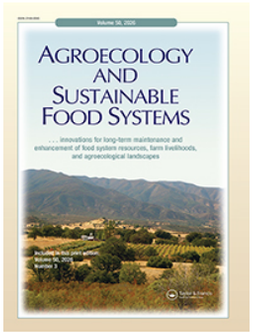

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The importance of market gardeners' characteristics, distribution channels and food supply chain challenges for the viability of their farms: insights from a territorial study in Belgium

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ABSTRACT

In Northwestern Europe, while market gardening farms mostly align with agroecological principles, their viability is questioned. Conducted as part of a Participatory Action Research, our study explores the viability of 18 market gardeners in Coeur de Condroz (Belgium). Through semi-structured interviews, we identified four factors (i.e. working conditions, collaboration among farmers, distribution channel choice, and farmers' aspirations) and five systemic issues (i.e. land availability, skilled workforce scarcity, inadequate training, consumer behavior, and lack of political recognition) affecting the viability of market gardening farms. Our results highlight the value of approaches incorporating farmers' perspectives to study and support agroecological supply chains.

KEYWORDS

Vegetables; short food supply chains; challenges; viability; agroecology; local

SUSTAINABLE DEVELOPMENT GOALS

SDG 10: Reduced inequalities; SDG 11: Sustainable cities and communities; SDG 12: Responsible consumption and production; SDG 2: Zero hunger; SDG 8: Decent work and economic growth

Introduction

Our global food systems are unsustainable and are in need of transformative changes (De Schutter 2017; Béné et al. 2019; Ritchie et al. 2022). Agroecology is increasingly recognized as a strategy to shift away from industrial agricultural practices and pursue comprehensive transformations in food systems (Wezel et al. 2020; IPBES-Food 2021). Agroecology is a science, a set of practice and a social movement (Wezel et al. 2009). The meanings, definitions, interpretations and approaches to agroecology have evolved over time. According to Gliessman (2018), agroecology is "*the integration of research, education, action and change that brings sustainability to all parts of the food system: ecological, economic, and social*".

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Small and medium-scale diversified market gardening farms are an example of proto-agroecological farms that challenge the global food system (IPES-Food 2016; Van der Ploeg et al. 2019). In this paper, we refer to market gardening farms as farms where fresh fruits and vegetables are cultivated exclusively within their rotations. Small and medium-scale market gardening farms include farms with a cultivated area ranging from less than one to ten hectares, with low level of mechanization, and that grow a wide variety of fruits and vegetables (Dumont A and Baret P 2017). These farms, especially when they are in organic agriculture, are more inclined to promote agroecological practices, enhance environmental performance and functional biodiversity, and increase added value for farmers (Dumont 2017; Palomo-Campesino et al. 2022; Pépin 2022). For these reasons, they are referred to as *proto-agroecological farms*, following Van der Ploeg et al. (2019) as they align with many agroecological principles, even though they do not explicitly identify themselves as agroecological.

This type of market gardening farms are mainly involved in Short Food Supply Chains (SFSC), or, to a broader extent, in local food systems and/or alternative food networks (Navarrete 2009; Dumont 2017; Chiffoleau 2019). Despite some criticism in the scientific debate – particularly regarding the inclusivity of SFSCs for low-income populations, as well as their energy use and logistical efficiency (Boni 2019; Huddart Kennedy et al. 2019; Enthoven and Van den Broeck 2021) – many researchers have highlighted their potential positive impacts (Mundler and Rumpus 2012; Chiffoleau et al. 2017; Maréchal et al. 2019). These include: promoting healthy food, supporting farmers and the local economy, enhancing consumer willingness to pay, lowering the environmental impact, and strengthening social ties in the community (Chiffoleau et al. 2017; Enthoven and Van den Broeck 2021).

Therefore, SFSC have been recognized as having a key role in challenging the current food system. They are often considered as niches in the multi-level perspective framework (Geels 2011) of sustainability transition research (El Bilali 2019). Additionally, in the realm of agroecological literature, it is recognized that shortening the food supply chain and reestablishing direct connections between producers and consumers constitute pivotal stages in the transition toward a sustainable food system (Wezel et al. 2020). This is also reflected in European political decisions, with the European Commission that supports the shortening of food supply chains to enhance resilience of regional and local food systems through its "Farm to Fork" strategy (European Commission 2020).

However, such as in other SFSC, small and medium-scale market gardening farms exhibit weaknesses, including inefficient logistics and a questionable viability for the farmers (Dumont 2017; Maréchal et al. 2019). Viability, often considered a sub-dimension of sustainability (Landais 1998), generally refers to the ability of a farm to generate sufficient income to ensure the long-term

livelihood of its workers. While there is no universal definition, many approaches converge on the idea that a farm is viable when it can cover its costs – including depreciation – and pay at least a minimum wage to all active workers (Cochet 2015; Spicka et al. 2019). In this paper, we refer to the definition of K. Morel and F. Léger (2016) who define viability as "*the possibility for farmers to live on a long-term basis in accordance with their material and immaterial needs and values*." This definition of viability goes beyond that of economic sustainability – which focuses on the ability of a farm to withstand changing economic conditions – by also including the lived experiences, values, and broader socio-territorial context of farmers (Latruffe et al. 2016; Spicka et al. 2019). The above definition of viability originates from a more field-based and bottom-up construction and therefore allows for a self-reflexive approach that encompasses the manifold aspirations of market gardeners beyond the sole notion of profitability (Plateau et al. 2019).

Assessing viability requires a comprehensive understanding of the socio-economic and territorial environment of the farm (Spicka et al. 2019; Louah 2020). Previous studies have indeed shown that the poor viability of small and medium-scale market gardening farms is specially due to a low profitability, resulting from a high demand in workforce (Dumont 2017; Dumont et al. 2020; Morel 2016; Plateau et al. 2019). Besides, other issues associated to the market gardening food chain have been previously reported, such as access to land, the role of mechanization, the role of volunteering, the weak networking among market gardeners, the inadequate training and the lack of financial support (RwDR 2022). These challenges highlight the need to gain a deeper understanding of the specific constraints and realities faced by market gardeners, in order to better assess their viability and support their development.

Existing literature related to market gardening SFSC primarily compares long and short distribution channels, with only a limited number of studies exploring the diversity within the short distribution channels employed by market gardeners (Navarrete et al. 2015; Enthoven et al. 2023). Yet, marketing decisions significantly influence the viability of market gardening farms (Morel 2016). Therefore, there is a clear need for further research to better understand the viability of market gardening farms through a detailed examination of the variety and realities of their marketing channels.

In addition, there remains a lack of territorial-level studies addressing the issues faced by market gardeners (Navarrete et al. 2015; Morel K and Léger F 2016; Lamine et al. 2019; Drottberger et al. 2021). Additional place-based research, examining the distinct differences and challenges related to farmers' distribution channels, can provide valuable insights for evaluating the viability of such agroecological farms (Mundler and Rumpus 2012; Anderson et al. 2019; Maréchal et al. 2019).

