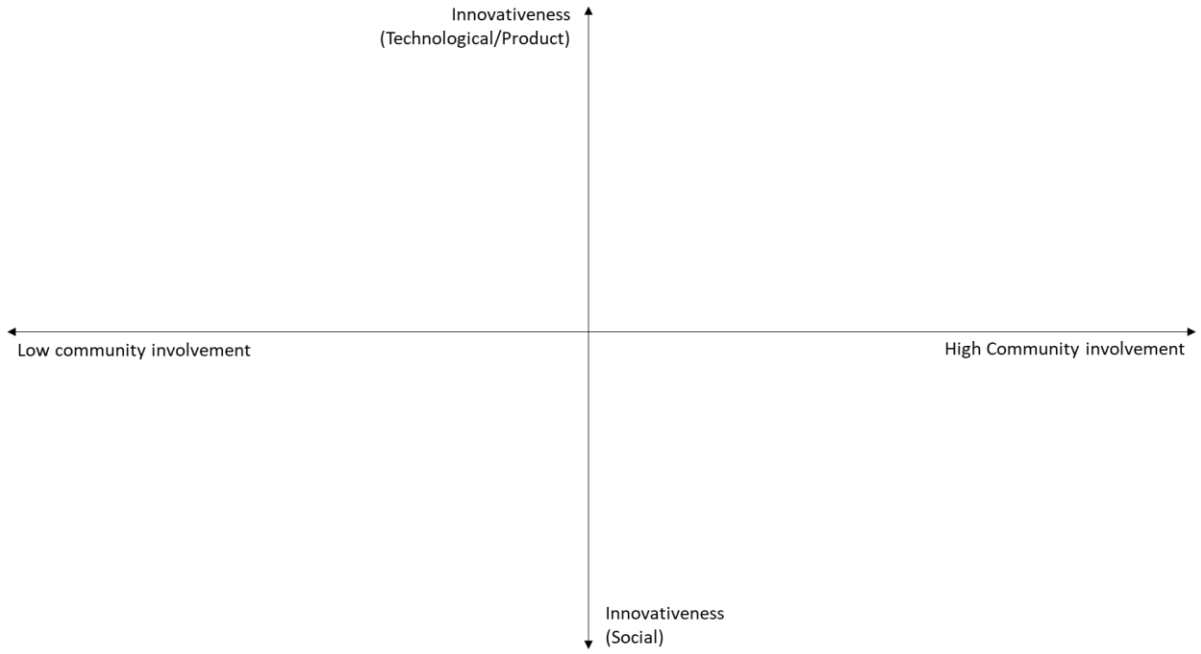

Figure 6: Main criteria for the business model classification in CRFS

These criteria (main field of innovativeness and level of community involvement) build the frame for the classification of CRFSi business models presented further below in the results' section of this report.

3.2 SWOT analysis

The acronym SWOT (Strengths, Weaknesses, Opportunities and Threats) names a widespread method to analyse the environment of an organization (threats and opportunities) as well as internal attributes (strengths and weaknesses). Usually the SWOT analysis is performed like an organized brain storming in order to collect information needed for strategic planning and evaluating (Culp, Ken III; Eastwood, Christy; Turner, Susan; Goodman, Melissa; and Ricketts, 2016; Namugenyi et al., 2017).

The SWOT analysis is an integral part of T5.1 by synthesising hindrance and opportunities that a certain business model can face. Strengths can be used to find out, which benefits can arise from one business model and how they can be exploited to take advantage of opportunities, like consumer trends. The analysis of weaknesses of a business model can be a starting point in finding ways to overcome them and prevent a business from failure due to naming possible risks.

For this task, the arguments for the SWOT analysis derives from the papers identified and analysed in the literature review process. The papers were allocated to the academic partners of the consortium with reference to their field of interest. In order to organize and structure the process of gaining information a spreadsheet was developed. The following figure sumps up the information queried by the table (see table 3).

Table 3: Literature review information requested for SWOT analysis

Information for the SWOT analysis	
Colum heading	**Content**
Object of reference	the paper can refer to a business model, a specific kind of urban agriculture (e.g., rooftop garden, aquaponics, allotment garden, etc.) or name a group of activities like Z-Farming
Argument No.	many of the selected papers name advantages (strengths) and disadvantages (weaknesses) with regard to the object of reference. Moreover, the papers deal with possible opportunities or threats. We would like to use these arguments for our SWOT analysis. Please enumerate up to four or five of these arguments for each paper. Each column stands for its own. This means, that a row only enumerates the amount of arguments you type in, without putting them into a contentual relation. That's why a strengths you identified does not need to fit to the weakness you type in next to it
Strength (internal)	which kind of strengths are related to the object of reference? (improving social coherence, improving people's diet, ecosystem services, convey skills, ...)
Weakness (internal)	which kind of weaknesses are related to the object of reference? (high investment costs, exclusion of vulnerable groups...)
Opportunity (external)	which external opportunities might strengthen the object of reference? (e.g., greater demand for regional food, potential to make use of unused resources, wish for nature-related activities, etc.)
Threats (external)	which external threats might limit the object of reference in it is development? (e.g., contamination of heavy metal in the soils for community gardens.)
Potential for adaption	which changes should be implemented to overcome the named problems or to improve the development of the object of reference?
Information concerning characteristics of business models	the papers may contain information which might be of interest for the classification on business models. Please indicate this, so we can read the papers and take advantage of it

4. Results

4.1 Agricultural entrepreneurship in a nutshell

Globally, agriculture is usually seen as a low-tech, partly closed industry with limited dynamics, which is operated by many rather small family farms (Dias et al., 2019). In accordance, farmers are agricultural entrepreneurs and decision-makers who aim to maximize their profits. The focus in the second half of the last century was on producing an increasing amount of bulk products for globalised, long food supply chains. Scale increase is one of the main strategies adopted in European mainstream agriculture. "By breaking down limits of geographical dependence on local resources, the global agri-food system has led to the spatial remoteness between production and consumption" (Wästfelt and Zhang, 2016: 173). By doing so, it does not only allow to be competitive with other farmers in terms of price but also to meet the demands of supermarkets and retailers for continuous and large supplies. Agriculture in the second half of the 20th century was characterised by production-oriented – often intensive and mono-functional – production (Zasada, 2011). Farms' declining share of profit and the cost-price squeeze of commodity production has put barriers to market access to the forefront along with the inevitable effect of agricultural abandonment and structural change in agriculture (Berti and Mulligan, 2016). That being said, an increasing body of investigations provides insights, that the focus on farm size increase might only have a short-term impact on business figures. Increasingly, it is not being a business case for all farms and not for the long-term. This is even more noticeable in contested urban areas. Additionally, "the process of modernisation of the primary sector had led to a sort of "industrialisation" of agriculture, characterised by intensification of production and standardisation of output whose main downsides have been the increase of the environmental impact of farming" (Henke and Vanni, 2017: 12).

The European agricultural market is regulated and financially supported, especially through the Common Agricultural Policy (CAP) measures and payments. Yet, food trade liberalisation and the CAP reforms led to stronger market-orientation pathways in agriculture. These developments brought entrepreneurial thinking to the forefront. However, entrepreneurial skills, behaviours, and business strategies are still considered to be lacking in larger parts of the farming sector. This is also a reason, why entrepreneurship research overlooked the agricultural sector for decades (Fitz-Koch et al., 2018 in: Dias et al., 2019). An additional reason for omitting agriculture in entrepreneurship research beyond market regulations and public support is "the perspective that agriculture is a special case" (Dias et al., 2019: 126). EU's Common Agricultural Policy states multifunctionality as a main objective (Wästfelt and Zhang, 2016). Multifunctionality is one key term for identifying the new paradigm of development defined as post-productivism (Ward, 1993; van der Ploeg et al., 2000 in: Henke and Vanni, 2017).

The identification, assessment and utilization of entrepreneurial opportunities is gaining importance also in agriculture, including new products and innovations in process, distribution and marketing stages. By doing so, agricultural entrepreneurs increasingly develop new products, aim for higher food quality, step into niche markets, and apply new technologies (Dias et al., 2019). Diversification and pluri-activity going beyond primary food production are strategies of rising relevance in European agriculture, too. Promotion of diversification is a key element of European Union's CAP as well as of European research frameworks like Horizon 2020 (Benedek et al., 2021). This reflects the rising entrepreneurial component in agriculture and food industries going beyond the earlier prevailing protected system. Cooperation and networking skills, innovative abilities, and risk-taking are increasingly important requirements to realize business opportunities – also and increasingly in the farming and food sector.

A systematic literature review performed by Dias et al. (2019) demonstrates the recently growing number of scientific articles making agricultural entrepreneurship a subject of discussion. This embraces rural and urban areas, but also new business models, innovations, and social entrepreneurship. Their review highlights that most entrepreneurial skills' studies are performed in

Europe, arguing that European farmers "require a large variety of skills in order to successfully manage an agricultural enterprise" (Dias et al., 2019: 129). This is supported by findings arguing that this is especially important in regions with high land and labour costs impeding global competitiveness. Reviewed studies (Shakya et al., 2010; Subrahmanyeswari et al., 2007) were able to show a positive significant relationship between farmers' entrepreneurial behaviour and annual income (in: Dias et al., 2019). However, it is important to highlight that some farmers have limited abilities to adjust to new business strategies successfully and to exploit their opportunities. Dias et al. (2019) show with their desktop research that the business models diversification (product diversification, on-farm non-agricultural diversification, off-farm diversification) and differentiation (in production, processing, and marketing) are gaining importance contrasting the earlier prevailing economies of scale thinking. "Closer links between producers and consumers, localised food systems, and bottom-up initiatives could play an essential role in encouraging healthier and more sustainable food consumption" (Mihailovic et al., 2019: 1).

McElwee et al. (2006) show that the acquisition of entrepreneurial skills and farmers' attitude are challenges of the European agricultural sector; both in farming core businesses as well as diversified strategies going beyond primary production (in: Dias et al., 2019).

From a Europe-wide perspective, many farmers did not adapt to changing framework conditions (changing policies, stronger market liberalisation, CAP reforms) resulting in decreasing income levels. This led to a decreasing number of farmers and growing average age of farmers. In contrast, other farmers align their business to identify and exploit entrepreneurial opportunities, like niche markets, added-value activities, etc. Being located in or near cities and metropolitan areas causes obstacles, but provides also advantages, like lower transportation costs and easier access to consumers when organizing the distribution and marketing locally. However, "protecting a sustainable and efficient agricultural sector requires the presence of the other actors in the whole food chain in order to supply farmers and help them access markets for their products, as well as provide information and technical services" (Akimowicz, Cummings and Landman, 2016: 24).

Within the conducted systematic literature review, most linkages between CRFSi and business models occur for peri-urban agriculture, short supply food chains, Alternative Food Networks (AFN), on-farm diversification, and building-bound food production (rooftop, vertical, indoor). Only very few ones connect economic topics with the food system level. Business model links to the food system level are scarce, while for certain CRFSi several empirical and theoretical debates exist. Hereafter, these main types of CRFSi are briefly described in individual sub-chapters before turning from these types of CRFSi to a classification of CRFSi business models.

4.2 Main types of CRFSi

4.2.1 Peri-urban agriculture

Farming in close proximity to the city world, peri-urban agriculture, is an important type of food production seen from both ends – production and consumption. The amount of food produced in the peri-urban areas of temperature latitude cities is many to several times higher compare to inner-city food production. However, it has to be admitted that urban and peri-urban agriculture as key types and initiatives of CRFS cannot feed cities entirely (O'Sullivan et al., 2019).

Following Opitz et al., (2015) peri-urban agriculture ranges from small- to large-scale agriculture at cities' fringes. Professional farmers' and gardeners' main goal is economic viability and sustainability. Beyond producing food and non-food products, global North's peri-urban agriculture has the potential to provide valuable ecosystem services, societal values, but also resilience of the local economy (McClintock, 2010; Mok et al., 2014; Zasada, 2012; Wästfelt and Zhang, 2016). These values result in a re-appreciation of agriculture near cities (Wästfelt and Zhang, 2016).

"Worldwide, cities face two irrevocable challenges: their disconnection from food production areas and the destruction of farmland" (Paül and McKenzie, 2013: 94). According to Wilson (2008), peri-urban agriculture is compared to more rural areas spatially and temporally different: spatially fuzzy and scattered and in terms of time transitional and uncertain (Wästfelt and Zhang, 2016). The farmland is highly contested: land prices increase, land uses with high returns (residential, industry, energy …) displace farmland, but also the anticipated urban encroachment can lead to missing investments in future-oriented agriculture. This refers to von Thünen's reversal proposed by Sinclair already in the 1960s (Ruoso, 2019).

In peri-urban areas, small and medium-sized farms have to cope with both, globalisation and urbanisation. From both vantage points – urban and rural – these areas can be seen as areas left behind (Wästfelt and Zhang, 2016). Nonetheless, Caputo (2012) points out that urban and peri-urban agriculture as a generator of food, income and employment is on the rise along with a re-emerging interest for local production to contribute to sustainable urban food systems among decision-makers (Baker and de Zeeuw, 2015; Benis and Ferrao, 2018). According to Houston (2005), peri-urban farmers cover only about three per cent of the agricultural land of mainland Australia, but contribute approximately 25% of total gross value of agricultural production.

Apart from the obvious constraints for peri-urban farmers being situated in close proximity to cities, the other side of the coin provides favourable framework conditions for earning higher profit margins when taking advantage of the urban environment, namely market proximity (Bryant et al., 2013; Gardner, 1994; Heimlich and Barnard, 1992; Houston, 2005; Pölling et al., 2017). This includes high-value food production, niche products, short supply food chains, innovations (product, technological, social), and diversification into non-food offers and services. Cities are the places of highest food demand – quantitatively and qualitatively (McClintock, 2010; Brinkley, 2012; Pölling et al., 2016). This allows peri-urban agriculture to become a locally embedded model of agriculture and a main component of City Region Food Systems (van Huylenbroeck et al., 2007). Zasada (2011) highlighted already more than ten years ago that peri-urban farmers are more diversified and multifaceted than elsewhere; including also non-productivist tendencies, like local embeddedness, short supply chains, low farming intensity, a high degree of diversification, and open-minded societies (Wilson, 2007; Zasada, 2011). Alternative forms of agricultural activities concentrate in peri-urban areas to "capitalise on the benefits of proximity" (Marino et al., 2018: 116).

However, it is important to mentions that being situated in an urban or peri-urban surrounding does not mean to make use of the locational advantages per se: some farmers continue producing commodities for global market's long value chains. Yet, an increasing number of consumers – mainly living urban – prefers regional production (Zasada, 2011). Products characterized by high added values, high transportation costs, freshness, and high perishability possess comparative advantages when being located urban (s. Heimlich and Barnard, 1992; Gardner, 1994; Mougeot, 1999; Pölling et al., 2016; Mihailovic et al., 2019). "Peri-urban agriculture can be innovatively managed. Local food is a logical way to reconnect urban dwellers with nearby food production" (Paül and McKenzie, 2013: 103).

In many areas close to cities, fruit, nut and vegetable producers continue to be important food suppliers for the surrounding cities (Jackson-Smith and Sharp, 2008; Mok et al., 2014). Sroka and Zmija (2021) point out that even small farms can generate satisfactory income, especially when focusing on vegetable and fruit production – one of the main strategies of peri-urban farms. Value-added products allow higher product prices; often resulting in higher farm income (Mihailovic et al., 2019). Small peri-urban agriculture is either ground-based unconditioned or ground-based conditioned (O'Sullivan et al., 2019): ground-based unconditioned include peri-urban field farms, but also market gardens and community farms, while ground-based conditioned embrace (partly) controlled systems, like greenhouses and poly-tunnels. Open small-plot intensive farms (SPIN farming) with a suitable

maximum size of 0.4 ha is one example (Christensen 2007; Opitz et al., 2015). Greenhouse cultivation is a typical peri-urban land use in many European metropolitan areas like Lisbon, Paris, Bordeaux and Lille (Peron and Geoffriau, 2007), in the Lea Valley near London (Garnett, 2001), around Copenhagen (Zasada et al. 2011) and Westland near The Hague, The Netherlands (Korthals Altes and van Rij, 2013). Apart from relying fully on-site conditions, additional artificial light, heating, irrigation and artificial growing media can boost harvests in greenhouses (Opitz et al., 2015). However, this demands thorough calculations, whether the extra efforts pay off. Furthermore, it is increasingly recognized and discussed that this focus on high value products alone has some limitations: a disproportionate specialization tends to decrease the economic resilience of farms (Sroka and Zmija, 2021). "The survival of farms requires innovative adaptation and investment to take advantage of the new constraints and opportunities that characterize the peri-urban environment" (Akimowicz, Cummings and Landman, 2016: 25)

On a system level, agriculture's adaptation to urban framework conditions means a shift from conventional farming to alternative practices in many ways (Paül and McKenzie, 2013). Overall, peri-urban agriculture changes very dynamically under altering conditions (Sroka and Zmija, 2021).

Farmers develop adaptation strategies to adjust to the shifting urban environment (Ruoso, 2019). Various scholars propose overlapping and complementary, but partly also contradictory types of peri-urban agriculture's adaptation strategies. These strategies partly go towards the business model thinking, partly not. Chapter 4.3 specifically focuses on a classification of CRFSi business models.

A comprehensive heterogeneity of peri-urban agriculture becomes obvious following different magnitudes of change, namely *incremental* (the system maintains its main functions), *systemic* (changing fundamental aspects of the system in form, function, or structure) and *transformative* (deep modification of the system (Ruoso, 2019). Different types and classifications of peri-urban farmers' adaptation strategies to take advantage of urban proximity are presented and discussed in scientific debate. These named adaptation strategies have to be seen in light of authors' varying backgrounds, motivations, and objectives:

- positive adaptations, normal adjustments, and negative adaptations (Johnston and Bryant, 1987);
- deepening, broadening, and re-grouping strategies (van der Ploeg and Roep, 2003);
- specialization, niching, multifunctional agriculture (Wästfelt and Zhang, 2016);
- horizontal growth, farmland concentration, specialization, multifunctional farming, reduction of livestock, de-intensification and farmland abandonment (Sroka and Zmija, 2021);
- agri-environmental practices, food marketing, food quality, crop diversification, educative activities; leisure and cultural activities (Ruoso, 2019);
- quality, embeddedness, and territoriality of food (Wästfelt and Zhang, 2016).

Peri-urban agriculture is dependent on the place, as location of their activities; they compete for attention with generic and 'place-less' commodity products (Markey et al., 2008; Wästfelt and Zhang, 2016). By doing so, they are able to answer the specific demands for culturally-acceptable food (Wekerle and Classens, 2015; Cerrada-Serra, Colombo, Ortiz-Miranda and Grando, 2018).

Peri-urban settings support the transition from purely production-concentration to more multifunctional farming activities as they benefit from city proximity (Sroka and Zmija, 2021). Multifunctional farms are capable of circumventing disadvantageous urban conditions, but exploiting the urban consumer potential. Multifunctional farming adds other land uses and activities than

production into the farm business, e. g. leisure and recreation, accommodation, education, landscaping, etc. (van der Ploeg and Roep 2003; Renting et al. 2009). “Several recent studies argued that peri-urban areas have unique potential for multifunctional agriculture” (Wilson, 2008: 371).

Beside the trend towards stronger development of multifunctional agriculture, it has to be noted that peri-urban land is decreasingly used for food production (Olsson et al. 2016; Wästfelt and Zhang 2018). Yet, the peri-urban farmland is growingly used for horse farms, hobby farms and activities not or only loosely connected with food production (Ruoso, 2019). Bomans et al. (2010) summarize the dominance of horses as livestock kept in many of global North’s peri-urban areas as “horsification”. This allows maintaining the rural character around cities, but obviously reducing food production capacities for the local urban population (Paül and McKenzie, 2013). Following Henke and Vanni (2017), the most reactive farms – are supplying an increasing number and variety of social and economic services to the urban population. Diversification developed as a specific business strategy in their case study region Italy.

