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Lara, Szymon Wojciech and Tsiami, Amalia ORCID logo ORCID: <https://orcid.org/0000-0002-1122-4814> (2026) Forgotten crops – minor roles, major values. A case study from the United Kingdom. International Journal of Gastronomy and Food Science, 46. ISSN 1878-450X

<https://doi.org/10.1016/j.ijgfs.2026.101688>

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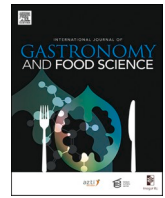
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Forgotten crops – minor roles, major values. A case study from the United Kingdom

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ARTICLE INFO

Keywords:

Forgotten crops
Minor varieties
Supply chains
Value chains
Food security
Sustainability
Resilience
Biocultural heritage
Food systems diversification

ABSTRACT

Maximising food production has driven unsustainable agri-food practices that accelerate biodiversity loss and weaken food and nutrition security, dietary diversity, and systems resilience. These dynamics have marginalised minor and traditional crops. Yet, underutilised crops, alongside their commodity relatives, could strengthen local economies, preserve biocultural heritage, and enhance nutrition security through diversified supply chains.

This study identifies barriers and facilitators to integrating forgotten crops into modern food systems. Using a qualitative case design centred on a UK wholesaler that distributes minor edibles and connects actors across a niche value chain. We have conducted eight semi-structured interviews (non-random snowball sampling), recorded, transcribed and thematically analysed the data in NVivo Pro 14 software.

Key barriers identified include supply-demand mismatches, inadequate pricing mechanisms and limited stakeholder awareness. Facilitators include relational, trust-based and flexible value chains that enable rapid adaptation and de-risking. Independent chefs emerge as key actors that translate agrobiodiversity into flavour-led menus, building demand and normalising seasonal procurement.

We argue that effective food systems diversification requires coordinated action by producers, wholesalers, retailers, chefs, consumers and policymakers, alongside targeted education efforts and more flexible procurement and pricing mechanisms. For gastronomy and food science, these findings motivate sensory characterisation and nutritional profiling of minor crops to support menu integration, forecasting and quality at scale.

1. Introduction

Global biodiversity is declining at an alarming rate, two in five plant species are now threatened with extinction and agri-food production is a major driver of that loss (Antonelli et al., 2020; Williams et al., 2020; Thrupp, 2000). Modern food systems are highly homogenised, with nearly 90% of global calories deriving from a small set of commodity crops, despite hundreds of established food crops (Capone et al., 2014; Antonelli et al., 2020). Such structural dynamics undermine dietary diversity, food and nutrition security, and overall food systems resilience due to associated environmental footprint, while marginalising minor and traditional crops across value chains. In response, diversification, particularly through the partial reintroduction of neglected and underutilised crops (NUS) or through forgotten varieties of modern commodities, has been promoted to off-set some of the low agrobiodiversity risks and enhance future food and nutrition security (van der Merwe et al., 2016; Mustafa et al., 2019; DEFRA, 2020; Medina-Lozano et al., 2021).

NUS used here interchangeably with 'minor', 'traditional' or 'forgotten' occupy a small and often informal niche in the contemporary food systems (Sarkar and Sensarma, 2019; Antonelli et al., 2020; Lara and Ryan, 2025). Beyond definitions, multiple strands of evidence indicate their potential contributions, supporting food production in rural and under-researched agricultural settings (Mayes et al., 2012), providing adaptive traits for climate, abiotic and biotic stresses, and potentially helping in crop breeding programmes (Padulosi et al., 2007; Negri et al., 2009; Maxted et al., 2014; Lara and Ryan, 2025). Furthermore, these crops, in their *in-situ* environments, help to sustain biocultural heritage, which can conserve agrobiodiversity and traditional foods through use across gastronomic landscapes (Kuhnlein et al., 2009; Jacques and Jacques, 2012). While minor crops retain roles in parts of the Global South, those have been significantly marginalised in high-income and industrialised contexts such as the UK (van Zonneveld et al., 2023). Still, pockets of *in-situ* diversity persist, with increasing roles of small-hold growers and seedbanks, illustrating how food

This article is part of a special issue entitled: Spain Gastronomy Conference 2025 published in International Journal of Gastronomy and Food Science.

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<https://doi.org/10.1016/j.ijgfs.2026.101688>

Received 16 October 2025; Received in revised form 1 April 2026; Accepted 3 October 2026

Available online 8 October 2026

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Table 1
Business case study protocol followed during the study.

A) Overview of the Case Study	- Mission and Goals of the Case Study - Case Study <i>Hypothesis</i> and <i>Propositions</i> - Theoretical Framework (<i>Value Chains, Markets, Investments and Policies</i>) - Role of the protocol in guiding the case study (<i>Protocol serves as the agenda for the line of inquiry, linking the project's aim, objectives, research questions – see supplementary material S1</i>)
B) Data Collection Procedures	- Names and Details of key Contact Persons (<i>cooperation agreement template</i>) - Data Collection Plan (<i>Roles of people to be interviewed, types of documents to be reviewed</i>) - Expected Preparation prior to Field Work (<i>scoping review of documents and benchmarking</i>) - Recording equipment and location selection (<i>London, company headquarters</i>)
C) Protocol Questions	- Development of interview questions based on the research questions (<i>scoping review of documents</i>) - Application of questions during a mock interview - Modification of questions based on evidence from mock interview and consultations - Development of a final set of questions and prompts
D) Findings - Analysis and Presentation	- Transcription of Audio Recordings - Fact checking with interviewees, (<i>reception of final agreement for the use of the generated data</i>) - Data Extraction - Written Analysis and presentation

heritage and agri-food institutions can co-produce agrobiodiversity outcomes (SASA, no date; Negri et al., 2009; Maxted et al., 2014d; Martin et al., 2023).