Furthermore, as highlighted by agroecological scholars, research aimed at supporting (proto-)agroecological farming systems must critically engage with

diverse forms of knowledge to avoid reinforcing existing power asymmetries (Gliessman 2016; Wezel et al. 2020; López-García et al. 2021). This epistemological stance implies that researchers should design their studies in collaboration with farmers and other relevant stakeholders, recognizing them as co-producers of knowledge rather than passive actors. In this context, Participatory Action Research (PAR) emerges as a particularly relevant methodological approach and research stance (Cuéllar-Padilla and Calle-Collado 2011; Šūmane et al. 2018; Maughan and Anderson 2023). PAR is defined as "*a scholar – activist research approach that brings together community members, activists and scholars to co-create knowledge and social change in tandem*" (Cornish et al. 2023). Empirical evidence from agroecological initiatives around the world demonstrates the transformative potential of PAR (Park 1993; Tandon 2000; Cuéllar-Padilla and Calle-Collado 2011; Guzmán et al. 2013; López-García et al. 2021).

Through its chosen perspective on viability and its wider methodological intentions, the present research endorses a PAR stance. More precisely, this paper presents findings from the diagnostic phase conducted through semi-structured interviews with 18 market gardeners at a rural territorial scale (i.e. Coeur de Condroz, seven municipalities). This phase constitutes the initial stage of a longer-term endeavor to co-produce knowledge with and for market gardeners, in order to better depict the tenets of their viability as they actually experience it. This study thus explores their main characteristics, the distribution channels they use, and the key food chain issues they perceive.

To achieve this, we address the following research questions (RQ):

RQ1: What are the main characteristics of market gardeners and the distribution channels they use?
RQ2: According to market gardeners, what key issues are faced by the market gardening food chain?

Building on the insights hence collected, it then becomes possible to discuss how these critical factors may influence the viability of market gardening farms. In doing so, we seek to contribute to the ongoing research on building a more sustainable and resilient food system for the future by providing nuanced data and analysis on a specific agroecological system at a territorial level. This paper provides valuable insight to understand viability as it is experienced by stakeholders in their daily professional practice.

Methods

Context : the Walloon vegetable sector

In Wallonia, the vegetable sector is highly globalized, resulting in a high dependence on imported vegetables. Only 17% of the consumed vegetables are produced in the region while most of the vegetables produced are exported

(Riera et al. 2020; Apaq 2022). In terms of the diversity of cultivated species, peas, green beans, carrots and onions alone represent more than 80% of the cultivated area for vegetables. While most of the vegetables are cultivated for the processing industry, around a fifth of the cultivated area is dedicated to the production of vegetables for the fresh market. These fresh vegetables are produced by about 335 market gardeners that grow a large diversity of vegetables on small areas (Apaq 2022). A majority of them respect organic farming principles, and most of them are certified (Dumont 2017).

Study area

The study takes place in the Coeur de Condroz territory which consists of seven rural municipalities in the Condroz and Famenne agricultural regions in southern Belgium (55 880 inhabitants, 625 km^2; Statbel 2022; SPF 2023). Vegetable production is minor in these regions and represent 632 ha out of the 33 042 ha of cultivated area (SPW 2022).

As part of the Walloon government's call for projects "*Supporting the relocation of food in Wallonia*," funding has been allocated to a project in Coeur de Condroz. This project aims to support two local action groups ("*Pays des Tiges et Chavées*" and "*Condroz-Famenne*") and a network of actors on peasant and citizen seeds ("*Réseau Meuse-Rhin-Moselle*") to set up a local food policy council (Pays des Tiges et Chavées 2024). Our research is embedded in this context, as it is conducted in collaboration with the food policy council and the local action groups.

Cœur de Condroz is a coherent territorial unit, characterized by shared policy frameworks, market conditions, and socio-economic dynamics. This consistency reduces certain sources of variability – such as consumer behavior, weather conditions, and regional policies – thus strengthening the reliability of the analysis. Studying this territory also allows the research to produce locally relevant insights while contributing to broader academic discussions on the viability of agroecological systems at the territorial scale.

Sampling procedure

Market gardeners were identified by integrating information from three sources: databases from the two local action groups in the territory, the Belgian federal food safety agency (AFSCA) database, and data collected from market gardeners' websites. Two criteria were used for selecting market gardeners. The first criterion was designed to ensure the inclusion of practitioners who grow fresh fruits and vegetables exclusively in their rotations. This involves market gardeners on small, medium and large area (Dumont 2017). The selection excluded field crop producers mostly engaged in growing major crops (i.e. wheat, barley, sugar beet, corn, and

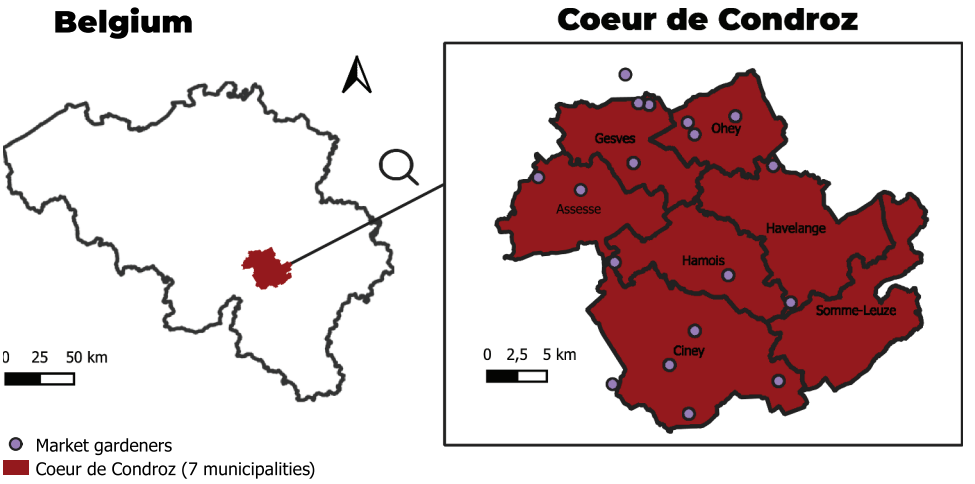

Figure 1. Map of the Coeur de Condroz area and location of the interviewed market gardeners. This map has been made with QGIS and Inkscape, using images from Flaticon.com.

potatoes), who only dedicate part of their land to the cultivation of vegetables. The second criterion stipulated that market gardeners must be situated in Cœur de Condroz or interact with other market gardeners or consumers in the area.

The sampling process enabled us to locate a total of 18 market gardeners (Figure 1). All participants provided their consent to be interviewed for this research. This implies that we may have interviewed all the market gardeners within the specified geographic area. Since all market gardeners within the defined geographic area were interviewed, the analysis presented in Data analysis is descriptive in nature and does not aim to extrapolate beyond this specific population. The interviews have been recorded, transcribed and coded. In cases where recording was not feasible (in 6 instances), only the handwritten notes were transcribed and coded.

Farm descriptions

According to Dumont's (2017) classification based on the technical orientation (small-, medium-, large-scale, or field crop producer) and the production model (organic, conventional, or agroecological1), our study identifies 14 market gardening farms on a small scale (i.e. < 2.5 ha), with 11 engaged in organic farming (i.e. agroecological farms). The four remaining operate at a medium scale (i.e. 2.8–8.3 ha), with one of them adopting organic farming practices. All studied market gardening farms cultivate a wide variety of vegetables (Table 1). Most of them do buying-reselling ($n = 15$) which accounts for 1 to 65% of their *revenue*.