In response to the post-productive, consumption-oriented requirements of the urban society, peri-urban farmers have intensified their uptake of multifunctional activities (Zasada, 2011).

4.2.2 Short Supply Food Chains

Rettig (1976) pointed out that back in the 1970s farmers did not consider benefits of being located in the urban proximity for short chain marketing and sales. Especially with the food crisis of the late 20th century mistrust and negative externalities of globalized agri-food systems came to the forefront (Renting et al., 2003; Sonnino and Marsden, 2006; Aubry and Kebir, 2013). Short Supply Food Chains (SSFC) contrast the globalized agri-food systems and are referred to as alternative food chain. Short circuits contribute to the re-territorialisation or re-localization of the food supply chains and networks.

Zasada (2011) argues – in line with Wästfelt and Zhang (2016) and Pölling et al. (2016) – that food production’s proximity to a city experiences a renaissance with a focus on specialised and high-value products. This results in a locational advantage for food producers close to cities and metropolitan areas (Marino et al., 2018). The geographical proximity allows locally embedded production and reduced or even cancelled dependency on world markets (Zasada, 2011). SSFC are a key feature and identify of urban and peri-urban agriculture; especially for fresh, non-mainstream, and processed food products (Pölling et al., 2017; Sanye-Mengual et al., 2019). SSFC allow differentiating markets and asking for higher prices, like premium prices (Benedek et al., 2021). Benedek et al. (2021) show that it is a typical strategy of small farms, which are more often in urban than in rural spheres. SSFC mitigate farmers’ market and economic risks by avoiding a too strong dependency from global market prices. Personal, transparent, authentic, and reliable producer-consumer relationships based on trust can be established with SSFC (Pölling et al., 2016; Mihailovic et al., 2019; Chiffoleau et al., 2021). Direct food chains are often considered to be more traditional and locally embedded as well as being integrated into more sustainable farming practices (Aubry and Kebir, 2013). “Food product quality based on geographical origin has become an established value-adding strategy” (Mihailovic et al., 2019: 2). SSFC are increasingly combined with environmentally friendly methods, like grass-fed beef, free-range rearing, etc.

Local producers increasingly consider SSFC as a suitable market approach since consumers show increasing preferences for regional productions (Henke and Vanni, 2017; Marino et al., 2018). This includes also a higher willingness to pay for locally produced food, like studies from Berlin and Ontario show (Dörnberg et al., 2016; Akimowicz et al., 2016). This enables farms to exploit local consumer potentials and avoid long value chains and globalized markets (Mihailovic et al., 2019).

SSFC embrace a wide range of relationships and market relations. SSFC have in common, that there is only a very limited number or even the absence of market intermediaries between producers and consumers (Parker, 2005; Aubry and Kebir, 2013). This is in many cases combined with a short geographical distance. The ideal form of SSFC fulfils both criteria; geographical and organizational proximity (s. Figure 7). Aubry and Kebir (2013) build on earlier work from Marsden et al. (2000) and Renting et al. (2003), who distinguished SSFC into ‘‘face to face’’, ‘‘proximate’’ and ‘‘spatially extended”.

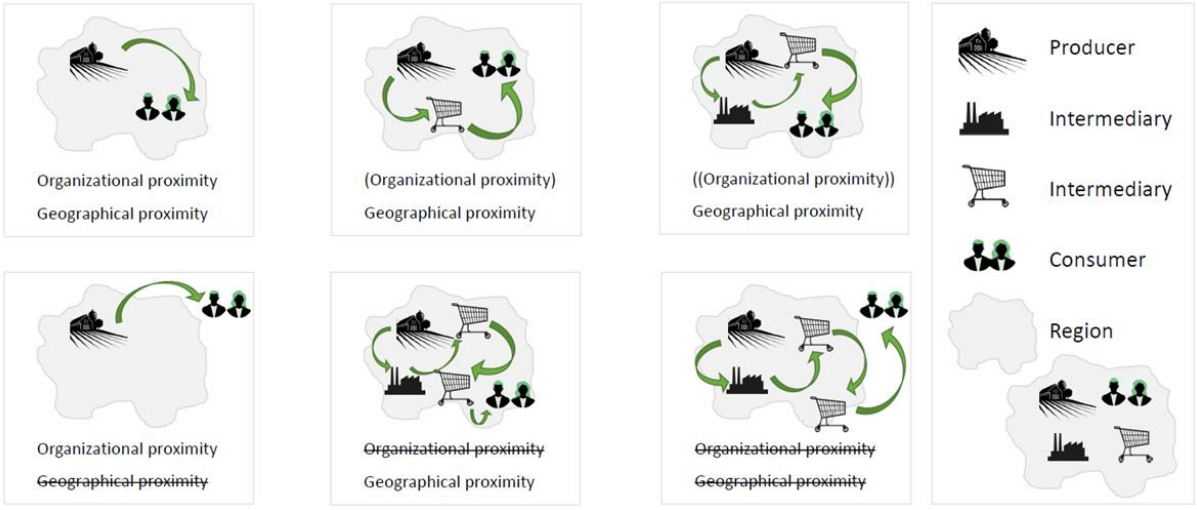

Figure 7: Organizational and geographical proximity between producers, consumers, and possible intermediaries. (Adjusted from Aubry and Kebir, 2013). Following their definition, at least on proximity criteria has to be fulfilled to be considered as SSFC; ideally

The strongest form of SSFC is direct sale between food producers and (urban) consumers, which can be performed in different ways: on-farm, farmers’ markets, box schemes, sale booths, (online) delivery, etc. An on-farm is a type of vertical growth strategy (Wästfelt and Zhang, 2016). Berti and Mulligan summarize SSFC and especially direct sale with “cutting out the middlemen”. Yet, direct sale suffers from a lack of capacity both, in terms of the volume of available produce, but also the required infrastructure to meet the growing demand for local and regional food (Berti and Mulligan, 2016). Besides direct sale, several SSFC take advantage of only one or very few intermediaries, restaurants, canteens, parties, and food festivals to differentiate marketing from mainstream ones (Pölling et al., 2016).

Peri-urban farmers tend to exploit several types of SSFC. In Ile-de-France/Paris for example, direct sales are dominating and the most popular form of SSFC, but s indirect relations are also developing steadily (boxes via intermediaries, direct selling in supermarkets …) (Aubry and Kebir, 2013). While the use of intermediary types of SSFC allows delivering relatively large quantities, direct sale arrangements and channels require more time committed to customer interaction and marketing with only small portions sold per transaction (Schmit, Jablonski and Laughton, 2019).

Depending on the specific channels, SSFC do not necessarily involve spatial proximity, nor local purchases – as long as organizational proximity exists (Benedek et al., 2021). However, when talking about CRFS geographical proximity is always a crucial criterion. Additionally, Figure 7 shows also an example not complying with the definition of SSFC, namely when the geographical and organizational proximity is not existing (bottom right of the figure).

When having the recent COvid19 pandemic in mind, Benedek et al. (2021) and others were able to show an increase in consumer demand for fresh and trustworthy local food, home deliveries, and online shopping options.

Aubry and Kebir (2013) argue that direct producer-consumer relations (geographical and/or organizational proximity) are expected to be financially more profitable compared to long supply chains. “As such it opens new opportunities to local urban agriculture that is severely threatened by global competition and urban sprawl” (Aubry and Kebir, 2013: 85). Value-added processing and direct marketing are recommended to increasing income and improving the economic viability of small farms, which are prevailing in urban areas and constitute an important type of CRFSi (Clark, 2020). However, the local alone is not a guarantee for successful SSFC arrangements. Chiffoleau et al. (2021) show that economic benefits of SSFC do not necessarily exist, when considering all costs appropriately, including total working hours for example. “There is growing evidence that farms selling through local food markets require different business models with different resource requirements” (Schmit, Jablonski and Laughton, 2019: 1).

The frontiers between alternative and standard food chains are blurred (Aubry and Kebir, 2013). This statement is also true, when discussing SSFC (this chapter) and so-called Alternative Food Networks (AFN; see next chapter). Scholars define and delimit both terms differently, so that certain types of direct producer-consumer relationships are seen as a SSFC, while other scholars subsume them under AFN. Both, SSFC and AFN present a common feature compared to long supply chains – a promise of difference (Chiffoleau et al., 2021).

4.2.3 Alternative Food Networks

Alternative Food Networks (AFN) include new producer-consumer relations in an effort to re-spatialize and re-socialize food production, distribution, and consumption (Sanye-Mengual et al., 2019). AFN provide an alternative to the dominant conventional and industrial food system relying on bulk production, economies of scale, and long value chain dependencies (Ilbery and Maye, 2005; Blay-Palmer and Donald, 2006). “AFNs [are] networks of, and relationships between, producers, consumers and other actors that embody alternatives to the more standardised industrial mode of food supply” (Paül and McKenzie, 2013: 96). Producers’ and consumers’ roles are different from their roles in the current conventional food system: consumers are becoming (more) directly involved in the food production and the distinction between producer and consumer is blurring, for what reason they are depending on the type of AFN also named prosumers (Opitz et al., 2016), co-farmers or co-producers (Medici, Canavari and Castellini, 2021). AFN include CSA (Community Supported Agriculture), Solidary Purchase Groups, Producer-Consumer-Cooperatives, local food movements, etc. Community-based initiatives bring together producers and consumers as directly as possible (Berti and Mulligan, 2016; Medici, Canavari and Castellini, 2021). AFN promote social transformation and social innovation in the agri-food system.

Alternative Food Networks go wide beyond pure market relationships - they build value-based chains of actors involved in food (Conner et al., 2011; Chiffoleau et al., 2021). As mentioned in the earlier chapter on SSFC, the boundaries between SSFC and AFN are vague. AFN are also referred to as civic agriculture, which highlights the key features of shared ownership and supportive relationships (Lyson, 2004; Vitiello and Wolf-Powers, 2014; Berti and Mulligan, 2016). Civic agriculture and food democracy allows citizens to take part in the decision-making about food production and consumption practices (Chiffoleau et al., 2021).

AFN allow to “set up shared goals and support […] the gradual shift from utilitarian private visions to economic models based on solidarity and the defence of common goods, in line with processes of moralization of economies” (Chiffoleau et al., 2021: 12).

Farmers are the price takers in traditional long chains, while they are the main price makers in direct selling. Differently, mutual agreements are key in AFN; the members agree jointly on prices since consumers become aware of the meanings behind the prices they agree to pay (Chiffoleau et al., 2021).

This brings coordination in governance, embedding, and marketing to the forefront (Roep and Wiskerke, 2012; Chiffoleau et al., 2021). The economic theories behind AFN focus on normative values, value-based food chains, place-based systems, partnership models, social entrepreneurship, moral economy, food democracy, and food sovereignty (Berti and Mulligan, 2016; Marino et al., 2018; Chiffoleau et al., 2021). AFN belongs to the shared value strategy, which provides business chances for small family farms by re-constructing local and personal ties (Berti and Mulligan, 2016). The marketness (relevance of price) and instrumentalism (individual motivation) go hand in hand with personal relations between the producers and consumers (Chiffoleau et al., 2021).

AFN have mainly emerged and dispersed around global North's urban and metropolitan areas. (Marino et al., 2018). "Peri-urban agriculture can be innovatively managed through AFNs as the distance between the (urban) consumer and the (peri-urban) farmer is shortened. Local food is a logical way to reconnect urban dwellers with nearby food production. […] such an initiative requires active farmer involvement and key stakeholder participation resulting in mutual commitment" (Paül and McKenzie, 2013: 103). The Baix Llobregat Agricultural Park near Barcelona, Spain, shows the development of AFN on a regional scale (Paül and McKenzie, 2013).
With their social entrepreneurship thinking, AFN are often not aiming for profit maximization. Clark (2020) shows that AFN struggle to achieve business success, so that Rossi (2017) as well as Chiffoleau et al., (2021) emphasize the need for larger professionalism and efficiency. The following gives insights into studies focussing on Community Supported Agriculture (CSA), food hubs, and shelf-harvesting gardens.

Community Supported Agriculture

Community Supported Agriculture (CSA) – in French AMAP and in German SoLaWi (Solidarische Landwirtschaft – is a cooperative relationship between the farmer and consumers, which are often named as CSA members or participants (Medici, Canavari and Castellini, 2021). The members pay agreed shares to the farm, while in return receiving the corresponding share of food products. Additionally, skills, labour, and responsibility can be shared (Brown and Miller, 2008).

CSA bring together "fair prices and wages, respect of the environment and shared sense of place, with producers and consumers not playing strictly separated roles but cooperating in sharing products, civic engagement environmental-friendly practices and shared production risks […] the close seller-buyer relationship attempts to create holistic, multidimensional relationships" (Medici, Canavari and Castellini, 2021: 1f).

CSA is a common type of AFN with fluent transitions to other AFN and SSFC like box scheme arrangements. Some thousand CSA exist in Europe along with increasing numbers year by year. Medici, Canavari and Castellini (2021) describe CSAs as the most representative form of paradigm shift in peasant agriculture.

Food hub:

Following their literature review, Berti and Mulligan (2016) define regional and local food hubs as innovative organizational arrangements, which build food supply chains based on shared values – so-called "value-based food supply chains". Food hubs allow small farms to answer the growing demand of local food, while individual small farms alone face organizational and infrastructural limitations.

Food hubs – like other AFN – focus on transparency (traceability …), democracy (reconfigured power relations along the chain …), equity (fair income, reasonable prices …), and access.
Food hubs open up new market channels and revenue streams for smaller farms by aggregated scaling or so-called cooperative scaling (Berti and Mulligan, 2016). Value-based food supply chains shift from

short-term profit maximization to economic sustainability and long-term viability. Food hubs offer advantages for producers (premium prices, equal profit margin distribution) and consumers (access to local food, quality characteristics, and reasonable prices). Food hubs "distribute more than food, they distribute social connections, relationships, and education" (Berti and Mulligan, 2016: 13).

Self-harvesting-gardens

Another AFN type based on sharing of resources and labour are self-harvesting gardens (Krikser, Zasada and Piorr, 2019). Self-harvesting gardens are oriented towards the generation of income and self-reliance. It is a service-focussed business model as consumers show willingness to pay for this kind of seasonal rental of small plots.

4.2.4 On-farm diversification

According to Cimino et al. (2021) on-farm diversification is a business strategy in which farm inputs like capital, land and labour are used to produce new products or services in order to gain access to new markets and revenue streams, that increase the farm income (Ilbery 1991 and Finger and EL Benni cited in Cimino et al., 2021: 1). By doing so the farm inputs are reallocated from the original agricultural production to new production fields (Cimino et al., 2021).

This business strategy is developed by market-orientated peri-urban farmers, that employ innovative solutions in order to adopt to the demands and changed expectations of the society in general and nearby cities in particular. The diversification includes a great variety of activities that create environmental, social and economic values and lead to a multifunctionality of agriculture in peri-urban regions (Cimino et al., 2021; Zasada, 2011; Mastronardi et al., 2015a and Lupi et al., 2017 cited in Marino et al., 2018). A classification of the activities undertaken can be done according to "deepening" and "broadening" strategies. Typical example for a "broadening strategy is care farming, educational services or accommodations on farm. Deepening strategies contain the shortening of the value chain due to direct sale or the offering of regional high-quality products. Both strategies provide benefits like more types of revenue streams and less income volatility (Mastronardi et al., 2015a and Lupi et al., 2017 cited in Marino et al., 2018; Cimino et al., 2021; Sroka and Zmija, 2021).

Economy of scope is another argument for employing diversification strategies. In this way farmers save costs due to combining complementary lines of production like milk and meat, becaus the cost for inputs can be shared among the production lines. Another benefit arises from a fuller range of products, a steadier work time requirement with less peaks in labour demand and improved resource efficiency (Panzar and Willing 1981 cited in Benedek et al., 2021; Akimowicz, Cummings and Landman, 2016).

The reasons why a farm decides to diversify its business are manifold. Cimino et al (2021) distinguishes between "opportunity driven" and "necessity driven" reasons for on-farm diversification. On the one hand "opportunity driven" means a situation in which the farmers decide to diversify, because they perceive it as an opportunity to gain business growth. Pull factors, that promote the decision for diversification, can be an increased profitability for new goods and services. On the other hand, "necessity driven" diversification is a risk management strategy, which is aiming for avoiding negative effects on the farm income due to external conditions (push factors like structural crisis or shocks) (Cimino et al., 2021). In this context on-farm diversification "(…) is largely acknowledged to be a key adaptation strategy for farmers to adjust to market dynamics and on-going political changes. It allows farmers to occupy extra family labour within the farm activities and to reduce economic risk in their business (Weltin et al. 2017 and Forleo et al. 2021 cited in Cimino et al., 2021: 1)". The relevance of this remark showed up in practice due to the agricultural crisis in the 1980s, when farmers in rural areas make use of this strategy to safeguard their farms (Ilbery, 1987 and Bryant and Johnston, 1992 cited in Zasada, 2011). Even though it has been underlined that the phenomenon of diversification is

not new to agriculture, farms searching for additional income source, beside traditional agricultural production, has remain as topical as ever (Alsos et al., 2011 and Carter, 1998a and Vesala et al., 2007 cited in Dias et al., 2019: 126). The decreasing profit margin due to agricultural overproduction and the increasing requirements of the society are only two reasons fostering diversification (Mastronardi et al., 2015a and Lupi et al., 2017 cited in Marino et al., 2018).

In the literature different distinctive feature have been identified that influence the likeliness of farms to choose on-farm diversification. The farm size is frequently mentioned, but not judged uniformly. One line of argumentation states that especially small farms tend to diversify their business, due to the fact that their resources are very limited, so that they can't compete with the price pressure. Following this argumentation large farms tend to specify because they can take advantage of their company size and achieve economy of scale (Mishra et al., 2004 and De Roest 2018 cited in Benedek et al., 2021). The other line of argumentation names "(…) more efficient allocation and exploitation of corporate resources (...)" in greater farms as reason for an increased likeliness of diversification (Meraner et al., 2015 and McNally 2001 cited in Marino et al., 2018). Moreover, the greater potential to devote resources to new business activities is mentioned as cause (Cimino et al., 2021).

Another structural factor is the proximity to potential customers. Therefore, the location matters, especially with regard to the distance to cities and spacial connections (Hansson et al., 2013 and Lange et al., 2013 cited in Cimino et al., 2021). Nevertheless, not only the proximity to cities is an important factor for diversification, but also rural areas can be favourable with regard to touristic business strategies (Lange et al. 2013 cited in Cimino et al., 2021). Employing consumer-orientated business strategies also depends on the entrepreneurial skills. These abilities are perceived as one of the main factors for diversification, because they contain the recognition of a business opportunity and the skills to make it work successfully (Yoshida et al., 2020 cited in Cimino et al., 2021). Although conventional farming needs entrepreneurial skills as well, studies suggest that entrepreneurial behaviour plays a greater role on diversified farms. (Carter, 2001 and Pyysiäinen et al., 2006 cited in Dias et al., 2019: 130). According to Cimino et al., (2021) farmers have been merely price-takers and market followers instead of active entrepreneurs, even though this quality might be critical for farm survival (Cimino et al., 2021).