Realising the potential of minor crops and varieties requires visibility and legitimacy across markets and value chains, not agronomic feasibility alone (Bloom and Hinrichs, 2011a,b; Brannan et al., 2023). This is equally important in high-income economies, where diversified supply can strengthen resilience and sustainability (Dwivedi et al., 2019; Borelli et al., 2020; Pinto et al., 2022). However, the organisation of minor-crop chains remains poorly characterised. Current literature defines these resources as frequently informal, lightly regulated and weakly measured, obscuring how actors coordinate supply, price, quality and risk hedging (Mortensen and Smith, 2020; Sánchez et al., 2022). Gastronomic actors, particularly independent chefs, may contribute distinctive mechanisms for value translation and demand creation, reframing biodiversity as flavour-led practice and thus normalising ‘seasonal’, ‘local’ and ‘forgotten’ procurement (Pereira et al., 2019; Moreau and Speight, 2019; Azam-Ali et al., 2024).

The aim of this study is to identify barriers and facilitators to reintegrating minor crops and varieties into food value chains. This is achieved through examining an existing case-study’s dynamics of minor crops value chains, and to explore how such insights can support the broader reintegration of forgotten crops into food systems, contributing to enhanced food and nutrition security at both, local and global levels (Dwivedi et al., 2019; Azam-Ali et al., 2024).

2. Methodology

The single case-study approach was selected as an appropriate design for this study and was based on an existing food wholesaler in the United Kingdom. This decision was founded on the *unusual* and *revelatory* paradigms of the nature of the business entity selected as per the criteria suggested by Yin (2009).

Sampling strategies for single case studies are limited in scope. The first step in sampling for particular case study research was based on the Screening of Case Study Nominations (Yin, 2009). Case Study Nominations were developed through online market searches and expert advice between May 2021 and June 2023, targeting UK based food businesses that are involved in growing, redistribution and processing

Table 2
List of identified interviewees with the role-name and seniority-level presented. Interviews took place at the company headquarters in London in June 2023.

Interviewee Number	Interview Date/Time	Interviewee Name	Role in the Company	Role Level in the Company
P1	in blanco	in blanco	Clients Relations Manager	(Sales Team – Senior)
P2	in blanco	in blanco	PR and Events Manager	(Brand Team – Senior)
P3	in blanco	in blanco	Head of Food Programmes	(Product Team – Senior)
P4	in blanco	in blanco	UK Sourcing Manager	(Sourcing/ Product Team – Senior)
P5	in blanco	in blanco	Head of Supply Chain	(Sourcing – Senior)
P6	in blanco	in blanco	Communications Manager	(Brand Team – Senior)
P7	in blanco	in blanco	Head of Education	(Education Department – Senior)
P8	in blanco	in blanco	Training and Research Assistant	(Education Department – Junior-Mid)

products made from forgotten and underutilised crops and varieties. There was only one eligible case study from across the UK that fulfilled the criteria.

The business selected for the case study met the criteria as a *unitary* example from the sector of the market and creates a perfect model for answering the research questions posed. A case study protocol has been created and followed through the data generation and the methodology used (see Table 1).

The business entity selected for this research project was a medium sized limited company with around 70 staff members (referred to from now on as “business”). The business’ main field of operation includes wholesale, retail and consultancy but also with certain product processing/manufacturing capabilities. The business is actively working with various actors from across the food systems interested in underutilised and neglected crops, for example, heritage farmers, orphan growers, independent chefs and educational institutions such as schools, colleges and universities. To create a representative sample from the case, the non-random, snowball sampling technique was followed, yielding a diverse panel of participants. Upon the identification of the lead interviewee, a total of 8 candidates have been selected and successfully interviewed. Each participant had a different background area and therefore contributed to forming a representative case sample (see Table 2 for the interviewee list).

The semi-structured and open-ended interviews have been

Table 3
The six-step thematic analysis process adapted from Braun and Clarke (2006) and utilised in this research.

Phase	Process
Familiarisation	Transcription of source data and repeated reading and informal analysis.
Initial Coding	Systematic application of subcodes and codes. Defining key codes emerging.
Identifying themes	Systematic identification of emerging themes based on collated codes and subcodes.
Reviewing themes	Level 1 analysis: check themes work in relation to the coded extracts. Level 2 analysis: generate a thematic map to show analysis.
Defining and naming themes	Further analysis and refinement of each theme. Create clear and unambiguous definitions for each theme. Mapping the overall themes.
Reporting	Selection of extracts that illustrate the map and relate clearly to the analysis, research question and existing literature.