Table 1. Characteristics of market gardening farms (Sd = standard deviation; *n* = number of market gardeners from which data were used). FTE = full-time equivalents. Cultivated area refers only to land used for vegetable production.

	mean	sd	median	min	max	n
Total area [ha]	15.52	30.32	2.75	0.23	100	18
Cultivated area [ha]	1.68	1.99	1.02	0.15	8.3	18
Nb. of vegetables [#]	39	14	38	20	70	18
Revenue [eu]	119 228	66 955	125 833	2 300	226 000	16
Profit before taxes [eu]	13 779	22 706	4 500	−18 259	49 600	16
Revenue per FTE [eu/FTE]	32 767	17 930	29 205	1 966	64 581	16
Profit before taxes per market gardener FTE [eu/FTE]	6 351	10 991	1 997	−6 598	34 848	16
Nb. of Market gardeners [#]	1.56	0.64	1.75	0.5	3	18
Additional FTE [#]	1.07	0.97	1	0	3.5	18
Total FTE [#]	3.42	1.38	3.37	1.17	6.92	18
Buying-reselling [%]	27.72	23.94	27.5	0	66	18
Subsidies [eu]	8 190	15 374	725	0	50 000	18
Years since installation [yr.]	8.28	6.39	6.5	1	25	18

Participatory action research process

As explained in the introduction, the results presented in this paper are part of the diagnostic phase of a broader participatory action research process (Cornish et al. 2023) in the Coeur de Condroz region. The general objective of this project is to analyze the viability of the market gardening SFSC and study its development paths at a territorial scale. While the methodology employed in this study is not transdisciplinary per se – given that semi-structured interviews are not inherently bottom-up – it nonetheless contributed to establishing trust, shared working practices, and a common understanding of the issues at stake. Ensuring mutual trust and openness toward the collaborative production of knowledge indeed constitutes an essential element of PAR projects (Chaussebourg et al. 2025).

The diagnostic phase served as a foundation for building relationships with local actors and preparing for the subsequent more participatory research phases. The results presented in this paper were discussed with market gardeners during a workshop attended by seven of the interviewees. Each market gardener also received a personalized report, which was reviewed and discussed individually with them to ensure the accuracy of the data and support a more informed analysis. The workshop aimed to validate the findings and to identify a shared issue for future research (not presented in this paper). These validation steps were essential for integrating diverse types of knowledge, including farmers' perspectives on the data, and for supporting a more robust discussion of our results.

Interviews

Interviews lasting one to two hours per market gardener were conducted during the year 2021–2022 and were structured into two distinct parts.

The first part consisted of a semi-structured and comprehensive interview (Kaufmann 2016; Magaldi and Berler 2020; Appendix A). It encompassed inquiries about the market gardeners' background and history, their perspectives and future plans for their farms, details about the workforce, and their insights on the key challenges confronting the market gardening food chain. In addition to gathering market gardeners' perspectives on the main issues affecting the market gardening food chain, this phase also served to initiate contact and establish a foundation of trust, which is essential for enabling future participatory research activities. This is also why comprehensive interviews were used, as they offer more flexibility and allow participants to express themselves more freely compared to rigid questionnaires.

The second part involved direct questions about both farm-level characteristics (e.g. cultivated area, types and quantities of vegetables grown, revenue) and individual market gardener characteristics (e.g. working hours; see questionnaire in Appendix B). Here, "*type of vegetable*" refers to the type of vegetable that market gardeners label differently and sell at different prices. We do not particularly refer to the varieties or the species. The rationale for this approach is that it simplifies data collection and still enables meaningful comparisons between market gardeners.

The calculation of working hours was based on Morel (2016). Market gardeners were asked to specify the number of working hours in a typical, busy, or quiet week, as well as the frequency of such weeks in each month.

Eventually, questions were asked about the proportion of their revenue derived from different distribution channels. Based on existing literature (Comps et al. 2011; Dumont 2017) and insights from a local market gardener, nine types of distribution channels were identified: markets (both annual and weekly), catering services (restaurants, hotels and cafes), on-farm shops, baskets (vegetable baskets prepared for consumers), local institutions (such as schools, nursing homes, and public social action centers), supermarkets, wholesalers, local cooperatives, and local shops. Following discussions with market gardeners, we chose to categorize franchise shops under local shops instead of supermarkets. This decision was made due to the small size of the shop and the fact that franchise shops sell their products exclusively within the local area. However, such as for supermarkets, they are supplied in majority through national purchasing agency, and for a minor part directly by local farmers.

Two market gardeners did not share their information on their revenue and profit before taxes. As a result, we gathered data from 16 market gardeners regarding revenue and profit before taxes.

Data analysis

All interview recordings and handwritten notes were manually transcribed, then coded and analyzed using inductive thematic analysis in QualCoder software (Brailas et al. 2023), following Braun and Clarke (2006) six-phase process. While the analysis of food chain-related issues was fully inductive, the sections on market gardeners' characteristics and distribution channels were guided more directly by the quantitative data collected in the questionnaire. In these latter sections, codes and themes emerged from patterns in the quantitative results and were then explored and validated through the interviews. In the end, all interviews were coded based on a combination of themes derived from the issues identified during the interviews themselves, as well as from the quantitative data related to market gardeners' characteristics and distribution channels. In the "Results" section, the notation "(n= ...)" indicates the number of market gardeners who shared similar opinions in their interview. The quotes are translated by the authors into English to enhance reader comprehension.

Quantitative data from the questionnaire were analyzed with the R software (R Core Team 2023). The analysis encompasses descriptive statistics outlining the characteristics of market gardeners and their distribution channels. Additionally, two networks were established: one to depict connections among market gardeners and distribution players, and another to illustrate Spearman correlations among quantitative variables. We acknowledge that the small sample size ($n = 18$) limits the statistical power of correlation analyses. For this reason, only stronger correlations (Spearman's $r > 0.5$ or < -0.5) are reported, and results must be interpreted with caution. These are intended as exploratory insights within a local context, rather than generalizable patterns.

Finally, given the non-normal distribution of the results, a mean comparison Wilcoxon test was conducted, aiming to discern differences between small and medium-scale market gardeners. Furthermore, the Wilcoxon rank-sum test, implemented via the pairwise_wilcox_test function, was used to compare groups of unequal sizes ($n = 11$ and $n = 4$). This non-parametric test does not assume equal variances or sample sizes, as it operates on the ranks of pooled data, making it robust to differences in group sizes and limiting bias in the test statistics. However, the smallest group in our analysis has only four observations, which is close to the minimum recommended for the Wilcoxon rank-sum test. This small sample size may reduce the power to detect differences and limit the precision of p-value approximations. Consequently, results involving this group should be interpreted with caution.

Results

The results are presented in four parts. The first three parts cover market gardeners' characteristics, distribution channels, and their relationships, addressing the first research question. The fourth part discusses the main issues perceived by the market gardeners concerning the market gardening food chain, addressing the second research question.

Characteristics of market gardeners in Coeur de Condroz

Working conditions

Complexity of work. Seven market gardeners stressed that being a market gardener requires knowledge and experience in various domains. The ability to switch between these areas adds to the challenge of the job. In this context, six market gardeners expressed that working alone was hard.

> Finally. I always say, you need to be multi-skilled in the sense that: you are a boss, you are a businessman, you are a technician . . . (Market gardener A)

Work dependence on climatic conditions. Eight market gardeners emphasized their dependence on climatic conditions, which are subject to substantial variability from one year to the next. For instance, a market gardener shared that climate fluctuations over two consecutive years led to a notable variation in tomato yield – from 150 kg to 950 kg per year on his farm. One market gardener specifically highlighted issues concerning water accessibility and the consequences of water-related problems (e.g. droughts and floods).