In the literature, different types of diversification are described. The categorisation of an activity as diversification is not uniform. While Cimiono et al., (2021) describes diversification as rewarding strategy aiming for non-agricultural activities, Buciega et al., (2009) and Zasada, (2011) understand diversification "as a wide range of non-agricultural activities, yet often more or less loosely linked to primary agricultural production, such as tourism, recreation, leisure, education, health, cultural and natural activities" (Ilbery 1991 cited in Cimino et al., 2021: 1; Buciega et al., 2009 and Zasada, 2011 in Pölling et al., 2017). An even broader and more comprehensive approach from Salioni et al. distinguishes on-farm diversification into three subgroups. Firstly, the diversification of the agricultural output. Secondly, the differentiation of the product form other offers on the market due to specific product qualities. Thirdly, this kind of diversification involves no agricultural output like agrotourism. As a consequence, the author chooses a categorisation in "on-farm" and "off-farm" diversification. Off-farm diversification means that the members of the farm household use their work force to earn extra money apart from farming, which is called "pluriactivity" (Salioni et al., 2013 and Czekaj et al. 2020 and Blad 2010 cited in Benedek et al., 2021). In contrast to the definitions before, Vik and Mcelwee, 2011 emphazise the fact that the production or the provision of services is based on agricultural resources, which make the activity at least farm-related. For this reason, they don't consider off-farm work as type of diversification (Vik and Mcelwee, 2011 cited in Dias et al., 2019: 131). Different understandings of "Typologies of diversification" are shown in the table below.

Table 4: Typologies of diversification (Akimowicz, Cummings and Landman, 2016)

References	Types	Definition
Ilbery (1991)	Agricultural	Technical diversification focusing on-farm food and fibre production activities
	Structural	Oriented towards the non-farming community, takes into account the inclusion of farms in their regional environment
Van Der Ploeg and Roep (2003)	Deepening	Results in an increase of food and fibre production activities and includes value-adding activities
	Broadening	Results in the development of rural activities independent from food and fibre production activities – *e.g.*, agro-tourism, care farming, and nature conservation
	Regrouping	Re-orientation of factors towards non-farming activities – *e.g.*, off-farm income, low-external input farming
Barbieri and Mahoney (2009)	Non-traditional farming	New crops or livestock, or unusual agricultural practices
	Alternative marketing schemes	Access new markets through original marketing strategies
	Recreational activities	Tourism and hospitality enterprises (includes on-site purchases)
	Lease and rental of resources	Lease, rental, easements and timeshares of the farm and its resources
	Contract services	Custom farm work
	Value-added	Packaging, processing
	Historic preservation	Restoration of buildings and farm equipment in order to generate an income
	Education	Organisation of tours and educational sessions

The idea of multifunctionality gets mirrored by the manifold examples of on-farm diversification. Changed living condition and the growing interest for nature conservation has formed a societal attitude which contents itself not with agriculture production anymore. Social, cultural and environmental demands come to the fore and compete to some degree with production. As a consequence, diversified farms offer a wide range "(...) of services connected or close to agricultural production, especially agro-tourism (recreation, gastronomy, holidays), social (education, therapy, health, caretaking), and additional public and private ones (maintenance, log work, winter road clearance) (...)" (Hermans et al., 2010 and Wilson 2008 and Hassink et al., 2006 and Durand and Huylenbroeck 2003 cited in Hassink et al., 2020; Pölling et al., 2016). In this context Zasada points out, that (...) the delivery of environmental and recreational values by peri-urban agriculture has gained importance with the rise of the post-fordist society" (Zasada, 2011).

Social demands are met due to farm-based tourism, gastronomic business and the offer of leisure activities. Especially accommodation and recreational offers as well as horse-keeping belong to the major farm diversification activities with positive effects on the economic situation of farms and revitalisation of rural areas (Zasada 2011). City dwellers buying farms in the fringe of cities for part-time and hobby farming are less focused on agricultural production and income generation than on leisure and recreation (Præstholm and Kristensen, 2007and Busck et al., 2008 cited in Zasada 2011).

Another example of diversification is care farming. Care farming combines agricultural production with the care sector, by putting special attention on social services aiming for educational, health-related or societal support. Care farms serves social tasks like labour integration, rehabilitation, therapy and education for school dropouts (Zasada 2011; Hassink 2006 cited in Hassink et al., 2020). The first care farms initiated by farmers started at the end of the twenty centuries, today it has become merely a professionalized sector with relevance for employment and the economy for rural areas. Particularly the surrounding areas of great cities in the Netherlands – namely Amsterdam, Rotterdam and Utrecht – show a strong growth in care farming offers (Hassink et al., 2020).

Studies point out that care farming can be financial attractive by offering farmers an income alternative and providing beneficial effects to participants due spending time together with animals and in the nature. These beneficial effects improve the physical and mental well-being and help to develop social skills. Especially grassland-based farms and in particular dairy farms took advantage of this business opportunity. The operator models of care farms are very divers. In Germany and Ireland especially social care organisation are the operators of care farms. In the Netherlands, Norway and Belgium care farms are a second mainstay of family farms, which can be still engaged in food production. In Italy and France community-based organisations like social operatives run the care farms particularly for labour integration. All in all, care farming and diversification in general can give economic opportunities to farms but also reconnect "(...) increasingly urbanised society (...)" with agriculture (Hassink et al., 2020).

4.2.5 Building-integrated food production

Definition Building integrated agriculture (BIA)
A concept for agricultural production that is specially adapted to urban conditions is building-integrated agriculture. Building integrated agriculture (BIA) opens up new spaces for food production in and on buildings by using synergies between the building and the production activity (Besthorn 2013 and Specht et al., 2014 cited in Opitz et al., 2015; Benis and Ferrao, 2018: 31). The production can be on the rooftop (open rooftop farms or rooftop greenhouses), integrated in the facade (productive facades and edible walls) or inside the building (indoor farming) (see figure 8). Already existing or abandoned building are conversed for the usage or new buildings are especially designed for urban agriculture. Sometimes these buildings only serve agricultural production (single-farming-use) or be part of a diverse utilization concept (mixed-use). The production can involve animal husbandry or just plant cultivation employing soil-based media, aquaponics or hydroponics (Thomaier et al., 2014).

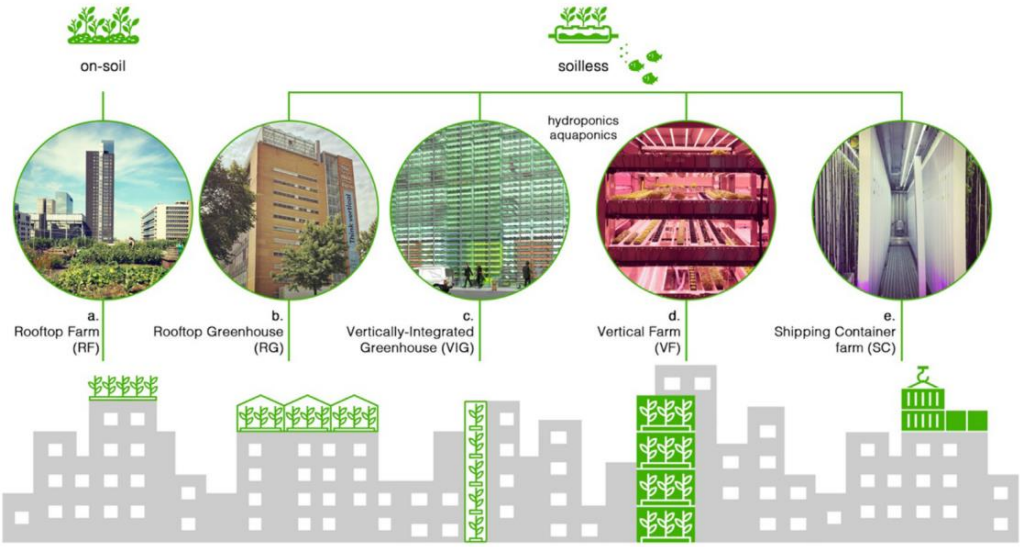

Figure 8: Typologies of commercial urban farms (Benis and Ferrao, 2018: 31)

Another term that refers to building-integrated agriculture is Zero-Acreage-Farming (ZFarming). Like the term "zero acreage" reveals, this kind of urban agriculture sums up all kinds of building-integrated agricultural production measures, that do not make use of farm land. According to Specht et al., 2016 open spaces like parks, wasteland or gardens, which are usually starting points for community gardens or other urban farming activities are excluded from this definition, due to their need for land. According to their definition ZFarming includes "all types of food production in and on urban buildings and is characterized by the non-use of farmland or open spaces (…)" like rooftop gardens, rooftop green houses, edible walls and indoor farming (Specht, Siebert and Thomaier, 2016; Specht et al., 2014 cited in Specht, Siebert and Thomaier, 2016). Buehler and Junge agree on this definition but add private backyard gardens or community gardens on vacant land to ZFarming. With regard to their classification building integrated agriculture is not the same as ZFarming but one category of it (Cohen et al., 2012 and Gardiner et al., 2013 and McClinton et al., 2013 and Sanyé Mengual 2015 and Specht et al., 2014 cited in Buehler and Junge, 2016).

As stated in the literature rooftop farms have the greatest practical relevance among envelop-integrated systems, as their number increases around the world, due to their sun exposed position and often unused space. Typical ways for the usage of rooftops are rooftop greenhouses (RG) or intensive green roofs. Technically sophisticated greenhouses are mostly located in North America. Moreover, an increasing number of indoor farming facilities can be recorded, while the tendency to use one or more

productions units stacked above each other, seems to be regionally different (Benis and Ferrao, 2018: 31; Thomaier et al., 2014). Approaches to maximize the benefits of Z-Farming Systems either use more production levels above each other in order to save space or recycle waste heat, water and nutrients (Specht et al., 2014 and Spread Co, 2016 and Touliatos et al., 2016 and Aerofarms, 2018 cited in O'Sullivan et al., 2019).

The product range of ZFarms include especially products that generate high turnovers like leafy greens and special or historic varieties of vegetables. beekeeping for honey production and pollination can be integrated in the utilization concepts as well. Moreover, a complementation of the product portfolio can be achieved due to animal husbandry. Typical examples are chickens for egg production and fishes as part of aquaponics. Also, non-food activities like workshops and educational offers play a role in income generation (Thomaier et al., 2014).

Rooftop Agriculture (RA)

As defined by Appolloni et al., 2021, rooftop agriculture is a building-based form of urban agriculture, which includes protected (rooftop greenhouses) and unprotected conditions (openair farms and gardens) for cultivation (Appolloni et al., 2021) (compare chapter X). According to Thomaier et al., the used media for cultivation are mostly soil-based and are placed directly on the roof or in raised beds and containers. Hydroponic systems are less frequent in use but still more common than aquaponics (Thomaier et al., 2014).

The construction forms vary depending on the objectives of the operators. Commercially run businesses aiming for the realization of profits tend to use intensive plant cultivation systems, by employing advanced technologies. According to Buehler and Junge commercial urban rooftop farms can be subdivided into two categories. On the one hand open-air farms exists with soil-based media, where a huge variety of vegetable is cultivated. On the other hand, especially leafy greens, tomatoes and herbs are cultivated in greenhouses with incorporated hydroponically systems. Operators that are merely aiming for charitable purposes (social-educational, improving living quality, etc.) have a tendency to employ cost-effective, low tech-solutions and recycled materials, in order to improve the availability of healthy food with a small investment (Appolloni et al., 2021; Buehler and Junge, 2016; Specht et al., 2015 and Benis and Ferrao, 2018 cited in Appolloni et al., 2021).

Unconditioned and conditioned systems of BIA

Unconditioned systems of BIA

With regard to building integrated agriculture, literature differentiate between unconditioned and conditioned production systems. Unconditioned Systems are roof top gardens, balcony gardens or green walls. These systems are technologically less advanced but offer some environmental advantages like the combination with rainwater harvesting and irrigation systems, which serve practical needs as well as limited budgets. Moreover, the environmental impacts of these low-tech rooftop gardens are favourable in comparison to high-tech rooftop greenhouses (Brooklyn Grange, 2018 cited in O'Sullivan et al., 2019; Opitz et al., 2016).

Conditioned systems of BIA

A great share of the investments in urban agriculture belonged to the field of controlled environment farms. Especially rooftop greenhouses (RG) or plant factories (PF) have a considerable importance in this sub-sector. With regard to commercial purposes greenhouses on rooftops play a major role. The cultivation methods equal those in traditional horticulture production, but have the locational advantage of being close to the consumers and therefore saving transport distances. Besides, they are often in connection with the renewal of brownfields or new utilization strategies of abandoned buildings or revitalisation of disadvantaged neighbourhoods.

Adaptations to the urban setting that improve the use efficiency of the scarce factor space are vertical stacks. In this way plants can be stacked above each other to optimize the output per square meter. A practical implication of this technique is performed by Sky Greens in Singapore. They operate rotating towers, in which plants are stacked above each other but still receive natural light for growth. Even more technology driven are plant factories, which embody by now the highest form of technology. Plants are fully cut-off from all kind of environmental influences. They receive artificial light through low-energy LED lights and are often grown in hydroponically or aeroponically systems (Clarke, 2017 and Gozham Greens Farm, 2018 and Lufa Farms Inc., 2018 and Sky Greens, 2014 and Kozai et al., 2016 cited in O'Sullivan et al., 2019).

Vertical farm

The idea of vertical farming came up in the 1960s and was initially described "(…) in Ruthner's patent on the use of "three-dimensional space for the cultivation of plants independently of seasons and climatic conditions" (Ruthner, 1966 cited in Benis and Ferrao, 2018: 34). Vertical Farming contains several forms, which all aims at improving the output with regard to the area size. The growing systems are closed and intend an intensive year-round production and high yields. Typically forms for realisation are skyscrapers (called skyfarms) or plant factories. Apart from the roof the facades of a building can also become a place for food production. The term vertically-integrated greenhouses (VIG) describe a patented concept, in which plants are cultivated in a hydroponic system. The cultivation happens within a double skin building facade. According to Benis and Ferrao there is up to now, no practical application of this concept (Benis and Ferrao, 2018: 31; Germer et al., 2011 and Kozai, 2013 cited in Benis and Ferrao, 2018: 32; Adams and Caplow, 2012 cited in Benis and Ferrao, 2018: 31; Pfeiffer et al., 2014: 87).

The production inside the building is subsumed under "indoor urban vertical farming (IUVF)". This production method allows to control all kinds of growth-factors, that are important to achieve maximum outputs, due to the isolation of the plants from any environmental influence. The sun radiation gets imitated by artificial light and the plants are cultivated in hydroponic systems (aeroponic or fogoponic). According to Kozai the optimization of the growth conditions improves the yields, in comparison to open-field agriculture, more than 100 times. Moreover, the water efficiency of plant factories with artificial light is improved, by consuming only 2% of the amount of water which would be needed in open-field cultivation. Nevertheless, the investment-cost outnumber 15 times of a greenhouse. The operation costs are dominated by high labour costs. Taking all this into account the market share of this system is comparably low. Even though it is described as a method to provide fresh, locally grown food, which is free of pathogens, it's related with great environmental impacts (Avgoustaki and Xydis, 2020a; Avgoustaki and Xydis, 2020b; Kozai 2015 cited in Avgoustaki and Xydis, 2020b). Due to the high need for energy the GHG emissions are often remarkable. As practical examples Kulak et al. 2013, shows that producing strawberries in London, has a higher carbon footprint than importing them from Spain. The findings of Theurl et al. 2014 underline this result. Also the tomato production in heated greenhouses produces two times more GHG emissions than importing Spanish or Italian tomatoes (Kulak et al. 2013 and Theurl et al. 2014 cited in Benis and Ferrao, 2018: 33).

Aquaponics

Aquaponics is a system that combines the production of plants (often horticultural products) with the generation of high-protein aquatic species (e.g., fish) in a soilless indoor system. The system receives great attention through its circular structure, in which the nutrients from the fish production serve as fertilizer for the plants. Therefore, it's considered as resource-friendly production method, especially with regard to water and nutrients. Moreover, the option to produce proteins within the city makes it a technology of high interest (Pfeiffer et al., 2014; Junge et al., 2017 cited in O' Sullivan et al., 2019; Baganz et al., 2019). Nevertheless, the implementation is comparably low, because of economic

hindrances and the needed knowledge in both fields, horticulture and aquaculture. The high investment cost and the operation cost, primarily labour and energy costs, put the financial viability at risk (König et al., 2016 and Bosma et al., 2017 cited in Baganz et al., 2019). As a consequence, the products are mainly for high-value markets with premium prices. Therefore, the location and the access to a group of buyers that is willing to pay these prices is crucial (Pfeiffer et al., 2014; FAO, 2016 cited in Asciuto et al., 2019). According to Bailey et al. 1997, large aquaponics are more likely to be financial viable than small ones (Bailey et al. 1997 cited in Asciuto et al., 2019). Another factor can be the integration of additional services and educational trainings to improve the profitability (Love et al. 2015 cited in Asciuto et al., 2019).

Opportunities and threats of BIA

Social acceptance and benefits
High-Tech solutions for food production face a certain scepticism among city dwellers. There is a risk that innovative cultivation methods like hydroponic and the generated products are confronted with a rejection due to the perception as unnatural and unhealthy. On the one hand the replacement of earth as growing media by an aqueous solution and on the other hand the proximity to possible sources of pollution, because of the urban environment, are described as reasons for unease (Specht et al., 2016 and Sanyé-Mengual, 2017 cited in Benis and Ferrao, 2018: 35). A possible way to cope with this problem, while improving the uptake of innovative production methods by society, is a stronger involvement of the community due to connections with local organizations (Allegaert, Wubben and Hagelaar, 2020). The consumer acceptance can benefit from such approaches, which is crucial for the sucess or failure of the business (Specht, Siebert and Thomaier., 2016). A wider target group would improve the acceptance. Nevertheless, the reliance for premium prices restricts the possible target audience to those with high purchase power (Specht, Siebert and Thomaier., 2016; Allegaert, Wubben and Hagelaar, 2020).

According to the literature there are also some societal benefits associated with BIA, namely the inclusion of marginal population in social and economic terms, as well as the reduction of gender inequality (Van Veenhuizen, 2014 and Haase et al., 2017and (Velmurugan et al., 2019 cited in Appolloni et al., 2021). Moreover, unused or already built-up land can be used, saving space for other purposes and creating new places within in the cities (Specht et al., 2014 cited in Benis and Ferrao, 2018: 31; Thomaier et al., 2014).

Environmental impacts
Controlled-Environment Agriculture (CEA) confer specific benefits like a year-round production, higher yields and resource-efficiency with regard to water and land-use. Synergies between the building and the production unit can improve the energy efficiency (Gould and Caplow, 2012 and Nadal et al., 2017 cited in Benis and Ferrao, 2018: 31). Another argument is the possibility to produce food even under harsh and unsuitable climate conditions and at the place of consumption, which can shorten transport distances (Allegaerd, Wubben and Hagelaar, 2020; Lufa Farm Inc., 2018 cited in O'Sullivan et al., 2019). As a consequence, food production in and on buildings can help to improve the resilience to climate change and the food availability (Georgiadis et al., 2017 and Gupta and Mehta, 2017 and Baudoin et al., 2017 cited in Appolloni et al., 2021). Farming on the building envelope can even serve ecological proposes (Oberndorfer et al., 2007 and Harada and Whitlow et al., 2020 cited in Appolloni et al., 2021).

Nevertheless, the influence of food miles on the environmental impacts are considerably small (Wakeland et al., 2012 and Wallgreen 2006 cited in Specht, Siebert and Thomaier, 2016). A large part of the greenhouse gas emission happens during the production phase (Weber and Matthews, 2008 cited in O'Sullivan et al., 2019). Especially controlled environment growing systems are very energy-intensive (Dyer et al., 2011 cited in O'Sullivan et al., 2019). The lightning as well as temperature and humidity control lead to high energy consumptions. Current research tries to improve the energy

demand of the LED lightning systems by lowering the heat waste generation and optimizing the spectra for plant growth at the same time (Kozai et al., 2016 cited in O'Sullivan et al., 2019). For this reason, Z-Farming methods are not necessarily environmental friendly or more sustainable (Bennis and Ferrao, 2018: 33; Specht et al., 2014 cited in Specht, Siebert and Thomaier, 2016).