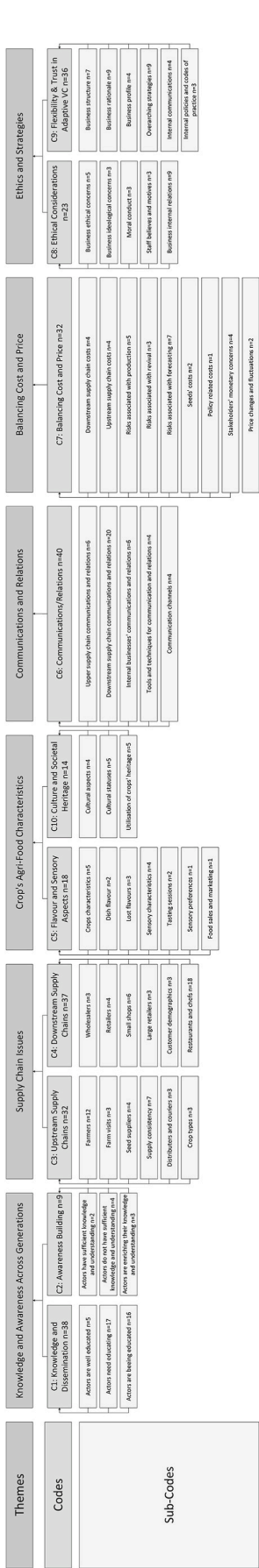


Fig. 1. Hierarchical representation of themes, codes, and sub-codes generated through interview data analysis. The diagram visualises the structure and relationships between analytical categories. n denotes the number of individual quotations contributing to each sub-code and their aggregation within corresponding codes.

conducted face to face, in English and at the headquarters of the company located in London. Each of the interviews has lasted approximately 45 min. Questions and prompts have been used to support the interviewing process where the guide questions were used (see [supplementary material S1](#)). The interview questions and prompts material have been prepared prior to the interviews as were based on the findings from a scoping review of documents to tailor the questions accordingly. The review was conducted on documents released by the business case study prior to April 2023. The interviews have been audio recorded, transcribed, and analysed using NVivo Pro 14 software programme. The analysis followed the thematic analysis procedures outlined by [Braun and Clarke \(2006\)](#), the steps of the analysis are presented at [Table 3](#). Tables have been designed using Microsoft 16 Visio tool and Figures using Python (Pandas library) within Google Colab.

3. Results and discussion

The thematic analysis generated six interconnected themes that show how forgotten crops circulate within their value chains, including gastronomy and the wider food systems (see [Fig. 1](#)). These six themes demonstrate both barriers and opportunities for reintegrating minor crops into contemporary diets. The following sections present the six themes sequentially. Each theme begins with a brief overview, followed by illustrative coded extracts and accompanying qualitative analysis and interpretation. Although presented separately, the themes are interconnected and should be considered collectively as part of a coherent analytical narrative highlighting the central role of chefs, wholesalers and growers in shaping resilient food value chains.

3.1. Theme 1 - Knowledge and awareness across generations

Issues linked to initial knowledge and understanding of minor crop value chains by consumers has been highlighted as a key limitation to their popularisation. The findings suggest that targeted and tailored educational campaigns, by the value chain actors, could help to boost acceptance and facilitate uptake of forgotten crops through smart diversification strategies ([Marra et al., 2012](#)).

3.1.1. Knowledge dissemination

Consumer acceptance, amongst other reasons, depends significantly on familiarity with the product ([Saitone and Sexton, 2017](#)). Poor understanding of the nature of minor crops and derived products, as well as associated negative connotations (cultural/economic) with such foods, are likely to function as barriers to their popularisation amongst new consumers and users such as chefs ([Villa et al., 2005](#); [Saitone and Sexton, 2017](#)).

P5C1: "... many people don't even know what varieties are ((crop varieties)) ..."

The generational decrease in the overall understanding of how modern food systems operate is likely to be a key driver in the decline in knowledge (P2C1) about traditional and minor foods, further disincentivising the consumers, as well as other actors, from participating in their revival ([Kneafsey et al., 2008](#); [Azam-Ali and Jahanshiri, 2022](#)).

P2C1 "... it's a generational problem ((loss of understanding)). It's not going to be solved overnight ..."

Both public and private food system's actors have made efforts to popularise minor crops and traditional foods through various understanding and knowledge-building campaigns. For example, the FAO have highlighted their role in the Food Security and Nutrition Report ([UNICEF](#)) and Yolélé, a company from West Africa, popularises the use of ancient grains such as fonio ([Robinson and Book, 2024](#)). Nevertheless, current market conditions highlight the challenges associated with food market saturation, particularly the proliferation of product choices that may overwhelm consumers ([Cohen and Babey, 2012](#)). This challenge

may be particularly relevant to minor and underutilised crops within the same commodity category, such as grains or legumes, where the introduction of numerous varieties could intensify market competition without necessarily increasing meaningful consumer choice. Consequently, excessive product diversification may contribute to consumer confusion and reinforce unsustainable consumption patterns, potentially undermining the intended benefits of promoting greater food diversity.

It is worth highlighting the fact that, while many modern crops are produced at large scales as commodities, for example peas, rye and chickpea, their geographical areas of occurrence are not uniform. Despite being grown as major crops in one geographical area, they may be entirely neglected in another, even in scenarios where historical cultivation previously took place. This is often evident in the presence of commodity crop landraces that are able to grow under environmental and geographical conditions that are unsuitable for their improved versions. Furthermore, due to changing environmental conditions, there are significant shifts in various biotic stresses that many crops are prone to. Therefore, their future capabilities may be influenced by different factors, resulting in changes in the way and locations in which these crops are grown (McClatchie et al., 2024). This could mean that, for users, crop landraces and other neglected species may become more stable and predictable sources of food, whilst the agricultural sector undergoes significant change.