> We are never sure of having money coming in. That is what stopped me from moving forward. We are constrained by the weather and the climate. All it takes is a bad season and . . . We had floods, for example. Well, we are clearly screwed even though we had prepared everything, we had done everything well. (Market gardener B)

Highly physical nature of work. Six market gardeners stressed that market gardening requires a lot of work all the time. Three market gardeners reported suffering injuries due to physical exhaustion, such as lame leg, disc hernia, and back pain.

> So, to like our job, you really have to be passionate! As with any job, you have to find a purpose. In our case, I think that for everyone it is passion. [. . .] *Why? Because it's a very physical job and it depends on other things like the weather and the climate.* (Market gardener A)

Substantial working times. The surveyed market gardeners reported an average working time of 59.28 h per week (Appendix C). This changes strongly within the year. The busy working season last from April to October and

reaches a peak of 64 hours per week on average, in May. The least busy month is January with an average of 36 hours per week.

> Obviously we work on Sundays. You have to work all the time. (Market gardener C)

Economic performances

Twelve market gardeners mentioned clearly that market gardening is not a profitable job, specifically when you start and do not have land or money:

> Well, as a market gardener we know well that it is not with that job that we become rich. (Market gardener B)

Indeed, four market gardeners out of 16 have a *revenue per hour* of less than 11 €/h, which is close to the minimum hourly wage for non-qualified agricultural workers in Belgium (10.03 €/h in 2021; SPF Emplois 2021). It is important to note that this refers to revenue per hour, not wage; after deducting production costs and taxes, the actual remuneration may be significantly lower. As a result, none of the market gardeners reaches a *profit before taxes* higher than 9 €/h. Nevertheless, the *profit before taxes* is not a good proxy of what market gardeners really earn, as it depends on the farm's status and farmer's investments. In fact, market gardeners tend to lower their *profit before taxes* to reduce the taxes they must pay. Furthermore, six market gardeners pay themselves a salary ranging from 450 to 2100 € per month, not accounted for in the *profit before taxes*.

According to them, factors that influence the profitability of the farm are the initial situation of the farmer and the management practices (e.g. choice of distribution channel, development strategy, farm size, type of land access and share of buying-reselling).

This is in line with the positive spearman's correlation observed between the *Revenue per FTE* and the proportion of revenue generated from *buying and reselling activities* ($r = 0.59$, p-value = 0.016; Appendix D).

However, according to our data, *production model, year since installation*, and *cultivated area* do not have a major impact on the economic performances. The only significant difference concerning the production systems on the economical performances relates to farm size (i.e. technical orientation). Small-scale market gardeners have a higher *revenue per area* than medium-scale market gardeners (Appendix E). However, there is no difference in term of *revenue per FTE* between the two technical orientations.

Finally, it is worth noting that the amount of money coming from public subsidies perceived by market gardeners is rather low. Those who receive subsidies are market gardeners certified in organic farming (receiving on average 1 192 euros via the common agricultural policy) and/or market gardeners also cultivating field crops. Those who cultivate field crops obtain more subsidies since these are granted per hectare. Apart from the common

agricultural policy aid, only two farms received subsidies for investment or employment in 2021–2022.

Years since installation correlates to cultivated area

Our results show a positive correlation between *year since installation* and *cultivated area* ($r = 0.60$, p-value < 0.01; Appendix D). The low availability of land and its high price play a critical role in land access for the market gardeners (see section related to land access). As a consequence, young market gardeners face difficulties to access larger cultivated areas.

> There is a scarcity of goods to buy. And then the price. I was able to buy here because I already had 5–6 years of operation and profitability which meant that we were able to put in the money. And that I had a certain inertia. But from the start, without having made our hyper gradual start it would not have worked. (Market gardener D)

Distribution channels used by market gardeners

Poor connectivity

The market gardeners' network with distribution players reveals the absence of a unified community but instead consists of small groups connected to each market gardeners' network (modularity = 0.72 transitivity = 0; Figure 2). This network only represents sales of end products.

In addition to the on-farm sales, market gardeners work on average with 5.67 distribution players (min = 0; max = 15). Medium scale market gardeners tend to work with more actors (mean = 11.5) than small scale market gardeners (mean = 4). One local distribution cooperative is a central distribution player, selling products of 10 market gardeners.

In the survey, 16 out of 18 market gardeners expressed their motivation to enhance any type of collaboration with other market gardeners (e.g. selling vegetables to each other, sharing equipment, etc.).

Vegetables are sold locally

Market gardeners in Coeur de Condroz sell most of their products locally. Indeed, 97% of all the revenues come from local distribution channels (i.e. *local cooperatives, local institutions, local shops, catering, baskets, markets, on-farm shops*, and *other* types; Figure 3).

The remaining three percent are sold through *supermarkets* or *wholesalers*, that could also sell the products locally.

Strategic choices regarding distribution channels

The percentage of the revenue that each distribution channel represents varies substantially between market gardeners. Two market gardeners sell their products exclusively through business-to-business channels (i.e. without

using on-farm shops, markets, or baskets), having no direct contact with consumers. For three other market gardeners, the sales through *markets* represent 75% or more of their revenue. All the remaining market gardeners have an *on-farm shop* but the share of the revenue that comes from the *on-farm shop* is highly variable. In fact, the importance of the share of *on-farm shops* in the revenue is counterbalanced by the share of the revenue represented by baskets or local cooperatives.

In addition, supermarkets and local shops represent a higher share of the revenue for medium-scale market gardeners than small-scale market gardeners (Wilcoxon test p-value < 0.01; Appendix F). This may reflect how technical orientation influences marketing strategies, with medium-scale market gardening farms more likely to engage in conventional or intermediary distribution channels such as supermarkets and local shops.

Wholesalers: balancing scale efficiency and price pressures

Two market gardeners sell large volumes to *wholesalers*. They justify it saying that even if the products are sold at lower prices, this represents less sales efforts and larger volumes. One of them admits having felt pressure on the prices and reacted to it by choosing different distribution channels.