Economic

Even though urban agriculture is an emerging business field there is still little known about economic feasibility. Literature refers to macrosocial benefits like the usage of unexploited spaces (abandoned factories or rooftops) with the advantage of boosting local economies (Mandel, 2013 and Specht et al., 2014 and Thomaier et al., 2014 cited in Benis and Ferrao, 2018: 34; Allegaert, Shao et al., 2016 cited in Wubben and Hagelaar, 2020). But with regard to the single business operators, information referring to profitability, feasible business formats and operational cost is rare. Benis and Ferrao point out that "new modes of urban agricultural production are gaining momentum, establishing their viability as compared to conventional agricultural practices is a challenge when it comes to scalability, resource efficiency, and cost-effectiveness" (Benis and Ferrao, 2018: 30).

Technical driven innovations like vertical farms are struggling for economic viability (Angotti, 2015 and Banerjee and Adenaeuer, 2014 and Zeidler et al., 2017 cited in Allegaert, Wubben and Hagelaar, 2020; Opitz et al., 2016). Strategic decision making is crucial for economic sucess as vertical farms need to find a good compromise between operational costs and the productivity of the plant (Allegaert, Wubben and Hagelaar, 2020; Benis and Ferrao, 2018: 35).

One of the main problems for ZFarms arises from the high investment cost that are followed by high opertion costs (energy and labour). (Specht, Sieberta and Thomaier, 2016; Tomaier et al., 2014). Moreover, they have to be economically competitive with other utilization concepts like solar photovoltaics, residential or commercial use. The high prices in real estate market and the safety requirements because of the exposed location on top of buildings influence the investment cost (Sanyé-Mengual et al., 2015 cited in Benis and Ferrao). Leading to a "higher capital expenditures - in comparison with conventional rural farms" due to the urban environment (Benis and Ferrao, 2018: 34). As a consequence, alternative funding approaches gain in importance (Opitz et al., 2016).

In vertical farming, not only the high investment costs are perceived as problem, also the operation costs are substantial (Avgoustaki and Xydis, 2020b). The main cost blocks during the operation time are energy and labour (Kozai et al., 2016 cited in O'Sullivan et al., 2019; Thomaier et al., 2014 cited in Benis and Ferrao, 2018: 35; Agrilyst, 2017 and Hadley, 2017b cited in O'sullivan et al., 2019). In consequence, plant factories tend to cultivate leafy greens and herbs, because they are high value crops which need a short time for growth (some species require around 21 days and for microgreens only 5 days) and comparably small energy inputs (Benke and Tomkins, 2017 and Hiwasa-Tanase and Ezura, 2016 and Kozai et al., 2016 cited in O'Sullivan et al., 2019). Energy is not only one of the most important cost blocks, but also a weakness with regard to the environmental impact. While conditioned systems are very water saving, their energy demand is much higher than in open field crops. Improving the energy demand is elementary for economic and environmental reasons. Important starting points affect the LEDs as well as the need for the greater integration of renewable energy sources and the utilization of urban waste heat (Barbosa et al., 2015 and Van Ginkel et al., 2017 and Kozai et al., 2016 and Togawa et al., 2014 cited in O'Sullivan et al., 2019).

Supplementary services can be a strategy to gain additional income sources and integrate in the social environment. The offer can include guided tours or workshops, merchandising and the leasing as extraordinary event location. In some cases, co-products or adapted services can play a major role in generating revenues. Tasting events and weekly rooftop markets can be activities to strengthen the standing of an enterprise in the neighbourhood (Thomaier et al., 2014; Opitz et al., 2016; Benis and

Ferrao, 2018: 35). In most cases commercial run ZFarms are operated by start-ups, which cooperate with a specific retailer or they run their business independently (Thomaier et al., 2014).

Vertical farms have a very small market share (Allegaert, Wubben and Hagelaar, 2020). Due to the fact that they act on a premium market, it poses the question whether their products are affordable by the general population or creating further inequality in the accessibility of fresh food (Specht et al., 2014 cited in Benis and Ferrao, 2018: 35). Even though there is increasing investment in controlled environmental growing systems in Asia, Europe and the Middle East, it still has to be proofed, if they are able to meet the expectations of being healthy, local grown food, sustainable and safe (O'Sullivan et al., 2019; Agrilyst, 2017 cited in O'Sullivan et al., 2019).

4.2.6 Small-scale fisheries

Fishing has constituted a key element of subsistence strategies for hunter-gatherer societies from the beginning of human civilisation (Erlandson & Rick, 2010; Jackson et al., 2001; José J. Pascual-Fernández, Pita, & Bavinck, 2020a; Pitcher & Lam, 2015). Many antique Mediterranean civilisations engaged in fishing as early as 1-000-500 BC (Pitcher & Lam, 2015). European food supply has been linked to seafood and inland water resources for centuries or millennia. Diverse nations fished for cod, herring, sardines, pilchards, and anchovies as crucial for their food supply (Roberts, 2007). The preservation techniques used for these species were crucial for achieving this pivotal role.

Men, women, old generations, and the young have collaborated in these small-scale fisheries, although this has not been consistently recognised. In the past, all the family contributed to fishing businesses and household sustenance (De la Cruz Modino, 2012; Frangoudes, 2013; Pascual Fernández, 1991; Santos, 2015). Women helped the fishing enterprise by building or repairing nets, processing fish and selling the catches, gathering seafood on the shore, administering the business and taking care of the family (Frangoudes, Marugán-Pintos, & Pascual-Fernández, 2013; José J. Pascual-Fernández, Pita, & Bavinck, 2020b). Children began fishing at a young age, learning by doing (Lögfren, 1984; Miller & Maanen, 1982; José J. Pascual-Fernández et al., 2020b; Pascual Fernández, 1991), and family elders taught them, mended nets, and helped with other modest (Nemec, 1972; José J. Pascual-Fernández et al., 2020b; Stoffle & Stoffle, 2007). Until the 19th century, fishing technology was limited and relatively simple, with large boats, various gears, and small-scale fishing along coasts worldwide (Roberts 2007). However, the early growth of trawling in Europe created intense conflicts and angered many small-scale fishers, like with purse seining for small-pelagic species (Ansola Fernández, 1998; Pascual-Fernandez & De la Cruz Modino, 2011; Roberts, 2007).

In the last two centuries, in a process that sped up after World War II, Europeans increased their fishing activities in distant areas (Bavinck, 2011; Holm, 2012). In this context, large-scale fishing earned substantial public subsidies to grow and succeed (Pauly et al., 2002; Sala et al., 2018). However, a diversity of fisheries crises driven by resource exhaustion questioned industrial fishing's development model (Finlayson & McCay, 1998; McGoodwin, 1990). In the same period, small-scale fishers continued their activity in Europe and worldwide despite scarcer resources, with the added handicap that the markets were being shaped for industrial catches (José J. Pascual-Fernández, Pita, Josupeit, Said, & Garcia Rodrigues, 2019). Local catches, primarily distributed fresh, differed from those of large boats, which were marketed as salted, dried, smoked or canned. Later, after the Second World War, these large-scale fleets began to use freezing technologies on-board, and an entirely new market was created for their produce (Holm, 2012). This transformation did not reach widely small-scale fisheries, although it is possible to find in the European markets.

The current relevance of small-scale fisheries around the world is highlighted by FAO (2018), which estimates that about 60 million people are involved in fish production. Capture fisheries represent 68% of those numbers, and small-scale fisheries account for 90% of the workforce in capture fisheries (FAO, 2016). The global estimation is that fisheries "directly and indirectly support nearly 10-12% of the world's population (FAO 2012)" (José J. Pascual-Fernández et al., 2020a), with a strong role of female employment. In European Union, as of 2016, small-scale fisheries "make up around 82% of the active fleet (approx. 70,400 vessels), 47% of employment (52,000), and landings that are worth approximately 943 million euros annually (or about 14% of revenue generated by EU fisheries)" (José J. Pascual-Fernández et al., 2020a). The definition of small-scale fisheries varies worldwide, but the definition used by EU includes fishing vessels of less than 12 meters and not using towed gears (José J. Pascual-Fernández et al., 2020a).

Markets in CRFS

Small-scale fishers' ability to sell their catch, get fair prices, and add value to it is influenced by a number of factors. For instance, market access may be hampered by current national and regional legislation or world market trends. The analysis of the value chains which run from the capture to the customer in this sector are scanty. In most nations, where supermarket chains and big businesses dominate most fish markets, it may be easier for large industrial fishing operators to have a substantial presence on supermarket shelves than for the fragmented supply of artisanal fleets. In many value chains, the role of the small-scale fishing sector is minimal. Doe to these circumstances, it is critical to gather information on current methods for enhancing the value of small-scale fishery catches and the conditions in which these methods might serve as alternatives for small-scale fisheries. A particular emphasis should be focused on how small-scale fisher organisations might participate in fish selling in this environment. Generally, fresh fish caught locally by small-scale fishermen using sustainable gear is frequently not sufficiently distinguished from the catches chilled or frozen by industrial fleets (José J. Pascual-Fernández et al., 2019).

Many small-scale fishing operators are looking for innovative ways to market and sell their catch due to the competition from large-scale fishery products, international imports, and aquaculture products (Stoll, Dubik, & Campbell, 2015), with a variety of initiatives established during the past ten years to improve the marketing and differentiation of small-scale fishery products (Bolton, Dubik, Stoll, & Basurto, 2016; Godwin, Francis, Howard, Malpica-Cruz, & Witter, 2017; José J. Pascual-Fernández et al., 2019).

Scientific literature is scarce on marketing strategies for small-scale fisheries products. This topic has received little attention, and most of the research has been conducted in only a few countries; thus, there is significant room for further investigation. Anyhow, several strategies are being used for increasing the value of small-scale fisheries catches, such as ecolabels or other labelling schemes, alternative food networks or direct selling.

Direct marketing and local supply chains

Small-scale fisheries traditionally use direct marketing or short, local supply chains. In this area community supported fisheries (CSF), a resemblance of similar strategies developed with agricultural products, has expanded in the last decades. Most of the publications about these strategies have a North American bent, influenced by a strong organisation comprising actors from civil society, researchers and fishers: https://localcatch.org/, committed to strengthening the local and regional seafood systems through CSF. This movement, fostered by the collaboration of some key researchers, has increased these marketing developments' social and academic visibility. CSFs are arrangements

between fishers and consumers, usually without a middleman, in which consumers pay fishers upfront for scheduled seafood deliveries that do not detail species, facilitating the distribution of not-so-well-known species (José J. Pascual-Fernández et al., 2019). CSFs enhance local fishers' income, improve short-value chains with high-quality seafood, and engage local populations with fishing communities (Brinson, Lee, & Rountree, 2011). In addition, these distribution strategies reduce the seafood capture and supply carbon footprint, reducing the value chain's environmental impacts (McClenachan et al., 2014; José J. Pascual-Fernández et al., 2019). Scientific publications on CSFs highlight their implementation challenges, non-market benefits, market rewards, sustainability, and policy implications (Brinson et al., 2011; McClenachan et al., 2014; José J. Pascual-Fernández et al., 2019). These marketing strategies area also used in Europe and other regions (Brent, Jouanneau, & Josse, 2022; Josse & Brent, 2021; José J. Pascual-Fernández et al., 2019; Salladarré, Guillotreau, Debucquet, & Lazuech, 2018; Szuster, Bernstein, Kuldilok, & Cecil, 2021).

Ecolabels and other labelling strategies

Criticism about the sustainability of wild-caught fisheries has led to an emphasis on seafood sustainability certifications (Logan, Alter, Haupt, Tomalty, & Palumbi, 2008), which can be linked to specific large-scale fisheries' interests. Consequently, since the inception of ecolabel programmes at the end of the last century, these programmes, which promise transparency and sustainability, have grown internationally. Some authors view certification as a pervasive type of market governance through which merchants and NGOs exert influence over primary producers, taking advantage from them (Belton et al. 2011).

Some authors like Foley and McCay (2014), compare eco-labelling and certification with the privatisation of fisheries governance by building new property-rights-based organisations. Labels and certification organisations give certificate holders rights and duties, allowing them to access new markets and frequently excluding small-scale fishers from these markets because these fisheries usually lack the capital and the data required in the certification process. These schemes may promote cooperation and collective action by encouraging diverse actors who share the same stock to collaborate to obtain the certification, but developing collective action constitutes a challenge in itself (Foley & McCay, 2014; Wade, 1987)

Studies on certification standards and small-scale fisheries have criticized these frameworks. Several scholars have long argued that MSC (Marine Stewardship Council) labels marginalise small-scale enterprises and, in fact, few small-scale fisheries are certified by MSC (José J. Pascual-Fernández et al., 2019). In this context, other alternative models for seafood sustainability, focusing on small-scale fisheries, look more fit than ecolabels (Stoll, Bailey, & Jonell, 2019). For instance, in France, Spain and Japan, there are experiences with badges of origin used to certify small-scale fishery products. The 'Bar de ligne de la pointe de Bretagne' label identifies seabass caught with lines in Brittany (France) and distinguishes wild-caught seabass from aquaculture-produced (José J. Pascual-Fernández et al., 2019). In Spain, labels like "Pescado de Conil" in Andalucia or "Pesca artisanal", in the Canary Islands, help to differentiate the catches from small-scale fisheries in the local and regional markets.

4.3 Business model classifications

4.3.1 State-of-the art agriculture business models

Porter (1980) presented in his widely used and cited book "Competitive strategy" three generic business strategies – cost leadership, differentiation, and focus. Since then, this has been the main foundation when talking about business strategies or business models in economics and strategic management. The figure shows these three strategies in the domains of strategic target and strategic advantage (see Figure 9).

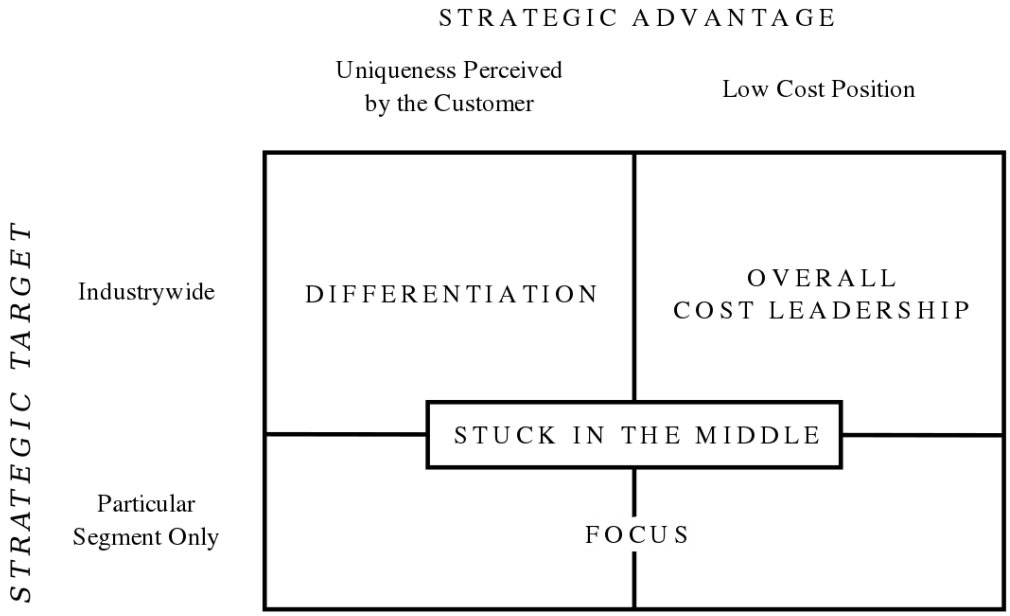

Figure 9: Porter's (1980) three generic business strategies

The cost leadership strategy (top right in the figure) concentrates on the pricing side by targeting price-conscious customers, meaning low costs. This be can mainly achieved by quantity or economies of scale, which reduce production costs per unit. Contrarily, the differentiation strategy is looking for customers who are willing to pay high(er) prices for high(er) quality. The companies aim for a unique selling point (USP). As the strategy's name highlights, you differentiate your product or offer from others. While both (can) have an industrywide target, the strategy focuses on a particular segment only (bottom half of the figure). One or few customer segments build the heart of the strategy, which is applicable mainly for comparably smaller businesses with less competition. It aims to provide unique and exclusive products and services.

Agriculture

Since the late 1990s, but even stronger in the last two decades, traditional agricultural functions and values have noticeably been replaced by new non- or post-productive features, adding a consumption-oriented component to a formerly production-oriented agriculture (Marsden, 1999; Brandt and Vejre, 2004; Luttik and van der Ploeg, 2004; Zasada, 2011). Nowadays post-productivist paradigm in agriculture does not imply a dominant business strategy or model (Henke and Vanni, 2017); it is "rather the co-existence of different agricultural models: small- and large-scale farms, food and non-food

products, non-marketable services, local markets and international trade flows" (Henke and Vanni, 2017:12), which are all fulfilling different and specific societal requirements.

Scale, size, and scope economies are traditional factors guiding adaptations on-farm (Chavas and Kim, 2010; Blancard et al., 2016). These economies allow farm efficiency increase either through specialization or diversification (Akimowicz, Cummings and Landman, 2016). Economies of scale and size belong to the general strategy of specialization including farm size growth for reducing unit costs. However, it is being debated that cost curves in agriculture are not U-shaped, but L-shaped: unlike larger farms, only smaller farms generate economies of scale when increasing size (Akimowicz, Cummings and Landman, 2016).

Several classifications of farm adaptation strategies are proposed. Van der Ploeg et al. (2002) defined three development trajectories – namely deepening, broadening and re-grounding. Marino et al. (2018) focus in their study on multifunctionality and diversification, while Henke and Vanni (2017) highlight three types of farm strategies: traditional, adaptive, and reactive.
One way forward to respond to the existing conventional agri-food systems and to create a competitive or survival strategy for small family farms is the re-construction of regional and local agri-food systems. This is in line with the concept of shared value strategy and Alternative Food Networks (Berti and Mulligan, 2016).

Urban Agriculture
In addition to the before-listed classifications of farm adaptations, an increasing body of literature is focussing on urban and peri-urban food production and their business models. While Smithers and Johnson (2004) identified four possible farm level trajectories in the face of pressures caused by urbanisation (growth and decline, intensification, persistence and de-intensification), Zasada et al. (2011) classified three types of peri-urban farms with different adaptation strategies: specialisation on high values, agri-environmental orientation, and life-style and recreational farming.

Although food production is a central issue even in urban areas, it is often a means to achieve other social benefits rather than the singular goal of producing crops, including community empowerment, youth engagement, education and job training (Pfeiffer et al., 2014).

When having the three generic business strategies from Porter (1980) in mind, there do exist some overlaps also with urban agriculture's business models (Pölling, 2016). While cost leadership (low-cost strategy) is not of relevance in urban areas, differentiation is a typical business model for peri-urban agriculture. Krikser, Zasada and Piorr (2019) highlight new market opportunities (direct marketing, innovation, interaction), which is in line with Vitiello and Wolf-Powers (2014) who name it "consumption base model", including income generation, place making as well as human and social capital growths.

From an US perspective, Vitiello and Wolf-Powers (2014) differentiate between thriving cities, like NYC and Chicago, and distressed cities, like Detroit. While thriving cities provide favourable conditions for profit-generating activities (farmer markets, restaurants …), social enterprises appear more promising in distressed cities following "mission above profit". Urban areas have great potential in terms of social value and niche business models (Allegaerd, Wubben and Hagelaar, 2020).

In the last ten to twelve years, a number of classifications of urban agriculture business models appeared. The first were building strongly on above listed examples, while the increasing dynamics and evolutions in this field, provided favourable conditions for further advancing debates on urban agriculture business models. Most classifications focus on the two most common business models for traditional peri-urban farms, differentiation and diversification (van der Schans, 2010; Pölling et al., 2017, Dias et al., 2019). These two often named business models are added with further, partly newly

emerging business models, like innovations, shared economy, the commons, and experience. Cost leadership (low-cost strategy) is not playing a significant role in urban and peri-urban agriculture.