P5C1: "... people might be familiar with like six different varieties of apples in the supermarket. But you know, I'll grow 60. How do you get that level of information? ((how do you communicate that information to your customers?))"

These issues associated (P5C1) with knowledge and understanding of minor crops translate directly into specific educational needs. Education around forgotten and underutilised crops should therefore also account for potential system-level bottlenecks, whereby their wider adoption, although desirable, could in certain cases lead to unintended and potentially unsustainable practices (Lara, 2025). For example, the widespread promotion and use of a single traditional cultivar may inadvertently narrow diversity, resulting in other, potentially more valuable, genetic resources remaining neglected *ex situ*. Furthermore, incentivising farmers to diversify production systems with, for example, landraces, may lead to the application of modern, input-intensive agricultural practices to their cultivation (Raza et al., 2025). This may be counterproductive, as many landraces have been selected for specific biotic and abiotic conditions that may no longer exist, and their conservation value is often better maintained through low-input systems or stewardship by seed guardians, rather than through chemically intensive agriculture (Azeez et al., 2018). Lastly, the successful reintroduction of a forgotten crop or vegetable does not necessarily imply that its cultivation practices will align with sustainability criteria, highlighting the need to consider not only what is grown, but also how it is grown within evolving food systems.

3.1.2. Awareness building

Simultaneously, popularising minor crops through educational campaigns can also lead to similar challenges in understanding, particularly among downstream food system actors such as consumers. While increased visibility and awareness are essential for driving demand, simplified or decontextualised messaging may overlook the complexity of how these crops are produced, valued, and sustained within local agro-ecological systems (Lara and Ryan, 2025). As a result, there is the risk that consumer-driven demand reinforces narrow preferences, standardisation, or inappropriate production practices. Therefore, effective information sharing and education must go beyond promotion, equipping consumers with a more nuanced understanding of origin, cultivation practices, seasonality, and diversity within crop species. In doing so, downstream actors can play a more informed role in supporting sustainable and resilient diversification, helping to align

demand with practices that preserve, rather than erode, agrobiodiversity.

Consumers as well as other actors might develop negative connotations due to incorrectly targeted information-sharing campaigns, resulting in conscious dislikes towards abductively marketed minor foods (Reisch et al., 2013).

P5C1: "... education and information overload and people not being familiar and having, like, this familiarity grinding them.....that's a big barrier."

On the other hand, current literature states that well targeted educational campaigns can have significantly positive impacts on health and sustainability-oriented consumer purchasing habits (Irfan and Bryla, 2024). Therefore, similar approaches targeting the agrobiodiversity and biocultural characteristics of minor crops could also be commenced. Some of the extracts presented below point towards such approach undertaken and school level to familiarise and educate pupils about principles of sustainable food systems such as seasonality and locality. Those could likely be used as platforms for future educational campaigns, more specifically about minor crops.

P7C1: "... I go into schools, and we do a whole thing on why seasonality matters ((in schools, following questions might be asked)) Guys can you tell us what the weather's like in spring? What's it like in summer and winter and autumn? What kind of crops grow then?"

According to the FAO (UNICEF), chefs are recognised as "key actors of change" due to their creativity and influence on eating trends (P7C1 quote), enabling them to shape consumer behaviour and practices across both the upstream and downstream segments of the food system. Furthermore, creating supply and value chain through which the often-disconnected actors, such as growers, processors (chefs and industry) and consumers are linked, could enhance the minor crops visibility and applicability, especially when discussed in relation to gastronomic landscapes (Pereira et al., 2019).

P7C1: "... ((chefs)) have knowledge of how to use things ((referring to special varieties)). Beyond that connecting the kitchen to the farm home cooks need help knowing what to do with something or how to prepare it ((referring to crops))."

The issues circulating knowledge and education are grounded in access and availability dilemma, as are mostly inaccessible to the generic consumer, either due to unfamiliarity, price disparities or market absence.

Here, chefs may act as key actors within the value chain, connecting farm and fork and enabling feasible diversification through the integrated popularisation of minor crops via menus. In this context, gastronomy functions not merely as an endpoint of the system, but as an active mechanism of translation, where crops are recontextualised through flavour, culinary preparation, and food narratives (Moreau and Speight, 2019). This role has been observed in relation to organic foods, where certified organic products, despite higher price points, have progressively been integrated into institutional settings such as canteens, contributing to wider consumer exposure and normalisation (Curtis and Cowee, 2009; Garcia et al., 2023; Zambrano Nuñez et al., 2023).

Such processes have the potential to elevate overall consumer awareness, particularly in societies that have become increasingly disconnected from the provenance of their food, and to facilitate the development of sustained future demand. Importantly, this effect may be further amplified when combined with the biocultural dimensions of neglected crops, including lost flavour profiles and associated histories. In this sense, chefs do not only introduce new ingredients, but actively construct meaning and value around them, positioning forgotten crops within contemporary food cultures (Moreau and Speight, 2019; UNICEF).

3.2. Theme 2 - Supply chains issues

Common barriers to food systems diversification with minor crops are often associated with either inadequate production volumes, uneven distribution or supply chain disturbances. These issues also affect other, complex commodity-crop supply chains, however, the strategies to tackle these issues often differ and tend to be unique in the minor crop scenarios (Porter, 2001).