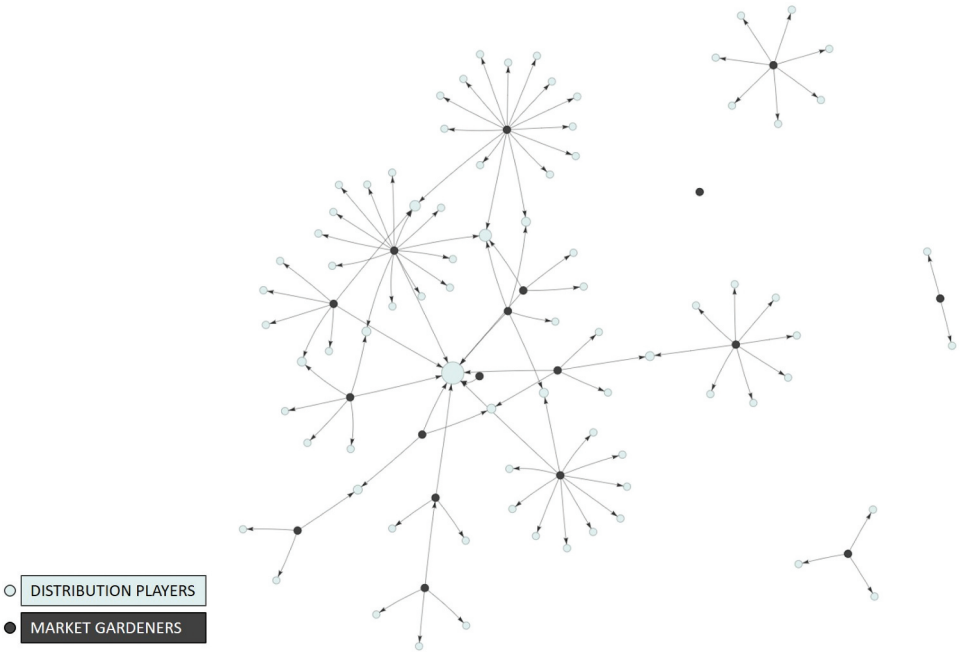

Figure 2. Market gardeners' network with distribution players. Arrows represent the sales (from market gardener to distribution players). Market gardeners with no arrows only sell their products on-farm. The size of the distribution players is proportional to the number of market gardeners they work with (i.e. number of in-degrees).

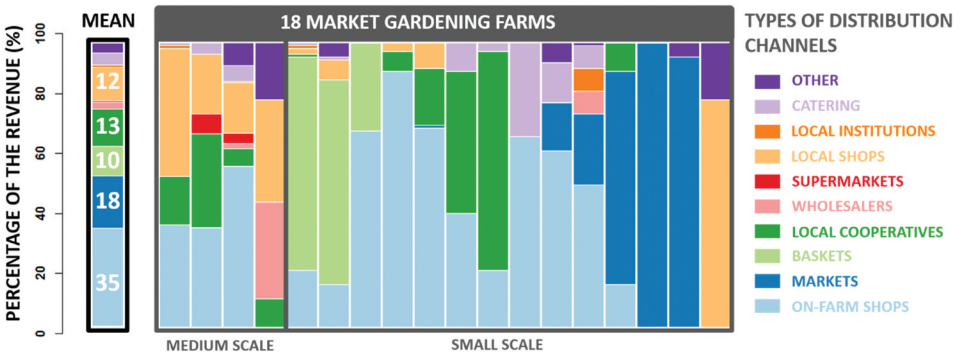

Figure 3. Percentage of the revenue for each distribution channel per market gardening farm. The first four bars represent medium-scale market gardening farms while the other represent small-scale market gardening farms.

> But the relationship with [wholesalers], it has not always been easy. This is typically what causes problems. It's the pressure on prices. But we also know who we're talking to, so we don't expect high prices. And then, having only half a full truck is costing me a lot of money! Even if the price is 20% cheaper, the sales effort that I would have to put in to sell this volume and the risks of loss of unsold items that I could have created if I did not have this type of customers, it's problematic too. So, all in all, you need a little bit of everything. (Market gardener E)

Absence of local institutions & catering

Local institutions and *catering* are distribution channels that are hardly used by market gardeners, representing on average 5% of their revenue. Six market gardeners mentioned that *local institutions* and *catering* are highly demanding, unpredictable, and require a lot of time for the few vegetables sold.

> Before, at the beginning. I worked with restaurants, but you have to chase them all the time to get your money. They buy you two salads . . . It's a lot of quibbling for not much. (Market gardener F)

Potential of local cooperatives

Market gardeners in Coeur de Condroz work with two main local cooperatives. One is a key distribution player, selling products of ten market gardeners. Opinions among market gardeners on both cooperatives are mixed. Eight agree that the cooperatives' intentions are good and that they have a great potential. They underline that local cooperatives allow them to reach more clients by extending their network and that this helps them to dispose of the surplus.

> I think it's a great initiative. As a market gardener. I find it great. [. . .] Here, with the cooperative, you do everything by ordering. There's no damage, there's no excess, it's great. (Market gardener G)

However, 12 market gardeners nuance these positive impacts. Some of them emphasized a pressure on the price due to increased competition between market gardeners ($n = 4$) and the consumer-driven decision model of the cooperatives ($n = 5$).

> These are basically good ideas. But the problem is that at some point, for me, they then tend to have a kind of monopoly too. They put market gardeners in competition. If someone has priority . . . I end up with all my fennels because in fact there was a guy who had priority. (Market gardener H)

Others criticize the structure of the cooperatives ($n = 5$), particularly its reliance on volunteers and subsidies and the irrelevance of employees' standard working hours compared to the reality of market gardening, where farmers often work evenings, weekends, and adapt to weather conditions – unlike employees who typically follow fixed schedules.

Main characteristics of market gardeners and distribution channels they use

Buying-reselling correlates with selling at markets

The share of *buying and reselling* activities in the *revenue* is significantly correlated with the share of the *revenue* originating from *markets* ($r = 0.63$, p-value < 0.01). *Buying-reselling* is done by most market gardeners ($n = 15$). This practice has been mentioned by some as essential for the farm profitability.

> For 4–5 years. I didn't do it, and I realized that I had to. All the market gardeners who say: "Yeah. we won't do it," well, they all end up doing it. People don't want to eat only apples. (Market gardener F)

Consumers' desire for a diverse selection of fruits and vegetables at their shopping destinations largely accounts for this phenomenon. *Markets*, in particular, require market gardeners to offer a broad range of fruits and vegetables because consumers prefer not to visit additional locations for their shopping needs.

Market gardeners who carry out a lot of *buying-reselling* (25 to 65% of turnover) mainly buy from a wholesaler. However, most of them pay attention to where their products come from. Often, these are fruits (e.g. bananas, oranges, etc.) bought outside Belgium. This range of market gardeners includes all those who attend *markets* (weekly or annually) and some who sell direct (*on-farm shops*).

Years since installation negatively correlates with baskets

The proportion of revenue derived from selling *baskets* negatively correlates with the *number of years since installation* ($r = -0.51$, p-value $= 0.029$). For example, two experienced market gardeners mentioned that selling *baskets*

directly to consumers demands a considerable amount of energy and, in their view, is not profitable.

Issues related to the market gardening food chain in Coeur de Condroz

Access to land: low land availability and high prices

Nine market gardeners brought up concerns regarding access to land. They unanimously acknowledged the low availability of land and particularly the difficulty of locating good and nearby land. In addition, the unaffordable cost of land was raised by seven market gardeners as another important aspect of the land access issue.

Besides, a trade-off exists between owning land, which demands substantial capital and could lead to years of debt, and renting land, which typically offers subpar conditions and lacks long-term security.

> The land pressure here in Belgium is crazy. It is crazy! [. . .] You don't have enough with five farming careers to pay for your land, that's not possible. It's just if you have money to invest. But when you start on the farm you don't have money to invest so you don't have 45 solutions. (Market gardener I)

The reasons for this lack of land access cited by market gardeners were the competition between cultivated and buildable area ($n = 2$) and the involvement of prominent landowners (e.g. large supermarkets) investing in land ($n = 3$), resulting in land speculation and a reluctance of these landowners to sell.

Competent workforce is hard to find

Finding workforce is essential for small market gardeners. Interestingly, this is perceived as a source of stress for three market gardeners that are not in organic farming, suggesting that production models may influence how workforce-related challenges are experienced. A major problem, highlighted by at least five market gardeners, is the difficulty of finding a workforce that is motivated, competent, and that stays in the long term.