The business model differentiation – like in Porter's generic strategies – aims for uniqueness. In urban agriculture, it is about niche production, but also differentiation in processing and marketing by integrating (parts of) the added-value chain on-farm. Niches, like exotic species or traditional breeds, create unique selling propositions and business options (van der Schans, 2010). City environments encourage farmers to identify activities along the whole added-value chain to innovate the business towards differentiation, with the aim of obtaining higher or even premium prices (Prain and de Zeeuw, 2007; Zasada, 2011; Mihailovic et al., 2019). Vertical integration shortens the added-value chain and creates manifold additional business fields that can be used. Within this business model, specific product features are very important to be successful, but personal producer-consumer relationships, transparency and authenticity help in terms of 'standing out from the crowd'. Cities offer favourable conditions for direct sale or other short supply chains (restaurants, canteens, other farm shops, etc.), eliminating additional intermediaries (Beauchesne and Bryant, 1999; Lohrberg, 2010; Zasada, 2011; Pölling, 2016). Differentiation is a common strategy for small and medium-sized farmers (Mihailovic et al., 2019).

Business diversification in and beyond food production towards new markets contrasts sharply with specialization (Pölling, 2016). Diversification in production as well as into services is another characteristic farm business model within urban areas. The variety of exploited commercial services connected to or close to agricultural production cover a wide range, such as agro-tourism (recreation, gastronomy), social support (education, therapy, health, caretaking), and further public and private services (Pölling et al., 2017). Among others, horse services, education services, and care farming are frequently used by urban farms due to the presence of a large number of (possible) clients. Diversification and multifunctionality are often successful reactions to urban pressure, which acts as an exogenous driver for farm diversification (Henke and Vanni, 2017).

As mentioned before, Alternative Food Networks and social entrepreneurship are playing an increasing role in urban and peri-urban agriculture as key components of CRFS.

When turning from traditional peri-urban agriculture to vertical farming, the business models include not only the sales of food products, mainly vegetables and fishes, but also sales of systems or services (Allegaert, Wubben and Hagelaar, 2020). This is especially true for rooftop greenhouses, indoor systems, and aquaponics.

Urban agriculture's business models emphasise the importance of location, meaning that cities and agglomerations provide favourable framework conditions for personalised business approaches (Pölling et al., 2017).

4.3.2 Classification of CRFSi business models

Based on this structured literature review on business models, this sub-chapter proposes a new typology of business models for CRFSi. Actually, it is not neglecting existing typologies and classifications of business models and strategies, but building hereon.

CRFS initiatives are diverse and heterogeneous, like Alternative Food Networks, vertical farming, short supply food chain, aquaponics, etc. This is also true for individual entrepreneurial activities, but common features can be derived based on the above presented structured literature review on main types of CRFSi and business models more general.

Four CRFSi business models are proposed – **focusing**, **deepening**, **broadening**, and **sharing**.

- **Focusing**: CRFSi concentrate on one or very few activities, e.g., one specific food product. In urban and peri-urban settings, CRFSi are concentrating on niches for creating a unique selling proposition.
- **Deepenin**g: CRFSi add activities beyond food production into their (business) portfolio. Here, we differentiate between full deepening (whole chain) and partial deepening (only parts of the chain).
- **Broadening**: CRFSi diversify their activities in production (product broadening) and/or into non-production activities and services (non-product broadening, non-agricultural diversification).
- **Sharing**: Community-based CRFSi with a strong civic empowerment, like CSA. This includes types with and without farmers cooperating with community.

The following table (Table 5) summarizes the main features of these four CRFSi business models.

Table 5: Main features of the four CRFSi business models

Focusing	Deepening	Broadening	Sharing
Niche products	Vertical integration	Product diversification	Alternative Food Networks
High-value products	Short Supply Food Chain (SSFC)	On-farm services	Community Supported Agriculture (CSA)
Specialization	Direct sale	Non-agricultural diversification	Civic agriculture
Quality	Proximity	Pluri-activity	Social innovation
USP		Horizontal integration	Food democracy
Controlled Environment Agriculture		Multifunctionality	Food sovereignty

The following figure shows the generalized position of these four types of business models against the degree of innovation and community-involvement. The degree of innovation is split into technological and product innovation as well as social innovation (see Figure 10).

When CRFSi concentrate on the **focusing** business models, the involvement of community is low, compared to the other three business models deepening, broadening, and especially sharing. Innovations in the business model focusing mainly take place with regard to technological and/or product innovation. Peri-urban farmers who focus on high-value crops, but also efficient building-integrated production types (vertical farming, indoor farming, and aquaponics) represent examples of the focusing business models.

Contrarily, the **sharing** business model is per se inherent or at least strongly interwoven with social innovation and strong community involvement – even until food sovereignty, food democracy. This is also referred to as civic agriculture. Community Supported Agriculture and other types of Alternative Food Networks are prominent and relevant examples of the sharing business model.

In between focusing and sharing, the two business models of **deepening** and **broadening** are more indifferent when it comes to community involvement and type of innovativeness. However, the CRFSi belonging to the deepening and broadening business models tend to focus on social innovations over technological/product innovations and encourage community involvement, e.g., in direct sale or pick-

your-own arrangements (deepening business model). As described before, the transition between Short Supply Food Chain types and Alternative Food Networks is diminishing and blurring. Mainly peri-urban farmers producing a huge variety of different food products and/or offering non-agricultural diversification measures follow the broadening business model.

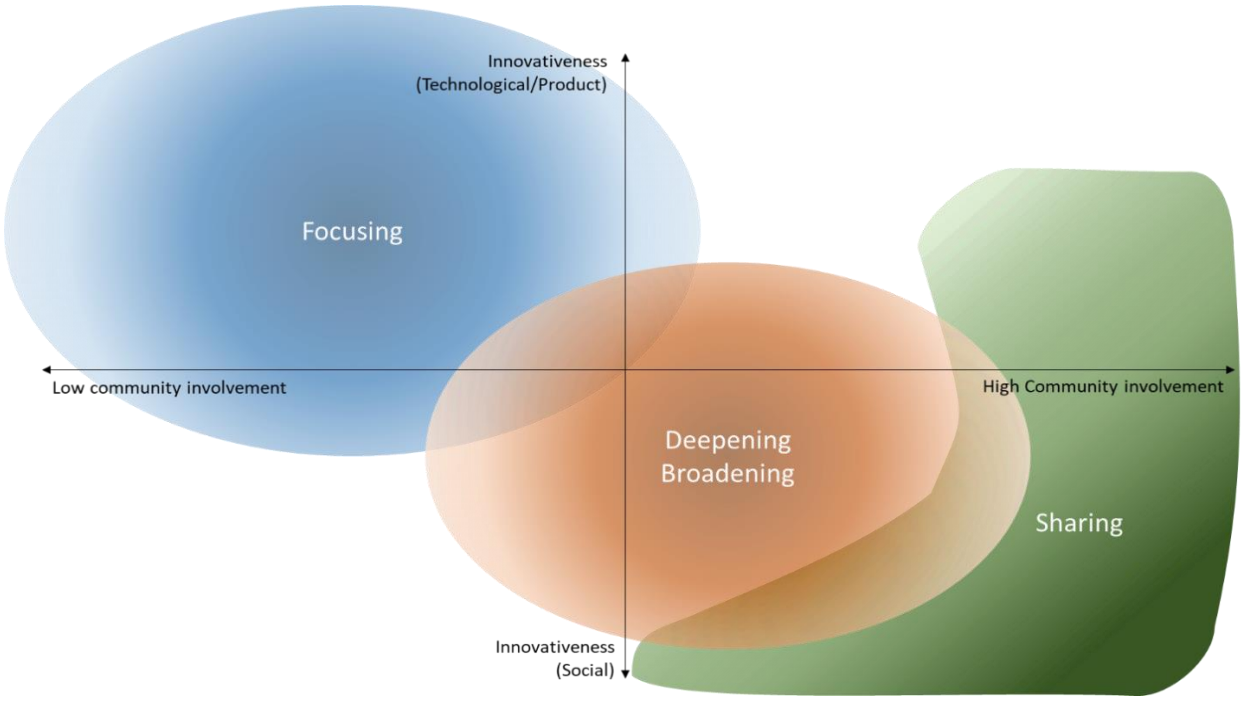

Figure 10: CRFSi business models focusing, deepening, broadening, and sharing positioned with regard to innovativeness and community involvement.

4.3.3 FoodE pilots as business model case studies

Here, the proposed four CRFSi business models are exemplified with the FoodE pilots, which are serving as good practice case studies (see here and D4.4 for more details). The pilots are grouped into one of the four CRFSi business models. Although some pilots take advantage of elements of not only one business model, it is possible to indicate the core business model for all (see Table 6).

Table 6: Grouping of FoodE pilots into the four CRFSi business models

CRFSi business model	FoodE pilot
Focusing	Bologna AlmaVFarm Bleiswijk Plant Factory Amsterdam Aquaponics Oslo Plant Factory Berlin Nolde “Water House”
Deepening	Napoli Urban Agricultural Park Iasi CUIB restaurant Tenerife ECOTÙNIDOS
Broadening	Bologna SALUS Space Bologna SERRA MADRE Romainville Cité Maraîchère Ljubljana prison honey Oslo educational hydroponic garden
Sharing	Oslo incubator for Sustainable Food Production Sabadell agricultural test spaces

Focusing

Five FoodE pilots belong to the focusing business model. Most pilots focus on technological innovation, like indoor farming, vertical farming, plant factory (Bologna AlmaVFarm, Bleiswijk Plant Factory, and Oslo Plant Factory), aquaponics (Amsterdam Aquaponics), or circular greywater – food production systems (Berlin Nolde "Water House").

Bologna AlmaVFarm and *Bleiswijk Plant Factory* strongly focus on technological innovation and research. For the indoor vertical farm Bologna AlmaVFarm (Link FoodE) research investigates for example lightning electronics, ebb and flow hydroponic systems, and aeroponic cultivation measures. Bleiswijk Plant Factory (Link FoodE) serves as a research centre to study climate control and crop cultivation strategies for a selected number of horticultural crops (energy-saving experiments, including lighting, irrigation, nutrient efficiency, and big data). Furthermore, they operate as a service provider for industry (business-to-business) and demonstration centre for commercial vertical farming and also aim to unveil new insights for greenhouse horticulture.

Figure 11: Impression from Bologna AlmaVFarm

Figure 12: Impressions from Bleiswijk Plant Factory

Berlin Nolde “Water House” (Link FoodE) works on an advanced greywater recycling plant for hydroponic greenhouse production, vertical production, and usage in fish tanks and residential buildings. Besides this technological core aspect, Nolde conducts education, training, awareness raising, and research as side activities.

Figure 13: Impressions from Berlin Nolde “Water House”

Amsterdam Aquaponics and Oslo Plant Factory add broadening and deepening elements into the focusing business models. Amsterdam Aquaponics (Link FoodE) uses the resource-efficient and circular combination of vegetable and fish production for the redevelopment of a former polluted urban brownfield in the North of Amsterdam. Parallel to the focusing business model, elements of the broadening and deepening business model are included, especially the educational centre for sustainable urban food production. The main objective is the demonstration, education, and awareness raising. The products are sold to a café next door.

Oslo Plant Factory (Link FoodE) produces indoor microgreens, baby leaf and salads production in multi-layer shelves. Yet, they go beyond the focusing business models. The whole chain (deepening by packaging and distribution to restaurants and shops) is covered and social inclusion builds a main feature of the plant factory. This brings together technological innovation and community.

Figure 14: Impression from Oslo Plant Factory (microgreens)

Deepening

Three FoodE pilots emphasize the deepening business model, namely Napoli Urban Agricultural Park, Iasi CUIB restaurant, Tenerife ECOTÙNIDOS. That being said, it has to be acknowledged that all three integrate also core elements of the broadening or sharing business models.

Napoli Urban Agricultural Park (Link FoodE) contributes to local food production and local food markets. Within the urban agricultural park, food production takes place on open fields, but also in greenhouses, including cultivation of potted aromatic plants. Along with the local production and marketing (deepening), the pilot offers training courses for disadvantaged people and educational activities. These latter activities bring broadening elements in.

Figure 15: Impressions from Napoli Urban Agricultural Park

Tenerife ECOTÙNIDOS (Link FoodE) focuses on enhanced short food chains in the fishery sector. More precisely, small-scale fishery and school canteens are brought together for establishing the short chain on the island of Tenerife. Additionally, broadening activities complement the short food chain: educational activities for school pupils and parents' associations as well as workshops with cooks.

Figure 16: Impressions from Tenerife ECOTÙNIDOS

Iasi CUIB restaurant (Link FoodE) offers meals based on local products (home-grown products and/or collected from surrounding producers). Overall, CUIB aims for zero waste by running a closed-loop model, including production, selling (+ donating food to vulnerable people), and supplementary educational activities. The deepening business focus of Iasi CUIB restaurant is combined with the sharing business model with its social enterprise elements.

Figure 17: Impressions from Iasi CUIB restaurant

Broadening

Five FoodE pilots exploit the broadening business model. Romainville Cité Maraîchère (Link FoodE) serves as a very suitable case study for the broadening business model. The systemic and multifunctional centre consists of a multi-storey greenhouse, educational gardens, social food approach, market gardening, and mushroom production. All these production components are added with further pillars; kitchen, café, canteen, educational greenhouse and garden activities. All these activities of Romainville Cité Maraîchère are working together in a holistic approach defining the broadening business model.

Figure 18: Impressions from Romainville Cité Maraîchère

The following three figures summarize Romainville Cité Maraîchère by using the Triple Layer Business Model Canvas from Joyce, Paquin and Pigneur (2015) adding a social and environmental layer to the economic layer, the latter originating from Osterwalder and Pigneur's (2009) traditional Business Model Canvas approach (s. also figures 1 and 2). The business model of this pilot is detailed in the attachment (s. Attachment 1)

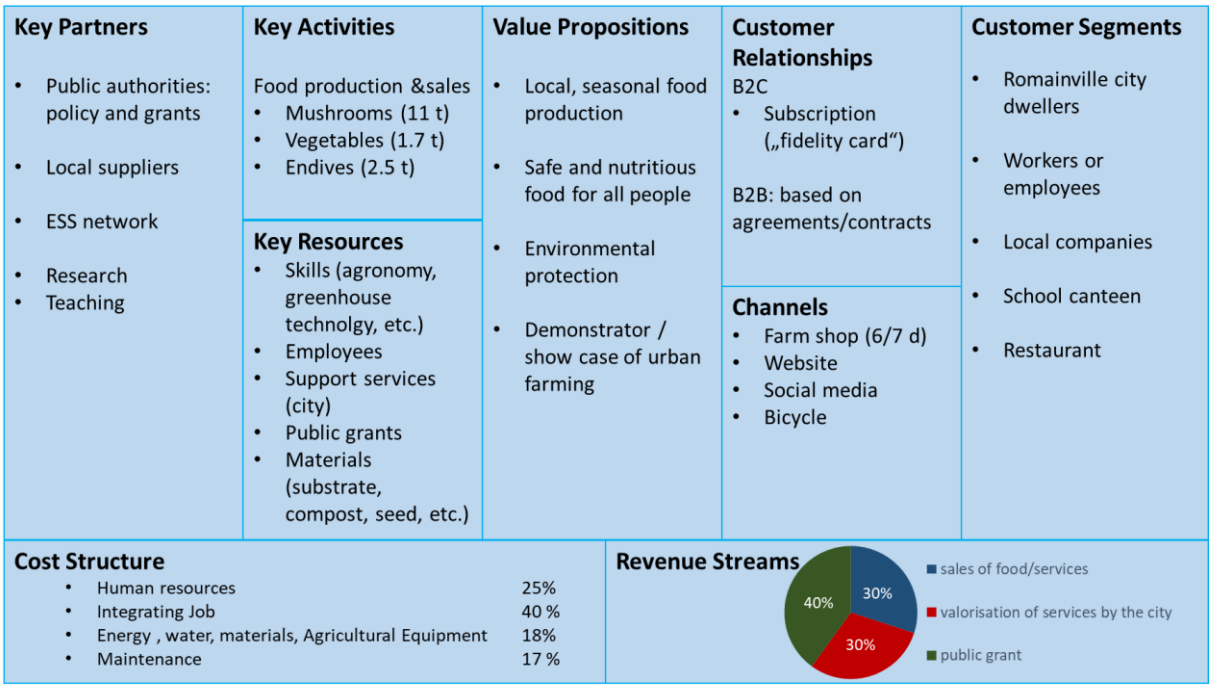

Figure 19: Triple Layer Business Model Canvas: Economic layer

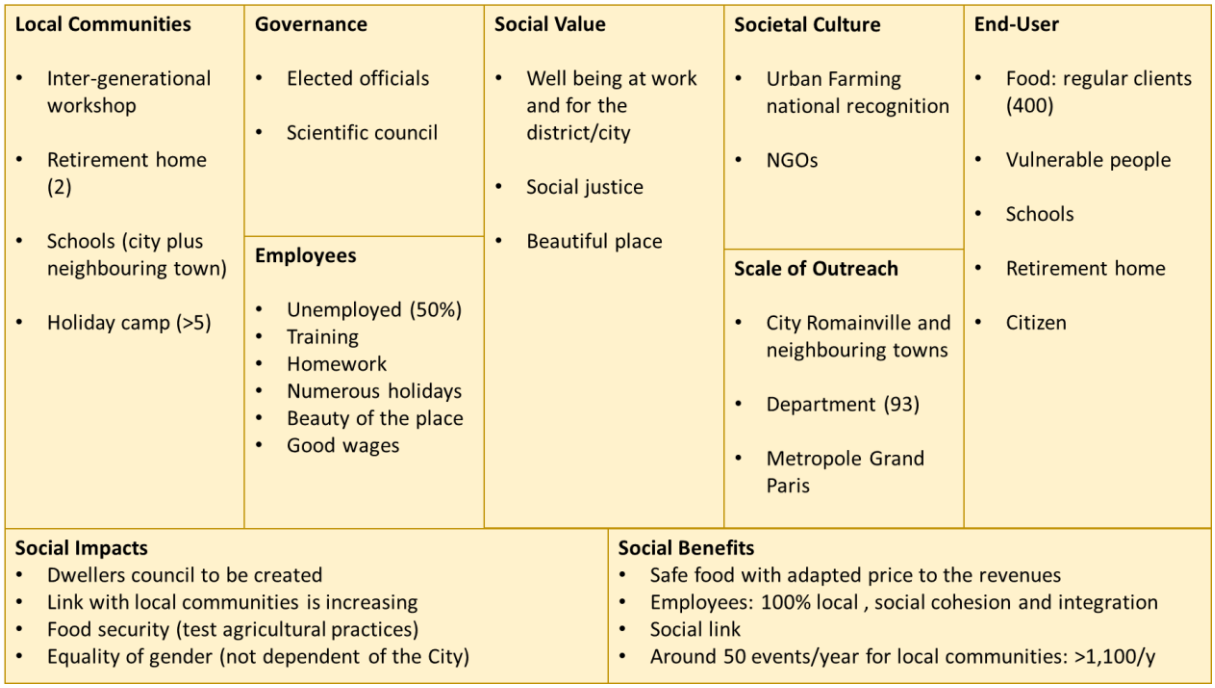

Figure 20: Triple Layer Business Model Canvas: Social layer

<table>
<tr>
<td>Supplies and Out-sourcing
• Local suppliers
• Substrate with compost
• Eco suppliers as often as possible
• Local employees</td>
<td>Production
• Greenhouse
• Natural light
• No pesticide/ biocontrol
Materials
• Organic seeds, fertilizers
• Compost, mushroom
• Substrate: Copo light (recycled aggregate, aerated concrete)
• Building infrastructure</td>
<td>Functional Value
Teaching
• seasonal food
• environmental practices (no food waste or compost)</td>
<td>End-of-Life
• Leftover Food/NGO
• Back to other gardens
Distribution
• Local
• Bicycle
• Electric vehicle</td>
<td>Use Phase
• Not determinate yet
• Teaching People
• Workshop</td>
</tr>
<tr>
<td colspan="3">Environmental Impacts
• Internal biodiversity
• Management of source of energy (wood)
• Management of water consumption
• Second hand equipment</td>
<td colspan="2">Environmental Benefits
• Landscape management
• Circular process: zero waste , recycling and reuse
• Pest management: no pesticide</td>
</tr>
</table>

Figure 21: Triple Layer Business Model Canvas: Environmental layer

The main purpose of Oslo educational hydroponic garden (Link FoodE) is learning and education, especially for school pupils and children in general. They are learning how to grow salads and herbs, which is significantly contributing to children's knowledge and capacity building in the food production and nutrition domain. This is not done in a common garden, but in a small-scale hydroponic system, which is adding efficient production systems into the education offer.