3.2.1. Upstream supply chains

One of the key challenges that any food retailer faces is access to sufficient products through a stable supply chain (Rucabado-Palomar and Cuéllar-Padilla, 2020). In minor crops' value chains, their mere nature impacts production rates significantly, forcing existing wholesalers and retailers to develop alternative means of maintaining stable supply, while preserving the sustainability and locality claims (Forsythe et al., 2015; Dudekula, 2025).

P4C3: "... with some of the forgotten edibles, often there's difficulty in providing a consistent supply."

P2C3: "I would love to source exclusively ((local)) from one grower in the UK. But in reality, they ((small local growers)) can't provide the price or the consistency of supply."

The findings, as evidenced above (P4C3 & P2C3), indicate that sourcing minor crops becomes more economically viable when drawing from a broader pool of suppliers – a practice somewhat aligned with the approaches adopted by larger wholesalers (Schmitt et al., 2015). However, in the context of minor crops, such suppliers are typically micro-scale enterprises, which could, in turn, hinder the effective implementation and scaling up of strategies aimed at promoting greater crop diversity and sustainable food consumption.

P2C3: "... If we were to use or replace our chickpea for a British grown legume or pea, we need about 15 to 20 tonnes a year and we would probably want that from a single grower ... ((challenges in sourcing lesser-known varieties))"

P1C3: "From a wholesale perspective, the challenge for small growers is quantities ..."

One of the key challenges in establishing minor crop farms, especially in developed economies such as that of the UK, is high risk, underpinned by significant start-up costs (Sánchez et al., 2022). Interestingly, the data presented below suggests that this particular business has emphasised long term strategies to mitigate such issues as highlighted by P4C3.

P4C3: "... we sourced 15 varieties of different kinds of tomatoes that are being grown in the same field in seven different places this year in the UK and the idea is that every year they ((farmers)) grow more and they save ((save their own seeds))."

Emphasizing that the initial risks associated with redistribution as well as costs with cultivation and the development of on-farm practices have been absorbed by the business, in hopes of establishing a new, trusted and long-term supplier for future operational capabilities.

P4C3: "... so for some growers, they're willing to put in ((effort to grow new/old varieties)), you know, depending on their scale, they might be willing ((to)) put in ... some growers that we work with ..., what is a trial for them? It is the entire production for a small farm."

P2C3: "... how a lesser-known varietal is going to pay for itself, and in order to do that they ((farmers)) need the support of distributors ..."

The aspects presented here clearly illustrate how the business case study, through the integration of tailored approaches to its suppliers, not

only acknowledges inherent risks but actively mitigates them by incubating and supporting the development of future supply. Many of these strategies might also be applicable to operations concerning downstream activities involving restaurants and households. For chefs, a stable supply is a critical aspect of their operations. This does not necessarily imply large-scale availability of a given product, as small and independent restaurants often operate within highly seasonal models. Rather, stability refers to the ability to maintain the supply of a minor crop, even in limited quantities, over a defined period of time and, importantly, across successive years. In this sense, predictability, rather than volume, becomes the key requirement.

3.2.2. Downstream supply chains

Cost is a major barrier across the downstream value chains and the efforts to help to mitigate that by the distributor have also been reported (see extracts below). Such approach not only ensures that products reach the end consumer but also create opportunities for the upper-stream actors to grow their operations and ensure more stable and higher yielding future (Sánchez et al., 2022). Furthermore, the downstream influences are not limited to cost absorption but also include efforts to help to popularise the products through the previously mentioned bio-cultural traits that many of these minor crops possess.

P5C4: "... so, we've had to put our prices up, but we've tried to absorb them ((the spikes in prices)) as much as possible and we want to try and then encourage sales ((referring to ancient corn and bean varieties)) of that product by also encouraging the culture and the heritage ..."

Still, cost is a major limiting factor in distribution and marketability of minor crops, as these tend to be more expensive when compared to their commodity relatives. Stable supply chains also depend on the ability to execute the push model, through which the business interacts with larger buyers, such as chain restaurants (Porter, 2001; Jang and Klein, 2011; Marra et al., 2012). These actors tend to operate on stricter budgets that are centrally monitored, and despite creating effective distribution channels, can also create issues with stable demand.

P1C4: "... a big barrier for us is if a restaurant wants to work on GP ((gross profit)) margins and has very strict ways of doing that ((sourcing in new products)) ... everything has to be put into a system and pre-approved ((for purchasing))."

P1C4: "Chain restaurants, we really struggle with, because often they have to be signed off by several people ... ((contracts)) ... also recipe testing is something that's very challenging ... ((in chain restaurants))."

Large-scale establishments provide a sufficient and stable source of income for many growers, as they operate at high volumes. However, as discussed above, their operational nature often marginalises crop diversity, as cost-driven models tend not to accommodate it. In recent years, however, there has been a notable shift, with large-scale caterers increasingly adopting low-carbon meals - an approach that would have been considered difficult to implement only a few decades ago (Jones et al., 2025, Özer et al., 2025). This shift may indicate that similar operational changes could be extended to biodiversity-oriented food provision in the future, suggesting that even cost-sensitive systems can adapt to broader sustainability priorities.