> And then we have labor problems too. We have a lot of difficulty finding labor. And since we have a market gardening farm, it requires a lot of labor. And we realize that we no longer find any. So, in fact, it becomes unmanageable. [. . .] Finding labor is awful! It is really one of the things that makes me the most stressed, actually. [. . .] Well, the obstacles are that we can't find anyone reliable. (Market gardener I)

According to eight market gardeners, it is difficult to find an employee or a trainee that stays. They said that, in general, the best workers leave to create their own business. Also, one market gardener highlighted that having employees was stressful in the winter season because you must find them something to do that still makes them profitable for you. In that sense, three

market gardeners mentioned that hiring seasonal workers is convenient because it provides workforce during the harvesting season.

Lack of quality training

Ten market gardeners highlighted the insufficient training quality in market gardening. One of them pointed out the limited knowledge about organic market gardening in Belgium and the lack of emphasis on organic farming and market gardening in agricultural schools.

> And the other fundamental element is training. And on that side, it's the same. Because in terms of organic farming we are absolutely nowhere. Nowhere! It's impressive. And it is not only that we are nowhere but there is actually a rejection. In agricultural schools, organic is struggling to find space. Here in [municipality] for example. I don't know what this school is called, there, there is hostility towards organic. (Market gardener J)

Consumers' behavior: why do consumers not buy local?

Three market gardeners argued that consumers are aware of the interest of purchasing local, but one said that it does not imply that they will purchase local products. Indeed, three other market gardeners mentioned that consumers are not ready to pay more.

According to market gardeners, the reasons why consumers are not buying local food are practical ($n = 4$) and because they have a wrong image of local products' price ($n = 2$). The practical reasons mentioned by the market gardeners are that the farms are far away from where consumers are, and that the consumers must go to several different selling points to fulfill their needs. In addition, they often lack time due to the current lifestyle. Concerning the price of local products, according to two market gardeners, consumers think that local is always more expensive, which is not necessarily the case.

Furthermore, five market gardeners highlighted the competition from supermarkets because they have all products in one place and can spend a lot of money on advertising.

> Yeah, that's it. Convenience. But there's still the communication aspect! When you get in your car, turn on the radio, you keep hearing [supermarkets], all the time. It is repeated constantly, and it stays in your mind all the time. They have huge visibility thanks to big budgets. And in the end, people are also paying for that in their vegetables. They're paying for the advertising, you know. They end up buying low-quality vegetables. That's my opinion. (Market gardener H)

Lack of political recognition

Seven market gardeners pointed out the lack of recognition of market gardening. Indeed, due to their unique and complex nature, market gardeners often face marginalization or a lack of recognition from public services and other farmers.

> I think that one difficulty is being taken seriously by the public authorities because we always feel not like a farmer but the little market gardener who does his weird thing on the side. So that plays out at the administrative level and at the financial level. But I think it also plays a role in the image that people have of our profession and the place we take in the sector. It's not always easy. (Market gardener K)

Discussion

In this section, we build upon the results related to the research questions one and two to discuss how farm characteristics, distribution channels and the issues associated with the market gardening food chain in Coeur de Condroz may influence the viability of market gardeners.

Viability of market gardeners: an approach to socioeconomic evaluation

We highlighted that market gardeners in Coeur de Condroz have low revenues and profit before taxes. This is in line with what market gardeners perceived and other similar studies (Morel 2016; Dumont 2017). One of the reasons these production systems might be less profitable compared to conventional systems is their heavy reliance on manual labor (Navarrete et al. 2015; Dumont 2017). Another key aspect that may impact the revenue of market gardening farms, is that strategic choices often involve trade-offs between different aspirations (Morel K and Léger F 2016). In practice, decent income is frequently in tension with other aspirations such as (environmental) commitment, acceptable workload, quality of life, and autonomy. However, Morel (2016) showed that microfarms can be economically viable due to an increased production per area, and a higher added value.

Our findings highlight that buying and reselling is a practice correlated with higher revenues among the market gardeners studied. This strategy has previously been identified as essential in a study on market gardening in Wallonia (Dumont 2017). The low taxation rate on food products in Wallonia and the ease of buying and reselling contribute to the adoption of this practice. However, these buying and reselling transactions create a genuine ethical problem as market gardeners rely on and support the main regime actors by purchasing their vegetables. This contradicts the principle of being financially independent from other non-agroecological actors (Dumont et al. 2020). Furthermore, selling more (and thus increasing revenue) does not necessary mean increasing profits and/or viability. Future research could explore the relevance of this practice in local contexts. One possible approach could involve facilitating the purchase and resale of locally grown vegetables that are less profitable for small and medium-scale farms, such as carrots, potatoes, and onions. For instance, if they are supported

by the authorities, local cooperatives, larger-scale market gardeners, or collective groups of market gardeners could facilitate the development of local buying and reselling practices.

We acknowledge that we were unable to apply the income proxy as defined by Dumont (2017), who calculates annual income based on profit before taxes for sole land owners, and profit before taxes plus managerial remuneration for incorporated farms. In practice, estimating the amount market gardeners actually withdraw from their farm income proved highly challenging, due to the heterogeneity of remuneration strategies, and the lack of clarity – sometimes even for the farmers themselves – regarding personal income, including possible undeclared earnings. As a result, we chose to rely on raw profit before taxes data, consistent with national statistics, while being fully aware of the limitations of this approach. Notably, Dumont (2017) also stresses in her thesis that this proxy, even when well calculated, is highly sensitive to accounting strategies, such as depreciation, and does not necessarily reflect the real economic viability of farms. The limitations of this indicator, and its continued use in official statistics, highlight the need for more robust and context-sensitive viability measures. There is a need to develop improved, context-specific quantitative indicators and corresponding methodologies to more accurately capture and assess the viability of market gardening farms.

We found revenues and profit before taxes to be inadequate indicators for accurately assessing and comparing the viability of farmers. Some farmers with low revenue and profit before taxes reported a satisfactory well-being without feeling deprived, while others with high revenue and profit before taxes expressed concerns about their farm's viability. We believe that factors such as minimum income needed to support the well-being of farmers, the maximum acceptable weekly workload, and the environmental and social aspirations that are meaningful to the farmer could be relevant additional information to better understand their viability (Morel 2016; Plateau et al. 2019). Moreover, in this paper, we treated the viability of farms and market gardeners as interchangeable, as they often do not differentiate between the viability of their farm and their personal viability (Lanciano et al. 2010). Further exploration of this dual perspective may assist researchers in gaining a deeper understanding, and if necessary, distinguishing between the viability of market gardeners and/or their farms. In addition, revenue and profit before taxes do not account for market gardeners' self-consumption of vegetables and complementarity activities, which may significantly impact their livelihood (David et al. 2010; Drottberger et al. 2021).

In this regard, we agree with Maréchal et al. (2019) and Morel (2016) that viability is not only related to farm profitability but also includes other aspects such as financial autonomy, price stability or contractual security. Moreover, the strategic decisions regarding the choice of distribution channels have been proven crucial in evaluating the viability of the farm (Morel 2016).