Figure 22: Impression from Oslo educational hydroponic garden

Ljubljana prison honey (Link FoodE) supports empowerment and rehabilitation as well as education and training offers for prison inmates by urban beekeeping. The strong social and care focus defines

the broadening business model, which are added with a concentration on one product (honey) as well as some processing and selling.

Figure 23: Impressions from Ljubljana prison honey

Bologna SALUS Space (Link FoodE) is positioned somehow between the broadening and the sharing business model. The multifunctional centre embraces different food issues, including indoor production containers and rooftop gardening, farmers' market, restaurant, educational activities, a training hub, and study centre. With the intercultural dialogue, social inclusion, and strong community-involvement, the for-profit cooperative shows strong connections to the sharing business models.

Figure 24: Impressions from Bologna SALUS Space

The second broadening FoodE pilot from Bologna, SERRA MADRE (Link FoodE), is a food and sustainability cooperative (hub), in which production goes hand in hand with training, events, workshops, and a restaurant. Additionally, aquaponics and hydroponics play an important role. Co-working brings this broadening approach together with elements of the sharing business model.

Figure 25: Impressions from Bologna SERRA MADRE

Sharing

While some of the before-mentioned FoodE pilots integrate elements of the sharing business model into their portfolio, two concentrate hereon. These two are Oslo incubator for Sustainable Food Production and Sabadell agricultural test spaces.

Oslo incubator for Sustainable Food Production (Link FoodE) acts as a business incubator with an urban beekeeping focus at several places (rooftop farm, farmland, and other places). Social innovation is an inherent part of the urban farming activities by following the Community Supported Agriculture concept: community members buy shares of the beehives, for which they receive honey in return. Furthermore, together with the youth the members sell the surplus.

Figure 26: Impression from Oslo incubator for Sustainable Food Production

Sabadell agricultural test spaces (Link FoodE) offer farmland to new farmers (new entrants into farming) for testing participatory farming practices (co-production approach). The pilot brings together (new and innovative) farmers, schools, and consumer cooperatives. Products are sold to the local Sabadell market and education activities complement the concept.

Figure 27: Impressions from Sabadell agricultural test spaces

The briefly presented pilots are positioned qualitatively into the following figure with regard to their innovativeness, community-involvement, and location in the four business models focusing, deepening, broadening, and sharing (s. Figure 28)

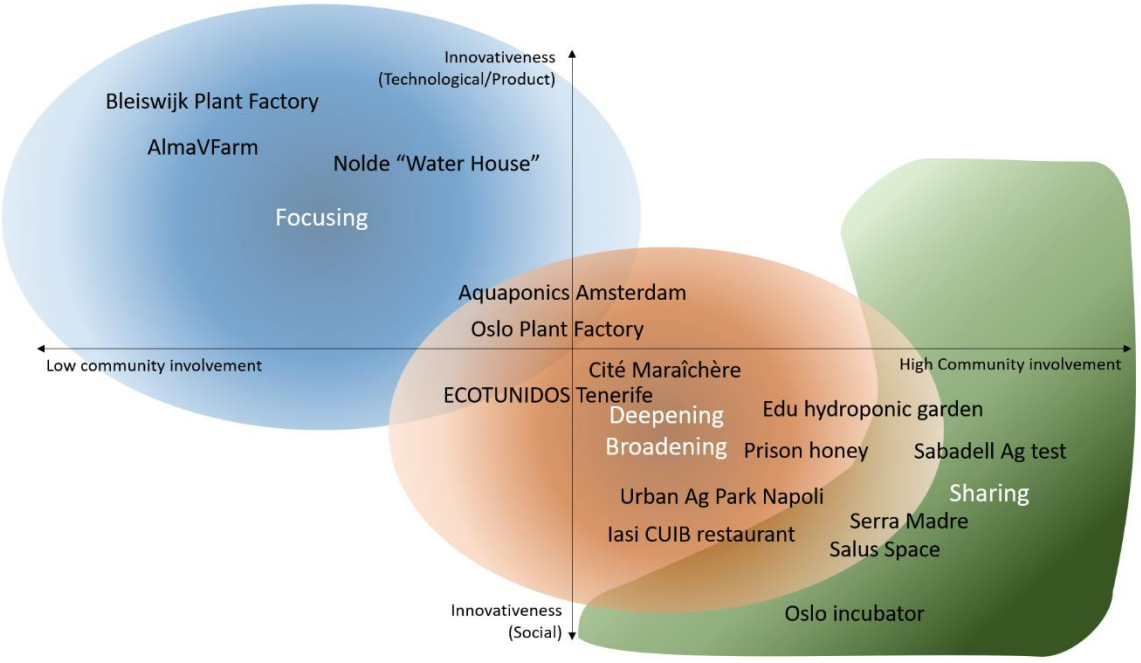

Figure 28: Qualitative positioning of pilots into the four business models with regard to innovativeness and community-involvement

4.3.4 SWOT analysis of CRFSi business models

The following chapter focuses on the strengths, weaknesses, threats and opportunities identified for the four business models "focusing", "sharing", "deepening" and "broadening" in the literature review.

Focusing

Strengths

The business model benefits from the quality of the produced food. Especially the regionality and the freshness of the products are perceived as advantages, which directly contribute to the economy of the CRFSi (Morel et al., 2017). The quality allows to demand higher prices and the option of direct selling supports the influence of the producer on the price setting (Chang & Morel, 2018; Goodman & Minner, 2019). Enterprises that employ growing measure like aquaponics, can advertise their products with favourable qualities like “pesticide free” (Al-Kodmany, 2018; Grard et al., 2020). A useful supplementation to attract more customers, can be broadening activities, to gain more attention for the core product (Chang & Morel, 2018; Morel et al., 2017; Saporito, 2017). By doing so, the focusing approach is merged with the broadening concept.

With regard to the local economy, the business model can be helpful to create new job opportunities and build up a new urban business field (Benis et al., 2018; Goodman & Minner, 2019; Saporito, 2017). The new business field can serve as a starting point for the creation of networks, educational and training offers (Benis et al., 2018; Saporito, 2017; Specht et al., 2014). Moreover, it can have a positive influence on the dependence on imported food. Some of the related growing measures can extend the growing season or lead to a year-round production, which can increase the level of self-sufficiency with local grown food (Graamans et al., 2018; Montero et al., 2017; Saad et al., 2021).

Due to the fact, that literature focusses especially on building integrated agriculture, there is a great interconnection to the real estate sector. The conversation of abandoned/un-used areas into productive urban landscape is perceived as a great strength of this business model, with positive side effects on the property value (Al-Kodmany, 2018; Benis et al., 2018). The combination with existing buildings can be a win-win situation, when exploiting the mutual interdependencies between the building and the productions with special regard to energy demand, thermal flows and water usage (Montero et al., 2017; Sanyé-Mengual et al., 2015). This can have a positive effect on the business’ maintenance costs (Al-Kodmany, 2018).

With regard to the environment, some of the business activities can provide support for an “urban renaturation” (McDougall et al., 2019; Saporito, 2017; Specht et al., 2014). Literature describes positive effects of green rooftops on the number of available habitats and biodiversity. Additionally, rainwater retention and the mitigation of the urban heat island effect are named (Grard et al., 2020; Whittinghill & Rowe, 2012). Also, a reduction in air and noise pollution and the sequestration of carbon are possible. The use of roofs for plant cultivation can also influence the life span of the roof in a positive way and help to save energy (Specht et al., 2014).

Most of the environmental benefits of CEA are related to efficiency and land use. The full control of the production conditions and the intended circularity generates high productivity, which might lead to savings in land, water and other resources (Gómez et al., 2019; Goodman & Minner, 2019; McDougall et al., 2019; Saad et al., 2021; Shao et al., 2016; Specht et al., 2015). By now, these techniques are showcase for innovation that generate not only high yields but also building expertise (Al-Kodmany, 2018; Chang & Morel, 2018; Goodman & Minner, 2019; Shao et al., 2016; Specht et al., 2014).

Weaknesses

The weaknesses of this business model are notably restricted to economy and environmental impacts. The economic feasibility gets impeded due to the novelty and complexity of the projects, especially with regard to long term viability and the limitations in size with regard to the urban setting (Chang & Morel, 2018; Sanyé-Mengual et al., 2017). In particular, high-tech vertical farm systems suffer from a low economic feasibility caused by both high investment and operation costs (Benis et al., 2018; Saad et al., 2021; Saporito, 2017; Specht et al., 2014, 2015; Whittinghill & Rowe, 2012). The costs for land, infrastructure and labour, as largest cost block among the operation costs, are challenging for the profitability of the enterprises (Chang & Morel, 2018; Gómez et al., 2019; Goodman & Minner, 2019; Milestad et al., 2020; Whittinghill & Rowe, 2012). Therefore, technical advanced growing measures remain restricted to horticultural products (Saad et al., 2021).

So far only a few commercial BIA farms exist in the global North. Most of them are in their infancies or evolution phase, which influences negatively the ability to pay proper wages. Therefore, good staff is hard to find (Specht et al., 2015). In order to achieve economic viability prices ranges comparable to organic food would be required (Benis et al., 2018). However, the price structure imposes an exclusivity, which might exclude people with low and middle income (Goodman & Minner, 2019; Specht et al., 2014, 2015). The purchase decision of the consumer might also be affected by the unease, with regard to the soilless growing media. High tech cultivation systems can come into conflict with their idea of naturality and image of agriculture (Specht & Sanyé-Mengual, 2017).

The environmental impacts are discussed in literature, pointing out that the production is not inherently sustainable (Specht et al., 2014). Especially indoor systems are criticized due to their energy dependency and high consumption (Gómez et al., 2019; Graamans et al., 2018; Saad et al., 2021). CEA indoor systems are dependent on the city's energy grid, while waive natural light as energy source (Al-Kodmany, 2018; Benis et al., 2018). The artificial light is energy consuming and produces unwanted heat (Gómez et al., 2019; Goodman & Minner, 2019; Saad et al., 2021). Another concern arises from the water quality of the run off, because nutrient leaching could endanger ecosystems downstream. The water quality of extensive green roofs is less problematic (Grard et al., 2020; Whittinghill & Rowe, 2012). Furthermore, two studies argue that compared to conventional greenhouses, those on roof tops ca not keep up with the yields per square meter; thus they are considered less efficient (Grard et al., 2020; Sanyé-Mengual et al., 2015).

Opportunities

For the business model "focusing" some opportunities arise from changing social values and demands. Regionality is identified as a product quality which is appreciated by costumers (Benis et al., 2018; Grard et al., 2020; Sanyé-Mengual et al., 2015; Specht et al., 2014). Moreover, growing concerns about health and the environment lead to an increased willingness to pay premium prices for the absence of pesticides. Therefore, food safety and freshness become strong selling points (Benis et al., 2018; Cerón-Palma et al., 2012; Graamans et al., 2018). A growing consumer awareness and the wish for transparency pave the way for the integration of knowledge transfer in the education systems. For this reason, hands-on food production gained in importance (Specht et al., 2014).

Food is an expression of lifestyle and a mean to create sociability. Furthermore, it is perceived as a starting point for reconnection with nature (Cerón-Palma et al., 2012; Morel et al., 2017; Specht et al., 2015). Especially young consumers are interested in food production and agriculture in general, as well as associated job opportunities (Morel et al., 2017; Saporito, 2017).

These societal aspects have an economic relevance. Building up business relations with local restaurants and shops and acting on local markets can be a beneficiary strategy to set up premium

prices (Milestad et al., 2020). Considering some of the advantages of vertical farming (freshness and no pesticides), it is reasonable to sell it in a comparable price category to organic food (Shao et al., 2016). The demand for fresh urban food may foster the availability and lead to an expansion of the green roof industry associated with job creation and positives effects on urban economies. While innovative projects can attract investors, there is also the option of financial aid for new products and systems (Cerón-Palma et al., 2012). Further financial supporting measure can derive from cooperation with social services, which can be a source of comparably cheap labour. Also, governmental support in shape of land rent discounts, subsidies or political changes could be worthful to reduce costs and foster pioneering projects (Chang & Morel, 2018; Shao et al., 2016; Whittinghill & Rowe, 2012). The increasing media interest can devote political and societal attention to urban agriculture (Benis et al., 2018).

The re-valuation of unproductive spaces within the city (e.g., rooftops) provides capabilities to take root even in densely populated urban areas and to build up regional food value chains (Al-Kodmany, 2018; Benis et al., 2018; Cerón-Palma et al., 2012; Saporito, 2017; Specht et al., 2015). Resource efficiency is one of the leading arguments for CEA. The access to land is especially limited for urban agriculture. Therefore, productivity plays a key role to optimize the utilization of scarce sources. As a consequence, the pressure on productive fertile agricultural land should decrease, while offering an opportunity to grow more food for a developing world population, without the need for more farmland (James & Friel, 2015; Saad et al., 2021; Specht et al., 2015). Moreover, urban agriculture could help to make resource and energy flows more circular. It offers potentials to reuse grey water and rainwater, to fix carbon, reduce the energy demand in the buildings, and improve the microclimate. Further connecting factors can result from reduced transportation route and recycling aspects (Cerón-Palma et al., 2012; Grard et al., 2020; Sanyé-Mengual et al., 2015; Specht et al., 2015). The increasing body of knowledge and the raise in sustainability assessment, for different types of BIA, will bring the climate architecture forward and help to minimize negative environmental effects like energy demand. A possible boost in yields could meet the trend of self-sufficiency in cities (Cerón-Palma et al., 2012; Montero et al., 2017; Saad et al., 2021; Sanyé-Mengual et al., 2015).

Threats

At present, this business model – especially when it comes to BIA – does not ensure that a sufficient amount of food is produced to meet the needs. The price ranges are not affordable for most people and represents therefore a small niche market (Chang & Morel, 2018; Graamans et al., 2018). The concerns of the consumers, who perceive the soilless growing media as unnatural, could lead to a rejection (Benis et al., 2018; Specht & Sanyé-Mengual, 2017).

There is a need to train and qualify personnel as labour availability is named as a challenge for enterprises (Cerón-Palma et al., 2012). During the initial phase there are several uncertainties and problems to overcome. Technical threats are caused by the high complexity, especially when adapting to an already existing building. The prevention of a building overloading results into the need to strengthen the structure (Cerón-Palma et al., 2012). Building designs can pose logistical difficulties in operating RUA and lead to problems with roof access (Zambrano-Prado et al., 2021). Despite several existing cases, vertical farming is still in an early stage and needs further practice and research (Saad et al., 2021).

The novelty of the business makes it a risk investment for banks and investors, aggravating the access to capital (Cerón-Palma et al., 2012; Chang & Morel, 2018). In this context, reliable investment calculations need long-term land use agreements, a detailed listing of start-up costs, followed by expected operation costs and revenues. Those data are difficult to provide due to the small amount of case examples (Chang & Morel, 2018; Shao et al., 2016).

Economic challenges during the operation phase emerge form high costs of supporting infrastructure, management and narrow profit margins for horticulture products. The high initial investment costs lead to long-term repayments. The expected increase in costs for energy and renewable resources may put pressure on the liquidity. In particular, energy costs are already a major cost block for these enterprises (Cerón-Palma et al., 2012; Saad et al., 2021; Zambrano-Prado et al., 2021). Another threat emerges from competitive pressure. Smaller enterprises run into danger to be overtaken by lager ones (Specht & Sanyé-Mengual, 2017).

Possible hindrances can also be political and governmental limitations. Legal requirements for buildings and the zoning code imposes limitations with regard to height or area of the rooftop (Sanyé-Mengual et al., 2015; Zambrano-Prado et al., 2021). The multifunctionality of the business activity with regard to collective utility is not recognized by urbanistic planning but reduced to a commercial activity (Saporito, 2017). Additionally, identifying specific policies that can support or hinder a business are difficult to detect (Zambrano-Prado et al., 2021).

The scarcity of suitable places – this concerns both rooftops and peri-urban farmland – is named as one of the main hindrances. Land in a suitable quality, which is usable for food production is very rare. Many of the existing buildings do not allow an integration within the rooftop, without strengthening the building construction, inducing high costs. Moreover, it is expected that place and area cost will rise in the following years (Saad et al., 2021; Specht et al., 2014, 2015).

The environmental impacts of this business model contain the competition with solar panels for suitable roof spaces and the environmental impact of the greenhouse construction materials (Cerón-Palma et al., 2012; Specht & Sanyé-Mengual, 2017). Different concerns arise from the high energy demand of lighting for indoor farming systems on the one hand and the higher benefits of outdoor urban agriculture activities, with regard to ecological impacts, on the other hand (Milestad et al., 2020; Specht et al., 2015). Nevertheless, urban air and water pollution may be challenging for food production (Grard et al., 2020; Saad et al., 2021).

Strategies from the SWOT analysis

Some of the strengths described have the potential to exploit existing opportunities or overcome possible barriers. The rising health concerns among society for food related risks due to the use of pesticides can serve as starting point to gain more acceptance for soilless growing medias. This could be combined with the increasing demand for educational offers in the field of food production.

Even though high-tech innovations need an acceptance within the general public, especially younger people seem to be an adequate target group with regard to the purchase of the products but also for possible job opportunities. In this way wooing young people can be a sales concept but also a mean against skills shortage. This target group can be very appealing for those companies due to their perception of food as part of their lifestyle. Nevertheless, groups of costumers, who appreciate regional production, are in general an interesting target group. Due to the premium price segment, there is a risk that restricting the marketing concept too much will not guarantee a sufficient group of buyers.

Another pitfall can result from the negative environmental effects, such as the high demand for electricity, which can overcompensate good sales arguments, such as short transport distances. The increasing awareness of environmental concerns could turn this very weakness of CEA systems into a snare. Correspondingly, further research must be done on energy intensity.

Sharing

Strengths

The business model „sharing" includes a stronger connection between costumers and producers. It is aiming for a long-term relationship by providing benefits for both parties. This relationship includes social ties as well as a bond of trust (Anderson et al., 2019; Bakos & Khademi-Vidraa, 2019; Borčić, 2020; De Bernardi et al., 2020; Jarosz, 2008; Kortright & Wakefield, 2011; Matacena & Corvo, 2020). The regionality of this business model shortens not only transport distances but also the value chains itself (Jarosz, 2008; Mazzocchi et al., 2020). Moreover, the value of the offered products does not only derive from the physical product but also includes a co-creation of value for the whole community (Morrow, 2019; Rolf et al., 2019; Sroka et al., 2019). Civic engagement within the production activities provides a sense of belonging (Spijker & Parra, 2018; van der Jagt et al., 2017). In literature, positive effects of the social interaction (Spijker & Parra, 2018) are described due to the stronger connection with local residents (Petrescu et al., 2021) and the provision of spaces where skills, knowledge, labour, and creativity are shared (Petrescu et al., 2021; Ulug & Horlings, 2019). The collaborative production encourages the creation of social relations and networking (Ulug & Horlings, 2019), which can lead to reinforcement of social embeddedness (De Bernardi et al., 2020; Rolf et al., 2019) and empowerment of citizens (Bonow & Normark, 2018).