On the other hand, smaller restaurants run by chef-proprietors represent key actors that not only provide stable demand, as highlighted previously, but also operate within less complex and more informal structures, which facilitate more agile and effective decision-making as noted by P1C4.

P1C4: "A restaurant is requesting a product that no one else wants and it's potentially very expensive for us to transport and it doesn't make logistical or financial sense for us to get that product ((delivered or bought in if new))."

However, it can also create value chains popularising the crops through innovative gastronomic concepts (Pereira et al., 2019). Yet, these value chains can at times be very fragmented and the pull strategy could lead to unfeasible requests in terms of delivery and availability of minor ingredients.

3.3. Theme 3 - Crop's agri-food characteristics

Apart from the efficiency and financial aspects, the characteristics of minor crops are essential elements in their valorisation and establishing effective value chains (Forsythe et al., 2015; Westling et al., 2019). Significant proportion of existing literature focuses on breeding, agricultural and nutrition characteristics of underutilised and neglected crops (Stamp et al., 2012). Little or no attention is given to other, also valuable aspects such as those of sensory and culinary nature.

3.3.1. Flavour and sensory aspects

Varietals of crops, such as their landraces are likely to consist of sensory traits that could be utilised to create competitive advantage for their growers and end users (Lara and Ryan, 2025). Yet, the sensory reservoirs of many of these crops have yet to be explored formally, specifically when referring to those crops that are preserved *ex-situ*. On the other hand, *in situ* preservation, such as that done by small-scale growers, allows for full exploitation of their various characteristics, including those of flavour.

P2C5: "So, I think it's seasonality ((it is important)), but it's led by flavour. So, we will check with the products to see what they're tasting like, maybe they need another couple of weeks before they get good before we start using them ((flexibility in approaches))."

Utilising such traits through effective valorisation methodologies, has the potential to also increase awareness, educate and attract potential investors and create opportunities for wider impact across the food systems (Kneafsey et al., 2008).

P6C5: "... that's all he ((potential investor, private or public)) needs to try ((a peach)) to know that's something worth investing in as a country. Like, let them ((policy makers)) experience that flavour and that can like turn the whole system on it, with flavour."

This example highlights not only the importance of flavour but the culturally grounded societal connection to food experiences and associated connotations to food heritage.

It is through breeding initiatives that primarily agronomic, and later nutritional, characteristics in modern crop cultivars have been prioritised (Stamp et al., 2012). This is understandable, as the primary goal of any breeding programme is to maximise yield and minimise overall on-farm risk. However, the diversity of other characteristics, particularly those related to flavour and texture, has often been marginalised and, in many cases, diminished over time. Landraces of modern crops and other traditional cultivars may still possess more favourable or distinctive sensory traits. This does not necessarily imply that they hold a competitive advantage over commercial-grade cultivars within wider food systems; rather, their value may emerge in more tailored, small-scale applications, for example through collaboration with chefs, where such unique traits are actively sought and appreciated. This has been observed in studies on heirloom tomatoes (Villena et al., 2023), pea landraces (Westling et al., 2024) and texture in melon landraces (Lázaro and De Lorenzo, 2015). On the other hand, forgotten fruits and vegetables may encompass entirely neglected flavour profiles which, if revitalised, could contribute to the development of novel gastronomic experiences (Stocks, 2009). Importantly, for such approaches to be successful, these unique sensory traits often need to be contextualised within compelling narratives, and forgotten crops frequently carry rich biocultural histories that can support their reintroduction and appreciation (Lara and Ryan, 2025).

3.3.2. Culture and societal heritage

The biocultural characteristics can also function as important leverage points for attracting wider audiences and establishment of feasibly aligned supply and demand scenarios. Forgotten crops have "timings of change" (Ryan et al., 2022) and are a rich reservoir of cultural and societal significance across the globe. This is not only limited to indigenous supply chains but also occurs in more complex economies such as those of Italy, France or even the UK (Negri et al., 2009; Maxted et al., 2014d; Lara and Ryan, 2025). A good example of that is the Scottish landrace barley "bere barley" that has a successful story of reintroduction due to its rich biocultural heritage and emotional attachment that is preserved by local communities since the 8th century (Newman and Newman, 2006; Mahon et al., 2016; Drosou et al., 2022). Chefs play particularly important roles in these micro value chains as can help to preserve the varieties through use (Moreau and Speight, 2019).

P7C10: "... our responsibility with a chef audience is to tell them ((the chefs)) how it's ((the variety)) being grown, what the characteristics ((are)), how the characteristics have been like, exacerbated by that growing method by that seed selection by that kind of cultural knowledge that is handed down from generation to generation ... ((as opposed to giving them recipes))."

P6C5: "... that's why in every region that we launched ((new products)), we launched to chefs, we start selling to chefs because chefs create that access point. If people are out there eating, eating food and like, maybe try new varieties, but they're leading with flavour and they're starting by understanding the ways that something can be cooked and the way it can be added to a dish then actually that's kind of subconsciously building up that knowledge base."

These various biocultural connotations are not only important for food and nutrition preservation but can also be utilised by enterprises to function as feasible and potentially scalable business models. The associated information, however, must be communicated via adequate channels to mitigate the generational loss in food literacy (Wijayaratne et al., 2018; Begley et al., 2019).