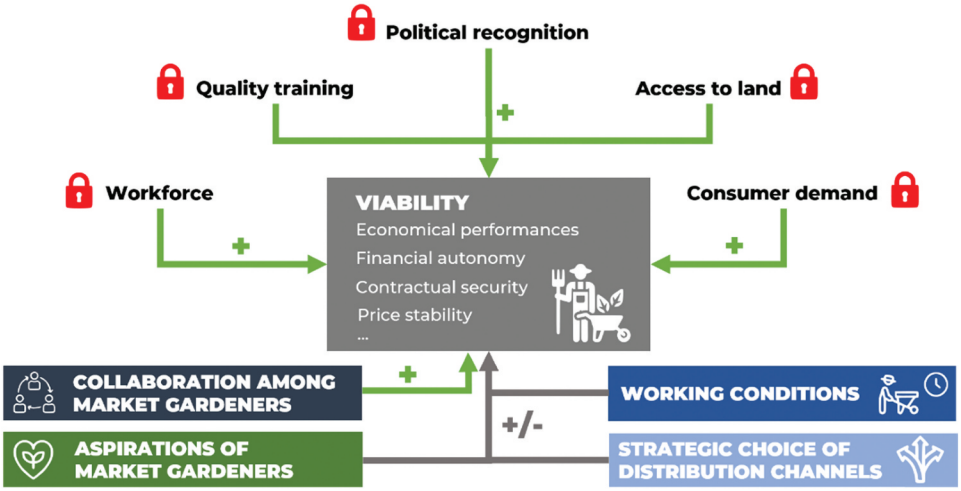

Figure 4. Schematic view of what influences market gardeners' viability. The red padlocks represent issues related to the supply chain that impact viability. The directional signs (±) reflect potential influences on farm viability as perceived by market gardeners and inferred from qualitative analysis, complemented by exploratory correlations. They do not imply causation. Images: Flaticon.com.

Considering this, the working conditions, all the information related to the distribution channels, the degree of collaboration among market gardeners, and the key issues identified in this research regarding the market gardening food chain have a direct or indirect impact on the viability of farms (Figure 4). Their impacts will be discussed in the four following subsections.

How do working conditions impact the viability of market gardeners?

Our results are in line with previous studies that highlighted the challenging working conditions in market gardening (Escalante and Santos 2010; Lanciano et al. 2010; Navarrete et al. 2015; Morel 2016; Dumont 2017; Hermesse et al. 2020). As mentioned by Navarrete et al. (2015), we observed a trend toward simplification among some experienced market gardeners, such as the willingness to simplify crop management and reduce the number of vegetables grown.

The calculated working hours are consistent with previous studies conducted in Belgium and France. which demonstrated a range from 36 to 120 hours per week (Lanciano et al. 2010; Morel 2016; Dumont 2017; Hermesse et al. 2020). These extended working hours are a common concern in small-scale market gardening and could potentially affect the farms' viability (Dumont 2017). However, in certain cases, market gardeners do not perceive working hours in a traditional sense, leading to a blurred boundary between work, domestic, and leisure time (Lanciano et al. 2010). Literature on

organic market gardening pointed out that work intensity is partly counterbalanced by an increase in work satisfaction, due to the interest and challenges that a more diverse system brings (Navarrete et al. 2015). As others, we found that direct selling contributed to a professional pride of producing healthy food for their local community (Enthoven and Van den Broeck 2021).

How do distribution channels impact the viability of market gardeners?

We observed that, apart from market gardeners involved in direct sales at markets, all of them resort to at least two or three different distribution channels. This aligns with the findings of Enthoven et al. (2023), who noted that market gardeners in Wallonia typically rely on one primary marketing channel with additional ones for smaller volumes. This diversification in marketing strategies for fresh vegetable production plays a role in mitigating the risks associated with selling perishable products (LeRoux et al. 2010).

In addition, market gardeners employ other strategic decisions. Those engaged in market sales predominantly prefer this channel for almost all their products. This specific choice has not been extensively documented in prior research, largely because studies do not delve into individual farmer circumstances, do not analyze the volume or turnover percentage distributed through different channels, or primarily focus on comparing direct sales with other distribution methods (Navarrete 2009; LeRoux et al. 2010; Comps et al. 2011; Enthoven et al. 2023). Another strategy used by market gardeners is to sell large volumes through a specific channel at reduced prices, leveraging economies of scale (LeRoux et al. 2010). In our study, we identified two market gardeners employing this strategy. However, it is worth noting that one of them acknowledged feeling price pressure, leading him to an increase in the number of distribution channels.

In our study, the use of basket schemes as a distribution channel was negatively correlated with the number of years since installation. One possible explanation is that this distribution channel is more commonly adopted by recently established market gardeners. Interview data offer insights into this trend: while some newer farmers may view baskets as a way to build strong consumer relationships and secure regular income, two market gardeners reported significant challenges associated with this model. They emphasized that baskets are time-consuming due to the harvesting and preparation workload, as well as the complex planting patterns required – an issue also discussed by Navarrete et al. (2015). Additionally, this channel involves year-long consumer commitments, which some farmers prefer to avoid. These findings raise questions about the viability of basket schemes, which may be less efficient in our rural context, and possibly also due to limited knowledge on how to optimize their preparation (e.g. baskets often being assembled individually per consumer, leading to long preparation times). Still, new market gardeners may adopt this model for other reasons, such as maintaining strong consumer relationships or securing regular income (Egli

et al. 2023); however, this remains a hypothesis that cannot be directly verified with our data.

The absence of local institutions and catering in market gardeners' distribution networks illustrates their current lack of viability, attributed to the demanding nature of these channels. In addition, our study revealed challenges faced by market gardeners in engaging with longer chains such as supermarkets and auctions. Market gardeners encounter a competitive disadvantage when competing with larger producers who sell similar products at lower prices, making it challenging for them to secure fair prices through those channels (Mazoyer and Roudart 2002).

How do distribution network and collaboration impact the viability of market gardeners?

Except for a local cooperative occupying a central role, most distribution networks are tailored to individual market gardeners. This situation underscores the competitive nature among market gardeners, who operate within a relatively confined territory while producing similar vegetables. They are therefore trying to establish their own distribution channel network so as not to compete on price with other market gardeners (i.e. horizontal competition). This perceived need for differentiation is also why some of them identified the local cooperative as a source of competition. Navarrete et al. (2015) also highlighted competition among organic market gardeners, especially in direct selling activities.

However, it is important to note that this competitive environment does not exclude the possibility of collaboration between them. In our study, several forms of collaboration were observed, corresponding to three of the types identified by Stoeva et al. (2024): decision synchronization (e.g. joint production planning through the cooperative), resource sharing (e.g. mutual exchange of equipment like a plow and a tiller), and collaborative communication (e.g. use of a shared WhatsApp group among market gardeners). The cooperative has played a pivotal role in fostering collaboration among market gardeners, particularly by enabling joint planning that helped market gardeners coordinate their sales. Moving forward, the cooperative has a key role to play in integrating the expectations of market gardeners to become a genuine lever for the development of the food chain – rather than inadvertently intensifying competition.

The role of collaboration is essential for sustaining local food systems (Renting et al. 2003; Lamine et al. 2016; Chiffoleau 2019; Maréchal et al. 2019). Collaboration is even sometimes seen as one of the conditions for the success of local food systems (Chiffoleau 2019). However, the way how new economic models are co-constructed and how networks are organized in such initiatives is crucial to foster transition and avoid co-optation (Duncan and Pascucci 2017; Chiffoleau Y, Millet-Amrani S, et al. 2019). By enhancing professional information sharing, collective initiatives can help solve technical and economic issues

originating at the farm level (Renting et al. 2003; David et al. 2010; Chiffoleau 2019). These collaborative efforts can also enhance viability through joint initiatives, such as shared use of specific materials, collective purchasing of inputs, sales of farm products or shared workforce (David et al. 2010; Navarrete et al. 2015). Moreover, collaboration and actions among farmers can help mitigate production irregularities through the exchange of products, as demonstrated in the mutual planning example mentioned earlier (Renting et al. 2003).