The traditional separation into producers and consumers is substantially reduced, thus enabling better-tailored production strategies, which contribute to food sovereignty (Morrow, 2019; Thomé et al., 2021) and more social resilience (van der Jagt et al., 2017). Moreover, the business model takes social and environmental concerns into consideration, but also provides a business opportunity for small local farmers (Jarosz, 2008). This way of production improves the knowledge about how and where food is grown and promote the appreciation of local food as well as sustainable and traditional growing practices (Matacena & Corvo, 2020) and therefore improving the willingness to pay for these product qualities (Mazzocchi et al., 2020). As a consequence, the financial responsibility for the business lies not only with the farmer but also among the community (Branco et al., 2011). Therefore, this business model often comes along with higher CEROI - community economic return on investment (Petrescu et al., 2021).

With a focus on the consumers, Alternative Food Networks (AFN) offer plenty of positive effects. They provide the access to fresh, healthy and locally grown food of high product quality (Bakos & Khademi-Vidraa, 2019; Bonow & Normark, 2018; Branco et al., 2011; Cretella, 2019; Kortright & Wakefield, 2011; Matacena & Corvo, 2020; Poças Ribeiro et al., 2021; Prost, 2019; Rosol & Barbosa, 2021). The products are seasonal and should guarantee fair "prices" that support local farmers and producers (Borčić, 2020; Cretella, 2019). Additionally, the production is characterized by more transparency and a stronger influence of the consumers on different steps of the food chain (Cretella, 2019; Mazzocchi et al., 2020). Against this background the reconnection with land and nature is an argument for to the increasing awareness of environmental issues (Rosol & Barbosa, 2021; Shao et al., 2016). However, it also refers to health related considerations like nutrition, food security and physical and mental wellbeing (Biewener, 2016; Bonow & Normark, 2018; Burgin, 2018; Senes et al., 2016). Moreover, the business model offers a foundation for food related education, community development and cohesion, as well as political and personal empowerment (Borčić, 2020; Maughan et al., 2018).

With regard to the farmers, the business model "sharing" offers a possibility to get access to alternative funding options and support from the local community and reduces their dependence of the prices from volatile global markets. The production is manly committed to ecological farming principles, but not necessarily certified (Branco et al., 2011; Rosol & Barbosa, 2021). The farmers can plan their production according to the immediate demand of the members (Rosol & Barbosa, 2021). They do not

face classic risks like low yields, which effect their revenues (e.g., CSA, self-harvesting plots, and other AFN). They benefit from quick payments, greater autonomy, fair prices and a greater social esteem of their work (Borčić, 2020). Through bypassing the middleman in the distribution chain, the producers can keep a greater share of the profit gained (Jarosz, 2008; Rosol & Barbosa, 2021), which enhances the economic viability of the farms (Davies & Legg, 2018).

Farmers are often supported by volunteers, who experience satisfaction due to their involvement in an activity that generates an "use-value". Most of the time, the unpaid work is non-exploitative meaning voluntary based and non-capitalistic (Biewener, 2016; Petrescu et al., 2021). Nevertheless, the business model can also lead to the generation of jobs and increase income (Delgado, 2017). At least, it offers opportunities of traineeship and wide-range knowledge transfer and education (Biewener, 2016; Petrescu et al., 2021; Ulug & Horlings, 2019). The integration of the consumer in the production serves also ecological purposes, as it improves energy and resource efficiency, due to benefits like less packaging and shorter transportation (Bakos & Khademi-Vidraa, 2019). The regional focus of the business supports regional economy competitiveness (Doernberg et al., 2016). Moreover, the business model leaves scope for design and can be adapted to the ideas of the participants (Haedicke, 2018).

Weaknesses

The functionality of this business model is very much dependent of engagement of the parties involved. Therefore, the term "tragedy of the commons "describes one of the biggest weaknesses of the sharing business model**.** Lethargy and disorganisation can lead to failure. In social sciences, this phenomenon is subsumed under the term free rider problem (De Bernardi et al., 2020). It refers to the inefficient and often not sustainable use of goods. In case of this business model, it is difficult to motivate locals to participate in the production and make them stick to the activity on a regular basis (Kato, 2013; Morrow, 2019). Especially when work happens on a voluntary basis, the success highly depends on the source of motivation and the question whether it will last (Follmann & Viehoff, 2015; Spijker & Parra, 2018). Therefore, UA has the potential to cause tensions between stakeholders' various perspectives (Bonow & Normark, 2018).

With regard to regional food supply, it should be mentioned, that AFN act as complex organizational systems, which is hard to scale up (Morrow, 2019). Therefore, it is difficult to fulfil local demand (Bakos & Khademi-Vidraa, 2019). Moreover, the commercial viability is at risk due to several reasons (Biewener, 2016). On the one hand the access to sufficient amounts of capital to cover the production costs is not guaranteed (Bakos & Khademi-Vidraa, 2019; Branco et al., 2011). The dependency of external funding to ensure the initial capital for production make the situation risky for farmers (Biewener, 2016; Branco et al., 2011; Laidlaw & Magee, 2014). Therefore, the business model is often restricted to small farms, in terms of size and revenues (Jarosz, 2008).

The key resource labour also provides reason for business failures. All in all, the high workload of the business model sharing competes with other farm activities and is often done by a core group (Follmann & Viehoff, 2015; Kortright & Wakefield, 2011; Rolf et al., 2019). Much of the work is done by unpaid volunteers and rarely offers the possibility of paid employment because of limited financial resource (Biewener, 2016). A combination of paid and unpaid workers is also problematic, as it can lead to tensions among the workforces (Follmann & Viehoff, 2015). Nevertheless, there is also a need for experts who, on a voluntary basis, instruct unskilled staff (Laidlaw & Magee, 2014). Due to the missing knowledge of the contributing members with regard agricultural and gardening skills the production needs somebody for supervising (Palau-Salvador et al., 2019). Not only the contributors need support, but also farmers also need training. In terms of production technology, they are familiar with their business, but entrepreneurial skills and knowledge in terms of managing communication

processes are not part of their original tasks. These skills are essential when it comes to coordinating processes such as the cultivation plan or coordination (Bakos & Khademi-Vidraa, 2019; Bonow & Normark, 2018; Kortright & Wakefield, 2011; Rolf et al., 2019).

Against this background, joint production planning is not always easy (Branco et al., 2011). Especially in the early stage of, for example a food hub, possible discomfort can occur due to a lack of product availability or technical issues (Prost, 2019). These problems can arise from difficulties in managing the production (Branco et al., 2011) or challenging natural framework conditions (soil, sunlight, water…) (Burgin, 2018). Issues can also emerge form a lack of processing units (Doernberg et al., 2016) and fewer investments in technology and marketing (Bakos & Khademi-Vidraa, 2019).

The design of the agreement between farmers on the one hand and members on the other hand is also fraught with challenges. Uncertainty about the duration of members' commitments (Bonow & Normark, 2018) leads to discontinuous actions and makes long-term business planning difficult (Spijker & Parra, 2018).

For city residents, who are buyers and participants, there are several issues related to the business model. For urban dwellers there is possibly only a little attractiveness due to high prices (Jarosz, 2008). These prices can become a barrier for people with small incomes (Jarosz, 2008; Kato, 2013; Prost, 2019; Ulug & Horlings, 2019). The participation in business models that rely on collective approaches and unpaid work are difficult for low-income households (Rosol & Barbosa, 2021). Moreover, in many sharing types, consumers need to provide a considerable amount of money upfront (Rosol & Barbosa, 2021) to finance the production.

With regard to an economic point of view the voluntary based membership makes turnover difficult to predict and discontinuous (Borčić, 2020). Moreover, a lot of experience has to be made to develop profitable facilities (Laidlaw & Magee, 2014). Additionally, standard cost benefit calculations do not take into account community economic value, failing to capture the real value of an urban common project (Petrescu et al., 2021).

The political support is low, as food does not seem to be priority for municipalities (Cretella, 2019). Municipal involvement (e.g., urban farming/gardening as a nature-based solution) is failing on municipal budget pressures, silo mentality, and environmental justice concerns (van der Jagt et al., 2017).

Opportunities

The analysed papers emphasized that the business model "sharing" has the potential to foster the local production of high quality and low environmental impact food products (Branco et al., 2011; Rosol & Barbosa, 2021) due to the use of place-based practices (Ulug & Horlings, 2019). According to literature some environmental benefits derive from this business model. It should enable urban sustainability transition (Davies & Legg, 2018) due to reducing food transportation and improving the use of energy and natural resources (Bonow & Normark, 2018). It offers the potential to strengthen agrobiodiversity in the urban area (Rolf et al., 2019) due to urban green spaces that provide ecosystem services (Anderson et al., 2019).

Economically, the close cooperation between farmers and consumers serves as a mean of risk reduction (Rosol & Barbosa, 2021), which enhances the income of the farmer (Jarosz, 2008) and provides higher financial security due to better prices (Rosol & Barbosa, 2021). The business model is based on a hybrid financing structure, consisting of revenue and donations (Doernberg et al., 2016). Moreover, it is in many cases relying on voluntary unpaid job (Biewener, 2016). In return, participants benefit from the sharing of resources and the acquisition of knowledge (Anderson et al., 2019). A

combination between the business model “sharing” and “deepening” is possible with regard to vertical integration, value-added production and direct marketing (Jarosz, 2008). The growing adoption of ICT can facilitate the process of digitalization of food commons (Morrow, 2019) and expand their outreach (Davies & Legg, 2018).

The business model can boost local economy (Branco et al., 2011) and support the development of communities (Bakos & Khademi-Vidraa, 2019). The building of social capital and the transparency positively influence the performance of AFNs (De Bernardi et al., 2020). As a result, “sharing” can lead to an incremental involvement of new forms of value within the capitalistic paradigm (Matacena & Corvo, 2020) while offering an alternative way of food production, which proposes a productive and co-created food approach (Delgado, 2017). Nevertheless, the coexisting local and global food markets can mutually reinforce one another (Mazzocchi et al., 2020).

Interactions between the business model and society are manifold. Three aspects in particular can be derived from the literature. first, the approach raises awareness on food issues such as regionality (Cretella, 2019; Matacena & Corvo, 2020). Second, it supports the formation of networks and encourages community building and engagement (Biewener, 2016; Branco et al., 2011; Jarosz, 2008; Morrow, 2019; Prost, 2019; Rosol & Barbosa, 2021). Furthermore, it offers approaches to optimize food safety but also the physical and mental health of the participants (Davies & Legg, 2018; Prost, 2019). These arguments can serve as a catalyst, which has the potential to increasing numbers of food organizations (coops) competing with conventional channels (Matacena & Corvo, 2020; Poças Ribeiro et al., 2021).

The transfer of skills and knowledge is relevant in this context in several respects. Not only do the participants (producers and members) acquire knowledge, they also stimulate social discussion about food issues (Borčić, 2020; Jarosz, 2008). Community supported food systems receive growing attention by policymakers and citizens (van der Jagt et al., 2017) and increasingly show up on neoliberal agendas of public and private actors (Follmann & Viehoff, 2015). The rising support and formal recognition by municipalities (van der Jagt et al., 2017) leads to growing influence with regard to the governance of urban green spaces and green policies (Spijker & Parra, 2018). Increasing recognition could also set in motion political processes that encourage the development and subsidization of AFNs (Mazzocchi et al., 2020; Palau-Salvador et al., 2019; Poças Ribeiro et al., 2021).

Threats

A number of risks are named in the papers, that have a negative impact on the prospects of success of the business model “sharing". Safety concerns emerge form possible contamination with lead and other heavy metals in garden soils (Kortright & Wakefield, 2011) caused by the city environment and local traffic (Senes et al., 2016). Furthermore, due to its collaborative nature, the business model has a high demand for communication and networking. If communication is not successful or if no sustainable network structure can be established between the relevant stakeholders, problems arise for the company (Delgado, 2017). Broad, rather generic objectives and no clear leadership can also endanger the business (Cretella, 2019).

An important constraint may arise from land as a production factor. Access to land is limited and, at the same time, renting prices are rising (Bakos & Khademi-Vidraa, 2019; Palau-Salvador et al., 2019; van der Jagt et al., 2017). Political processes such as urban growth and low support for (organic) farming further complicate the situation (Burgin, 2018; Doernberg et al., 2016).

The demand side can also pose a challenge (Poças Ribeiro et al., 2021). The lack of knowledge regarding AFNs and other sharing models can hinder the business as well as a limited demand (Bakos & Khademi-Vidraa, 2019; Poças Ribeiro et al., 2021). The diverse and changing wishes of consumers must be taken

into account, with the intention of achieving longer-term customer loyalty (Borčić, 2020; Branco et al., 2011). While product characteristics such as sustainability are viewed positively, they are also associated with high prices (Prost, 2019). Nevertheless, the risks exist, that costs can turn out to be higher than revenues (Kato, 2013). Especially costs of labour time and fuel, which are necessary for the success of direct marketing, can erode farm income (Jarosz, 2008). Depending on the sharing model, in some forms consumers face less financial obligations compared with CSA members giving pre-paid shares, meaning less mid- and long-term security for farmers (Rosol & Barbosa, 2021).

With regard to society, imponderability can emerge. The reproduction of the charity model of financing may cause social inequalities (Biewener, 2016) and foster gentrification (Follmann & Viehoff, 2015; Ulug & Horlings, 2019). The changing work environment leads to longer working hours, multiple jobs and female participation in workforce. As a consequence, the time and abilities for voluntary work decreases (Burgin, 2018).

Strategies

An important strategy that can be key to the business model's success is the ability to engage consumers and retain them as members over the long term. For this, entrepreneurs need special skills that go beyond agricultural production. It is advisable to attend targeted training courses in the areas of communication, marketing and business management. The skills acquired can help educate consumers about common production systems and recruit members. Higher production costs must be offset by additional value propositions to still attract price-sensitive consumers. Engagement with the public sector, such as social service organizations, promises to raise awareness of nutrition issues but also improving the access to low-cost labour. In addition, viable networks and options for longer-term supply contracts can emerge.

This approach is especially helpful because the business model relies on volunteers to a significant degree. Apart from offering a knowledge gain and new skills in the field of horticulture, there are only limited job opportunities, that include an income generation. This problem makes the business model insecure for farmers, due to the lack of binding nature of the labour relations. As a consequence, they can save money for wages but have problems to plan work capacities properly. The changed labour market and role distributions in society are reasons why often both partner work. Working hours do not leave much room for unpaid work. Especially not if the households have small incomes, which need to be supplemented with side jobs. As a result, this kind of participatory production cannot attract all kind of households. However, increases in life expectancy and improvements in health care are causing a large number of healthy retired persons, looking for a joint and meaningful occupation. Therefore, the targeting of pensioners is a possible strategy to gain committed workforces.

Policy support can help making the business model more accessible to all. This can be done by subsidizing environmentally friendly or social production methods. However, there is also the option to support social tasks of society such as integration into the labour market, support of disadvantaged neighbourhoods through programs and to combine them with food production.

Nevertheless, the possible danger of pollution due to traffic and heavy metal contaminations in the soils should be taken into account and tested before building up businesses. Only in this way the selling points of healthy and regionally grown food meets reality.

Deepening

Strengths

The business model "deepening" offers a strategy for the empowerment of small and medium sized farms (Leglise & Smolski, 2017). The regional marketing focus serves on the one hand the local economy and on the other hand provides a competitive advantage (Drottberger et al., 2021; Nelligan et al., 2016). In literature "deepening" is described as an entrepreneurial option (Drottberger et al., 2021), which is based on the economy of proximity, resulting in social and economic benefits (Leglise & Smolski, 2017) with the potential to increasing farm revenues and diversifying farm operations (Brekken et al., 2017; Elghannam & Mesias, 2019). Short Food Supply Chains help producers to retain a greater share of sales revenue (Rosol & Barbosa, 2021) by cutting out intermediaries (Charatsari et al., 2020). The increasing profits (Rucabado-Palomar & Cuéllar-Padilla, 2020) improve the financial resilience (Mundler & Jean-Gagnon, 2020) and the market stability (Dimitri et al., 2019) of the business. The farmers employ different types of sales channels (farm sales, box schemes, internet sales, direct sales), but also hybrid systems of short and other food chains are frequent in peri-urban areas (Nakandala & Lau, 2019; Ochoa et al., 2020).

In literature, plenty of success factors for this business model are named. The term proximity is a key word and, in this case, equivocal. Meaning short value chains, and short distances between the consumers and the point of sale but also an emotional proximity between the producer and the consumers. The direct connection and interaction enable customer loyalty and a more tailored production aiming for a high level of trust and reciprocity (Aguiar et al., 2018; Brekken et al., 2017; Clark et al., 2021; Delicato et al., 2019; Dunay et al., 2018; Elghannam et al., 2017; Elghannam & Mesias, 2019; Nakandala et al., 2020; Nakandala & Lau, 2019; Nelligan et al., 2016; Rivera et al., 2020; Ross, 2006; Rucabado-Palomar & Cuéllar-Padilla, 2020; Sellitto et al., 2018; Wittman et al., 2012).

In return, buyers expect high quality (Ross, 2006; Rucabado-Palomar & Cuéllar-Padilla, 2020), food safety, traceability (Sellitto et al., 2018), and transparency (Dimitri & Gardner, 2019). The offer needs to contain local fresh food (Yacamán Ochoa et al., 2019) and can arouse interest due to speciality foods (Feenstra & Hardesty, 2016). The producer needs to find and communicate a unique selling point. This can be an environmentally friendly production (Drottberger et al., 2021; Rucabado-Palomar & Cuéllar-Padilla, 2020; Sellitto et al., 2018) or the promotion and recovery of food related cultural identity (Leglise & Smolski, 2017). For this purpose, the farms can employ territorial brands and put emphasis on the origin identification of their products (Sellitto et al., 2018). Additionally, artisanal production methods are appreciated by consumers (Rucabado-Palomar & Cuéllar-Padilla, 2020) and perceived as natural, local, healthy and reliable (Aguiar et al., 2018). Moreover, farmers need to be flexible and able to adapt to changing demands and framework conditions to remain successful (Nakandala & Lau, 2019; Ross, 2006). Adaptations and business developments can be conducted more easily, when acting within a strong network or in cooperation with other local actors (Charatsari et al., 2020; Rucabado-Palomar & Cuéllar-Padilla, 2020; Sellitto et al., 2018).

Networks can serve as anchors in society and help to foster social interactions, community-building, civic engagement and social well-being (Buman et al., 2015).

Weaknesses

One of the greatest problems for CRFSi, which intend to take advantage of this business model, arise from the cost of the production. In comparison with conventional food production, they will face rising cost in terms of necessary infrastructure, labour and marketing costs (Mundler & Jean-Gagnon, 2020; Rosol & Barbosa, 2021; Rucabado-Palomar & Cuéllar-Padilla, 2020; Yacamán Ochoa et al., 2019). Nevertheless, qualified workers are scarce (Ochoa et al., 2020) and the working conditions suboptimal,

especially with regard to wages and holidays (Dunay et al., 2018). Farms and initiatives, which employ non-family members as workers, often can pay barely above minimum wage (Ross, 2006).

Business development is also hindered by a lack of multi-tasking competences regarding the manifold fields of businesses (production, processing, marketing, sale …) (Mundler & Jean-Gagnon, 2020). The performance of newcomers gets limited by their skills in agriculture, while for many entrepreneurs necessary knowledge regarding business management pose an obstacle (Delicato et al., 2019; Dimitri & Gardner, 2019; Drottberger et al., 2021). At the same time, low investments and access to land limit business growth due to the small size of family farms (Aggestam et al., 2017; Rucabado-Palomar & Cuéllar-Padilla, 2020).

For family farms stepping into this business model can be risky, because of a lack of longer lasting binding contracts. Sometimes, local food systems are considered fragile and even unreliable for producers (Wittman et al., 2012). For this reason, the short shelf life of the products can turn into a pitfall (Nakandala & Lau, 2019). According to literature, hybrid-selling strategies do not turn out to be suitable (Mundler & Jean-Gagnon, 2020) and online sales do not fit to the idea of "proximity" because of the missing direct contact and the chance to judge the quality prior purchasing (Elghannam et al., 2017).