3.4. Theme 4 - communications and relations

Communication channels and cross-actor relationships are extremely important in any supply chain. Usually, the more fragmented the supply chain, the higher the need for direct and personal communication, as opposed to larger entities that tend to rely on more indirect approaches facilitated by complex IT systems (Porter, 2001). In minor food value chains, as evidenced in the retrieved data, the business' staff are likely to maintain very approachable, on demand and simple communication channels.

P4C6: "Anything that we're buying direct from a farmer, they get my full attention ((including)) my personal WhatsApp, we communicate all the time."

Interestingly, the exemplars listed here indicate that the level and form of communication within this business remain relatively consistent, regardless of the size of the upstream actors involved. This pattern may be influenced by the notable disparities in scale among the case study's suppliers, which could necessitate a standardised approach to communication across the supply chains (Martin et al., 2009; Lokanathan and Kapugama, 2012).

P4C6: "One thing I think we do certainly differently ((compared to other businesses)), yeah, I don't treat a small grower ((different communication)) any different than a large grower."

Another layer in the informal communication channels is the level of trust between the associated actors. The mutual dependency tends to facilitate trust building between the actors along the same value chain

(Forsythe et al., 2015; Rucabado-Palomar and Cuéllar-Padilla, 2020; Dudekula, 2025). In the case of minor crops, expertise from potential competitors is also acknowledged as beneficial and information sharing seems to be more open than in traditional commodity value chains (Katsikouli et al., 2021).

P6C6: “Long term relationships with our customers, it has to be like a long-term journey. That's why it's a revolution we have to onboard people ((actors from the supply chain)) and get them involved or else it's just an information overload.”

The maintenance of high trust environment is also important in the preservation of sustainability orientated practices such as seasonality and locality (Kottila and Rönni, 2008; Macready et al., 2025).

P4C3: “... there's a lot of trust that we have at the foragers that we work with everywhere, from Cornwall to Sussex to Essex to Wales, and all the way up in the Highlands in Scotland, where there's a lot of feedback in terms of “this is the maximum that I can do”, which is sustainable ((the produce)). ((Interviewee quoting previous conversations)) “I can't do this and can't do that. And I just try to do my best to balance everybody and, you know, keep continuity, ((which is)) one of the biggest barriers.”

Furthermore, that level of trust and informal communication channels is also manifested through the lack of formally written contracts and other documents between the business and the growers and independent restaurants. On the other hand, personal relationships would be maintained to facilitate the efficiency in communication while ensuring that all actors across their respective value chains continue to derive mutual benefits (Bloom and Hinrichs, 2011a,b; Stevenson et al., 2011; Hastings et al., 2016).

P3V6: “Having growers like [person D], we can talk about his name, but he won't tell anybody else in the UK because we have that sort of an understanding, nothing written, nothing signed but that trust.”

P7C6: “... the account managers would take a group of chefs to see a farm ... ((they would also go)) to see the opera with six or seven chefs, that's the ((level of)) engagement ...”

These interactions are underscored by associated costs and risks and must therefore follow adequate price point strategies to ensure profitability, which could be a barrier forming aspect due to elevated cost for the consumer.

3.5. Theme 5 - Balancing cost and price

The issues circulating around cost and financial incentives have already been discussed at various themes, as are core to the existence of any supply and value chain. In the case of minor crops, there are challenges associated with adequate pricing, marketability and therefore, value distribution (Forsythe et al., 2015; Rucabado-Palomar and Cuéllar-Padilla, 2020; Dudekula, 2025). This occurs when interacting with upstream actors such as growers:

P1C7: “... the way we source and what we choose to pay growers, frequently we come up against price ...”

as well as through interactions with downstream actors such as restaurateurs:

P6C7: “... that's a huge challenge ((asking restaurants to pay more for old varieties)). But like you say, I think actually that's why we feel like restaurants play such a key role in this ... ((increasing sustainability)).”

A good example of the pricing difficulties is manifested through inadequate and often misaligned forecasting. This is due to unstable supply and demand scenarios that have been discussed previously, as well as the development of spontaneous characteristics and traits in the

minor foods (Westling et al., 2019). Standardisation and consistency are extremely important for the maintenance of any supply chain and need to be mitigated adequately (Bloom and Hinrichs, 2011a,b; Stevenson et al., 2011).

P1C7: “... If a chef is testing their summer menu in February, how do we ensure that we can even give them a price for the Summer ...”

Often, the barriers are linked to financial obstacles. Still, in order to maintain the trust and adequate relationships, as well as the establishment of stable supply chain in the near future, the business tries to invest into the growers and create opportunity for their development. This is seen as a key strategy for ensuring long term business growth opportunities (Stevenson et al., 2011).

P2C7: “((referring to an example)) ... we're going to take a hit on our ((profit)) margins on the understanding that in five years' time, that we're going to be paying half the price to this grower because their ((farmers')) costs are going to go down ...”

Despite the commercial, profit-driven nature of these businesses, some of the strategies identified, such as cost absorption, reflect principles of corporate philanthropy and suggest that business decisions are shaped not only by financial considerations but also by the ethical and moral values underpinning their operations.

3.6. Theme 6 - Ethics and strategies

Every business must establish its own ethical and ideological positions, which often are reflected in mission and goal statements, serving as tools for more targeted communication with customers and investors (Porter, 2001; Stevenson et al., 2011). In the case of this business, however, a formalised mission statement is absent; instead, its guiding values and intentions are conveyed more informally.