How does the market gardening food chain issues impact the viability of market gardeners?

The issues associated with land access play a critical role in the viability of market gardeners. If the farmer does not own the land, it is more difficult for him or her to get access to financial support and to invest in the long run (Dumont 2017; Drottberger et al. 2021; RwDR 2022). In addition, this lack of a long-term vision is often seen as preventing farmers from investing in agroecological practices, which are known both to be time-consuming and to yield the expected outcomes (such as providing ecosystem services) only over the long run (Duru et al. 2015). However, and quite interestingly, it appears that many market gardeners similar to those in Coeur de Condroz do implement agroecological practices despite not having long-term access to land.

The limited financial support received by market gardeners in Coeur de Condroz is evident, as only two of them received subsidies for investment or employment. Besides, the subsidies from the Common Agricultural Policy received by market gardeners are attributed to the area-based distribution method (Drottberger et al. 2021). This may change as the new Walloon Strategic Plan for the Common Agricultural Policy 2023–2027 has planned to give 4 000 euros per hectare for "*diversified market gardeners*" (SPW 2021). However, considering the average size of market gardeners in Coeur de Condroz, that would only represent 6 720 euros per farm, which is still less than the average of 20 071 euros per farm in Belgium (BELPA 2023). Proposals like increasing the basic income tax threshold, reducing employer taxes, or transitioning to an employment-based system for direct payments may address the lack of financial support for small-scale producers (Drottberger et al. 2021).

The challenge of land access not only affects non-owner farmers but also those who own land. Our study revealed that even land-owning farmers may encounter economic difficulties while repaying their loans. In our study, we noticed a positive correlation between market gardeners' experience and the size of their cultivated area. This shows another link between land and farmers' viability. Market gardeners mentioned that profits increase with experience (i.e. ranging from 3 to 5 years, depending on the market gardener3). Hence, this could potentially explain why older farms could invest in acquiring or renting more land. Another possible explanation is the decreasing accessibility

of land over time, due to rising land prices driven by speculation, urban densification, growing competition, and lease rigidity (Stassart et al. 2018; Halleux and Leinfelder 2025).

In line with previous studies, we observed the challenges faced by market gardeners in finding competent and motivated workers (Navarrete et al. 2015; Dumont 2017). This situation often leads to an inefficient and unprofitable workforce for market gardeners, as more time is spent on training and supervision than the time saved by their work. Additionally, skilled workers, typically trained on-site, often leave soon after.

Furthermore, we pointed out the lack of quality training for market gardening in Belgium. This could impact the economic performance of farmers, as some of them admitted feeling inadequately prepared to manage the diverse tasks involved in the job. Similar findings have been reported in Sweden (Drottberger et al. 2021).

Lastly, consumers' willingness to pay and rising demand significantly enhance farmers' sales. Previous studies indicate that consumers are willing to pay for local products, often even more than for organic alternatives, and local food is not necessarily perceived as expensive (Feldmann and Hamm 2015; Enthoven and Van den Broeck 2021). This can partly be explained by how consumers construct the value of food: affordability is not only about price, but also shaped by individual perceptions of what it means to "spend well" (Bååth 2022). In this view, paying more for sustainable or local food can be seen as a meaningful or justified expense. However, a study in Wallonia revealed that consumers in local food systems travel very short distances (Comps et al. 2011). Therefore, these systems are addressed almost exclusively to consumers nearby a selling point. In our study, market gardeners also emphasized that the distance to the on-farm shop affects consumers' willingness to pay. As a consequence, the supply in local products must cover the whole territory to meet enough interest (Comps et al. 2011).

Perspectives and conclusions

Market gardeners in Coeur de Condroz operate as small to medium-scale farmers, cultivating a diverse range of vegetables, and exclusively participate in SFSC. Their characteristics and challenges align with those of other small to medium-scale market gardeners in Northwestern Europe.

The viability of market gardeners is challenged by various factors in their working conditions, including the complexity of the farming system, physically demanding tasks, dependency on weather conditions, and long working hours. Conducting further qualitative research on market gardeners' perceptions of their extended working hours and conditions is essential for assessing whether these factors genuinely impact farm and/or market gardener viability or not.

The viability of market gardeners is critical. Our findings suggest that buying and reselling may be a strategy to enhance revenues for market

gardeners, raising important questions about its role and relevance within the development of SFSCs in Belgium. Despite the low economic performance, we argue that assessing viability should be nuanced by incorporating qualitative insights into how market gardeners perceive their viability, their values, and requirements. This would enable us to better understand the tensions faced by market gardeners arising from the combination of logics (i.e. self-management, agroecological, territorial and commercial logics; Plateau et al. 2021). In addition, we believe that more work is needed to develop improved, context-specific quantitative indicators and corresponding methodologies to more accurately assess the viability of market gardening farms, in a way that reflects the complexity of their realities and supports more informed decision-making.

Furthermore, while market gardeners use various marketing strategies, no single approach has proven superior, as each is adapted to individual circumstances. Yet, some of the channels, including local institutions, catering, and longer distribution channels, are presently inaccessible for market gardeners due to practical or competitive challenges. In light of these findings, future research could concentrate on developing strategies to render these distribution channels viable for farmers.

The local cooperative was found to play an important role in enhancing collaboration among market gardeners. While it holds significant potential, attention must be paid to potential drawbacks, particularly concerning competition and pricing pressures. Collaboration plays a vital role in strengthening the sector and enhancing the logistics of this SFSC. Additional institutional support and the development of new types of associations involving various actors within the chains and their surrounding networks would promote the establishment of collaborative networks (Renting et al. 2003). In this respect, governments can play a role by promoting territorial food policy projects such as food policy councils (Prové et al. 2019; Schiff et al. 2022) and other similar promising projects (Guillot and Blatrix 2021; Oliveira and Galván 2023).

Finally, we advise future research to look at other aspects than the farm economic performances to assess the viability of market gardening. Evaluating and promoting the viability of a farm necessitates an understanding of its unique requirements and values. By addressing the issues of the food chain faced by market gardeners, we attempted to do so. We advocate for research focusing on SFSC and their potential contribution to an agroecological transition to adopt a systemic approach, aimed at understanding the distinct requirements and principles of all actors within the chain. Thus, we align with other scholars in recognizing the necessity for participatory action research or similar participatory methods, to study and advance the development of agroecological SFSC, such as the market gardening SFSC in Coeur de Condroz (Wezel et al. 2020).

Notes

1. Note that according to Dumont (2017) classification, market gardening farms on small and medium scale practicing organic farming are considered to have an agroecological production model.
2. Modularity is a function designed to assess the quality of a partition within communities in a network (Newman and Girvan 2004). Transitivity reveals the presence of closely connected communities, clusters, subgroups, or cliques (Casleton et al. 2022).
3. This information comes from feedback from market gardeners when presenting the work. This is why it is not presented in the results.

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Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used ChatGPT in order to improve readability and language. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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