In general, consumers are very price sensitive (Dimitri & Gardner, 2019; Leglise & Smolski, 2017; Ochoa et al., 2020) and not always willing to pay the just price for local foods (Dimitri & Gardner, 2019). Even though the price of hand-crafted food is usually high (Ross, 2006) it often needs to compete with retailer prices (Elghannam & Mesias, 2019). Nevertheless, not only the willingness to pay limits the number of sales, but also the ability to afford higher prices (Warsaw et al., 2021).

Moreover, the capacity to support social, economic, and environmental goals are limited by the location of the CRFSi (Wittman et al., 2012). The necessary infrastructure is another issue. On the one hand, information is needed about the local offer to encourage consumers (Delicato et al., 2019). On the other hand, the access to distribution channels and the logistics are often limited for small producers (Ochoa et al., 2020). Therefore, more organization and coordinated aggregation or distribution of local products to the market is needed (Nelligan et al., 2016). Overall, the scalability of the business model is considered limited (Rosol & Barbosa, 2021).

Opportunities

The general prospects for the market with locally produced food are good. Overall, many predictions suggest the food sector will continue to grow until at least 2100 (Delicato et al., 2019). Especially metropolitan areas have a huge potential as sales market (Ochoa et al., 2020). Therefore, the proximity to cities is considered to be a competitive advantage (Mundler & Jean-Gagnon, 2020). Moreover, there is a continued increase in wealth, leading to shifting preferences in our diets (Delicato et al., 2019) and a growing demand for local food (Dimitri & Gardner, 2019; Rosol & Barbosa, 2021). At the same time, consumers become interested to engage within local food systems, this could offer options for value-added processing (Brekken et al., 2017). The evolving support for a local food economy, has the potential to scale up small to midsized farms, enhance the emerging market and contribute to a regional economy (Aguiar et al., 2018; Gruchmann et al., 2019; Nelligan et al., 2016). Additionally, literature names further opportunities arising for this business model with regard to the (re)connecting of urban and rural regions (Kurtsal et al., 2020) as well as the creation of new jobs (Warsaw et al., 2021). For the farms, which are intending to step into this business model, it is worth to check whether they can receive capital investment support (e.g., through local food public funds) (Mastronardi et al., 2015; Nelligan et al., 2016).

With regard to food quality this development could be beneficiary for the consumers, because of a strong correlation between direct sales and desirable food qualities. Organic practices play a huge role in this context, even though the products are oftentimes not certified. For animal husbandry selling arguments like free range as well as antibiotic- and hormone-free production are used (Brekken et al., 2017) as quality criteria. These product qualities are often visualized in the form of labels (Ochoa et al., 2020; Rosol & Barbosa, 2021).

Due to the fact that the business model is aiming for partnerships (Dimitri & Gardner, 2019) and local community promotion (Warsaw et al., 2021) and cooperations (Feenstra & Hardesty, 2016) it has the side effect to strengthen social cohesion (Leglise & Smolski, 2017). In addition, the topic of nutrition is increasingly coming into focus, expanding the knowledge about sustainable consumptions (Leglise & Smolski, 2017) and leading to peer-to-peer learning – also through social media (Drottberger et al., 2021).

Threats

Entering the market for regionally produced food is associated with a variety of difficulties and challenges for farms. On the one hand small farms occupy a relatively marginal place next to agro-industrial agriculture (Rivera et al., 2020). On the other hand, the food sector is dominated by grocery chains (Nelligan et al., 2016).

Moreover, the local food infrastructure (Nelligan et al., 2016) is often marginal and not offering suitable market supply-chain partners. In this context building up new networks and partnerships is difficult and cost intensive. Moreover, there is no one size fits all ideal marketing channel, meaning that the marketing concepts needs to be individualized and adapted to the region and costumers (Brekken et al., 2017). Additionally, the workload for farmers is quite high, and the productivity of small farms is often lower than that of specialized, larger farms (Mundler & Jean-Gagnon, 2020). Generally, climate change and weather events threaten the harvest and thus their livelihood (Zimmerman et al., 2018).

Currently, the market share of this business model is small (Nelligan et al., 2016) and the development is dependent on consumers' interest to buy locally (Yacamán Ochoa et al., 2019). In literature especially the interest of the costumers is called into question (James, 2016). Moreover, the consumer food choices are described as constantly changing (Delicato et al., 2019) and not very reliable. Furthermore, the higher prices of the products lead to gentrification concerns (Warsaw et al., 2021).

Another problem arises from the low level of political support. There are few concrete policies at the regional level (cities and metropolitan regions) (Drottberger et al., 2021; James, 2016). At the same time, support policies in agriculture are based on farm size and thus promote specialization and growth processes, as well as the crowding out of small and medium-sized enterprises. Integration into regional food systems or diversification are only partly the subject of support (James, 2016; Ochoa et al., 2020).

Another challenge is seen in the lack of access to research-based knowledge. Lacking consulting services that offer business support (Drottberger et al., 2021) and help farmers to acquire new skills are seen as an obstacle to productivity (Mundler & Jean-Gagnon, 2020).

Strategies

For small and medium-sized enterprises, the business model "deepening" can be a chance to make a living. However, the decision in favour of the business model is associated with many uncertainties that represent risks for the companies.

Current EU funding policy assesses grants based on farm size. Investments in the processing of self-produced food or in marketing and sales channels are cost-intensive, but do in many cases not lead to an increased subsidy volume. Accordingly, the costs are reflected in the prices, which can lead to lower acceptance among consumers and gentrification effects. For this reason, one of the most important compensation strategies for farmers is to build a strong network and acquire alternative funding.

The potential for regional foods can be exploited primarily through customer proximity, product quality and unique selling points in conjunction with good and convincing marketing approaches.

In addition, risks such as droughts and extreme weather events should be cushioned by insurance. Risk management is gaining ground and other entrepreneurial skills are becoming more important. Therefore, it can be useful for farmers to deepen their knowledge due to trainings.

Broadening

Due to the very limited number of references belonging to the broadening business model, the SWOT analysis synthesis focuses on the three remaining business models sharing, deepening, and focusing (see above). While the broadening business model goes beyond food production by adding non-food related diversification measures, the structured PRISMA method detecting literature focused specifically on food; following the main FoodE project objectives.

5 Conclusions

Following an introductory part on business models in general as well as well-known tools to synthesis and visualize business models, e.g. Business Model Canvas, this report on CRFSi business models is based on the structured literature review (PRISMA method) and the FoodE pilots as case studies.

The selected 218 papers from the PRISMA method were suitable to

a) describe main types of CRFSi, peri-urban agriculture, short supply food chains, Alternative Food Networks, on-farm diversification, and building-integrated food production,
b) propose a classification of CRFSi business models, and
c) conduct SWOT analyses for the proposed business models.

Four CRFSi business models are proposed – focusing, deepening, broadening, and sharing. The business model "focusing" concentrates on one or very few activities, e.g., one specific food product. In urban and peri-urban settings, focusing CRFSi are concentrating on niches for creating a unique selling proposition, especially controlled environment agriculture (vertical farming, indoor farming). The "deepening" business model adds activities beyond food production into the (business) portfolio, like processing and direct sale. The business model "broadening" diversifies activities in production (product broadening) and/or into non-production activities and services (non-product broadening, non-agricultural diversification). The "sharing" business model is community-based with a strong civic empowerment, like Community Supported Agriculture. The conducted SWOT analyses allow wider insights into the strengths, weaknesses, opportunities, and threats of the business models. This is not only interesting from a research perspective, but likewise for CRFS initiatives, businesses, and start-ups to position, adjust, and compare the own activities with regard to the state-of-play in this field. The SWOT analyses allow finding suitable and promising business models for CRFSi developments (expansions, adding activities) as well as for completely new entrants in CRFS. Furthermore, the FoodE pilots can be used for inspiration and practical and applied case studies and good practices of CRFSi business models.

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Appendix

Attachment 1: Sustainable BM of Cité Maraîchère

Cité Maraichère de Romainville, a French pilot of the FoodE project, is an urban vertical farm. Romainville, which is a city in very close proximity to Paris, is composed of about 30,000 habitants. Since the end of the last century the policy of this city is oriented to develop new tech industry as biotechnology or service company. In face of today's societal goals, the mayors promote social and environmental economic policies to protect vulnerable people and to develop food security.

Cité Maraichère is a vertical farm built by the city authority. Its goals are producing safe, local, and sustainable food for vulnerable people, and teach seasonality, sustainable agricultural practices, reduction and recycling of waste on 3rd to 6th floor. The areas of production represent 350 m^2 for vegetables, 100 m^2 for mushrooms, 30 m^2 endives, and 170 m^2 of outdoor farming. Technical local (storage, warming, etc) represent about 200 m^2 and another 100m^2 for the office. The food production is realized in bags with solid substrate and natural light. The restaurant occupies 200m^2 and 200 m^2 for social or teaching events. The total cost of construction is about 9 million €. The total annual costs are about equal the annual revenue streams; see below.

Total Annual Cost - ~500 000 €		
Salaries of employees	155 000	31%
Salaries of insertion employees	220 000	44%
Energy, water	30 000	6%
Supplies	45 000	9%
Maintenance	50 000	10%

Annual Revenue Streams- ~500 000 €		
Sales	55 000	11%
Insertion Grants	220 000	44%
Valorization of services by the city	175 000	35%
Grants	50 000	10%

Cité Maraichère is managed by the city hall services, and realizes six economic activities: production and sales food, educational activities for children and adults, restauration, job integration, research and test new sustainable practices as well as renting the location for sustainable events.

In the following, the triple layer Business Model Canvas is summarized (see also the Figures in the main text). Here it is detailed for the six business pillars production of food, teaching and events, renting, restaurant, insertion jobs, and research and testing.

ECONOMIC CANVAS of the key activities

Economic CANVAS of the 1st activity Production of food

Key activity 16 tons of vegetables are produced: tomatoes, pepper, basil, cabbage, kale, turnip, radish, beets, carrots, leeks, zucchinis, eggplant, pumpkin, aromatics herbs.

Key resources. The employees of the Cité Maraichère have different skills in agronomy, greenhouse technology. The support services of the administration realize the back office in financial support, law, etc. Publics grants for employment or innovative activities are needed, but it is a transfer of a public service to the Cité Maraichère. Agri-equipment and Raw (substrate, compost, seeds), biocontrol agents of the crop protection), light, energy and water are necessary for the growth of vegetables, mushrooms, etc.

Key partners are public authorities national and regional: ministries of economy, of labour, of industry and ecological transition regional, industry local authority, 21 local suppliers for seeds, plants, substrate, compost, sustainable economic network: 27 organisations (association of habitants, beekeeper, urban farms, beer maker, etc.). Research and university: INRAE, AgroParisTech, Universities of Paris, 4 business partners (Association of Short chain food growers, department 93).

Cité Maraichère proposes different **Values to the customer:** Local seasonal production, safe and nutritious food, environmental value, demonstrator of urban farming and agricultural practices.

The local Customers are Romainville citizens, employees of the local territorial companies, school canteens and restaurants. The distribution is made at the farm shop, with the web site, by bicycle.

The fidelity of the customer is maintained by subscription, scheduled days of sales and by the fact that the Cite Maraichère is a nice place to stay, to work for everybody.

Costs and Revenues: this activity is in deficit, but it is the sense and the base of the existence of this public facility: i.e. create a place to make people aware of good food. However, production just started in 2021, there were difficulties in recruiting a suitable market gardener. The building is a prototype, a lot of practice tests had to be made.

Economic CANVAS of the 2nd activity: Teaching and education

Key partners: 10 educational public and private stakeholders at the national, regional, local levels (philosophy house, media-library). About 35 popular education stakeholders from NGO (EMAUS, Secours Populaire), local associations of Romainville, etc. Social stakeholders are represented by social centres, senior citizen homes, nurses' network, restaurant etc. Research institutes – university in agronomy, education, philosophy, psychologist from science.

Key resources: Employees of the Cité Maraichère specialized in animation of workshops for vulnerable people from children to senior. Many pedagogic tools have to be proposed and adapted to the different people. It needs professional skills. The building aesthetic is essential to receive people and for their welfare. The support services of the administration: financial support, law, etc. Publics grants for employment or innovative activities.

Values: The price of the workshops for children and adults varies with the family income. They could be free and built with the cooperation of the inhabitants. Cité Maraichère as a nice building has a positive reputation as demonstrator of urban farming.

The Customers are the inhabitants of Romainville and the nearby towns, schools, associations, the nearby companies and their employees, the retirement homes. The workshops are proposed with a regular frequency, the customers can subscribe. After the workshop, the Cité Maraichère gives goodies (plants of vegetables, basket, herbal teas). The Cité Maraichère communicates on their website, with newspapers, flyers, and uses its partner networks (schools, retirement home, summer or holiday camps).

Costs and Revenues: this activity, which alone represents 43% of the total costs of all activities, is profitable. The city and the "Ministère du Travail, Plein emploi et insertion" pays for the service of adapting to the world of work and training the long unemployed.

ECONOMIC CANVAS of the 3rd activity: Rent spaces for holidays camp, private events

The city wants to create a place where the global challenges of sustainability, climate change, social justice is taught with conferences, workshops for children and adults. So, it rents the place for these types of events.

The key partners are public authorities with their networks, the companies of social economy (Economie Sociale et Solidaire in French) which can propose conferences and organise workshops. The restaurant in the first floor of the Cité Maraichère represents a nice place to take a meal. The "Les cheffes" comes from the social economy and they have a large network.

The key resources for the employees need skills in teaching environmental, agronomy, food disciplines. The support services of the city realize all the operations of back office (invoicing, quote, etc.).

The nice building and its classrooms are a good point to create **a value** of well-being to work and think. The prices are attractive for the associations and the ecosystem of social economy. **The customers** are Romainville dwellers, associations and companies of the territory, universities, research institutes, but also all the organisations specialized or interested in sustainability, urban farming and safe food.

This activity is balanced. For the 1st year, the development is not important and the city wants this activity to grow. No subsidies for this market activity.

Economic CANVAS of the 4th activity: Restaurant

The city created the restaurant with a standard professional kitchen, rents the space and gives the management of this activity to "Les cheffes" an independent female social organization. It employs people with cooking skills and unemployed people to teach them. This restaurant works six or seven days a week, from 10 am to 11 pm, with about 50 meals/session. It is also a tea and cafe shop. The public is represented by family, neighbouring employees, high school children, etc. For the first year of activity the turnover is not known.

Economic CANVAS of the 5th activity: Insertion job

The Cité Maraichère employs as soon as possible long unemployed to teach them. The rate of unemployment (17%) in Romainville and the department is one of the higher rates in France. For this service, the city receives subsidies. This activity takes time because the people have lost work landmarks. Insertion jobs take place in the restaurant, the market gardening, teaching in the children holidays camp etc. The cost and the revenues of this activity is balanced, but the indirect costs (time of the other employees, crop loss) are not identified.

Economic CANVAS of the 6th activity: Research and testing

This activity is a related activity. The Cité Maraichère is both a research subject in agronomy for the practices, in social and economic sciences for the question of social justice. This place could be and is a good place to realize participative science. Its operation is similar to that of a living lab – as proposed for instance by the European Commission in several EU-funded projects.

SOCIAL CANVAS

At this stage of the work, it is difficult to differentiate the part of each activity on the social or environmental impacts, for what reason one Canvas per dimension (social and environmental) brings together all the activities.

Social Value speaks to the aspect of an organization's mission. Three main values are supported by the city: well-being at work and for the district, social and food justice, and a nice place for the positive impact on the mental health.

The employees' component provides a space to consider the role of employees as a core organizational stakeholder.
So, Cite Maraichère employs and trains people who have been unemployed for a long time and who are not socially integrated. The employees' benefits are important: they can do homework, numerous holidays, they work on a beautiful place and near to nature.
Employees meet a large diversity of people; children, other employees, citizens during social or cultural events, etc.

The governance captures the organizational structure and decision-making policies of an organization. Here, it is ensured by the elected officials (city council) who decide on commercial and financial strategies in relation with the politic programme. A scientific council is a consultative body for the agronomy practices

Local communities: The Cité Maraichère wants to create intergenerational and social links between all people with low or high revenues. It makes workshops on food, nature, environment with i. a. schools and holiday camps. Some therapeutics events are organized also with the nearby hospital.
As much as possible, its suppliers are local and Cité Maraichère exchanges services with the local network.

Societal culture: The societal culture component recognizes the potential impact of an organization on society as a whole. Cité Maraichère has a national recognition in the sector of urban farming.

Scale of outreach describes the depths and widths of the relationships an organization builds with its stakeholders. Romainville's area of influence and partnership extends from Romainville to the other neighbouring towns being part of the wider Paris larger metropolitan area.

The **end-user** is the person who 'consumes' the value proposition. Cité Maraichère has 400 regular clients for the food, its policy is oriented towards vulnerable people, and all the citizens.

Social benefits: Cité Maraichère gives safe food with adapted prices. The employees are 100% local with 40% of integrated jobs. Cité Maraichère creates social links with the organisation of more than 50 events/year and it participates in more than 1,100 events per year. Several thousand people are connected with this FoodE pilot every year.

Social impacts to be improved: In terms of governance, the citizens could be involved and other local communities will be integrated. The Cité Maraichère is a unique vertical farm and it acts a prototype. Agricultural practices have to be ameliorated to obtain a regular productivity and a more important volume of food.

ENVIRONMENTAL CANVAS

The functional value describes the focal outputs of a service (or product) by the organization. One of the most important Cité Maraichère functions is teaching people how to eat better by showing how to protect the environment.

The materials component is the environmental extension of the key resources' component from the original business model canvas. Materials refer to the bio-physical stocks used to render the functional value. For example, Cité Maraichère is a greenhouse with glass materials, uses natural light, and biocontrol products for the protection of crops.

The Production component shows how Cité Maraichère may involve transforming raw or unfinished materials into higher value outputs. For example, Cité Maraichère uses organic seeds and eco-friendly building materials.

Supplies and out-sourcing represent all the other various material and production activities that are necessary for the functional value. Cité Maraichère work with local suppliers and eco suppliers with ecological labels. The employees are local to decrease unemployment.

The distribution represents the physical means by which the organization ensures access to its functional value. The food production is distributed by vehicle or bicycle without too much negative impacts on the environment (no production of CO^2; consumption of non-renewable resources).

The use phase focuses on the impact of the clients' partaking in the organization's functional value, or core service and/or product. Today, this component has to be characterized by a survey of the customers or the users.

End-of-life is reached when the client chooses to end the consumption of the functional value and often entails issues of material reuse such as remanufacturing, repurposing, recycling,

disassembly, incineration or disposal of a product. In our case the leftover food of the Cité Maraichère is given to the NGOs and the clients can compost their organic waste.

Environmental positive impacts: The architecture and interior design create a nice place both for the neighbours and for the well-being of the employees and the visitors. As much as possible, all the process and the construction have been thought in circular economy logic. The furniture comes from renewable resources or second hand. No pesticides are used for the crop protection as well as no artificial light is in use to produce food locally and sustainably.

Environmental impacts to be improved. There are some improvements, which still have to be made; for example, increase the biodiversity, management of the source of energy and reduction of water consumption.

In conclusion: The Cité Maraichère is a public facility wanted by the municipality. Its construction was carried out thanks to regional, national and European subsidies. The main mission is to promote sustainable agriculture and urban agriculture good practices; as well as to transmit knowledge on environmental impacts and good and healthy food to citizens. The activities are nested and oriented towards social and circular economy. Resources, partners, customers are shared by the different activities. It is a way to develop the aeras of the social, economic and environmental positive impacts. The construction cost is high and controversial. The Cité Maraichère is beginning its development and some readjustments have to be realized in the agriculture practices and other activities.