3.6.1. Ethical considerations

The preservation of the company's core values, centred on the widely recognised principle of environmental sustainability is primarily achieved through their practical implementation. Decision-makers actively align the business with suppliers and buyers who share similar ethical missions and objectives, thereby enhancing the feasibility of pursuing long-term moral commitments through the creation of stable income streams (Carroll, 2016). This strategic orientation is evident in the company's engagement with small-scale, sustainable growers and restaurateurs. Furthermore, the cultivation of trust, open communication, and effective information sharing reduces the likelihood of conflicting interests and supports the resilience of these value-based partnerships (Hastings et al., 2016).

P1C9: “... the philosophy ((aspect)) is complicated. Do ((business case study)), want to be associated with that product from a brand ((level?)).”

In instances where existing stakeholders alter their business models or diverge from previously shared values, the case study business may need to exercise its intermediary power to prompt appropriate responses from value chain actors. This proactive role enables the business to uphold its core values, particularly those related to environmental sustainability, despite emerging tensions or conflicting interests. By doing so, the business reinforces stability across its long-term value chains and ensures continued alignment with ethical and strategic priorities (Porter, 2001; Flynn et al., 2016; Cravero et al., 2021). This approach complements the company's informal mission expression and its commitment to working with like-minded partners, as previously discussed, highlighting the importance of relational management in maintaining cohesive and resilient supply networks.

P7C8: “... we've just had chefs every year being like “we want British tomatoes”, and we've ((referring to the business case study)) said

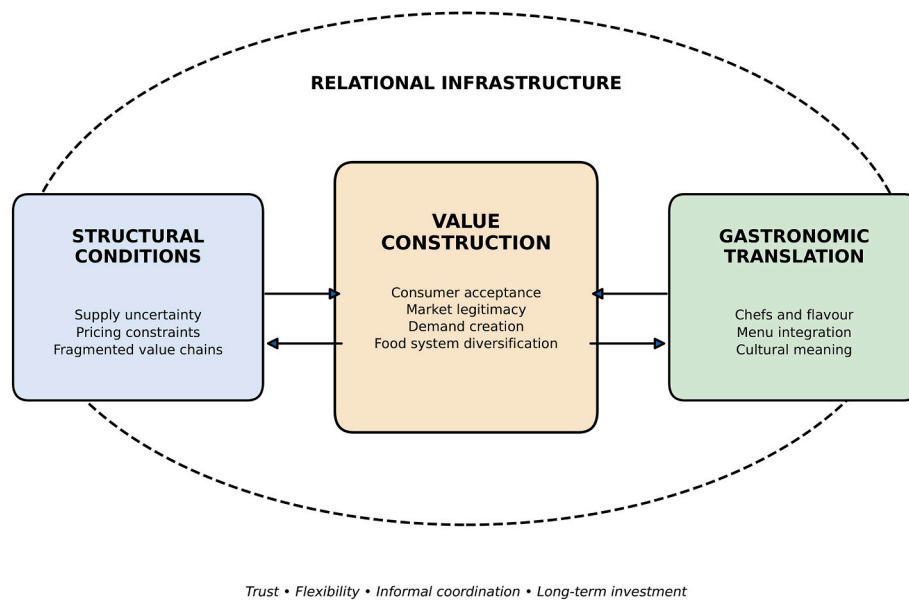


Fig. 2. Conceptual model of value construction in forgotten crop systems. Value emerges through the interaction between structural conditions and gastronomic translation, generating consumer acceptance, market legitimacy and demand, and supported by relational infrastructure.

they're not good. We're not gonna sell them. We're not gonna sell them to you - like we could, but we're not going to."

3.6.2. Structure

Simultaneously, the business case study tries to minimise the interference with their actors, specifically the restaurateurs, to allow for that flexibility in approaches to maintenance of their own value chains (Paciarotti and Torregiani, 2018; Royer and Simon, 2023).

P1C8: "... we will be so careful not to interrupt our relationship with restaurants."

Yet, the flexibility in approaches is a crucial element in the maintenance of the fragmented, personalised and short supply chains.

P8C8: "... if it's not tasting great, we're going to switch this week and see how things happen. I think we're all ((referring to different teams)) very flexible here, and as a result of that trust between the chefs and the account managers, there is that flexibility as well ..."

As evidenced above, the ethical and moral standards that pre-set the business activities are in-fact core to its operational capabilities and are manifested through the various themes discussed in this section (Stevenson et al., 2011; Wu et al., 2021). Educational and knowledge sharing campaigns together with marketing approaches across upper and downstream value chains as well as financial initiatives, all together, form the business model that is unique to minor crops.

Furthermore, the various chefs and restaurants, facilitated by intermediary businesses such as the case study presented, have the potential to form a new, hybrid business model that enables feasible diversification of food systems with neglected and underutilised crops. Through close collaboration with growers and flexible procurement practices, these actors can co-create demand that is aligned with seasonal availability, small-scale production, and crop diversity. In doing so, they reduce market entry barriers for minor crops while maintaining economic viability. This model relies on trust, communication, and shared risk, allowing niche products to circulate within value chains that prioritise adaptability, thereby supporting both sustainability and resilience within contemporary food systems.

3.7. Discussions

This study advances current debates on forgotten crops by demonstrating that their marginalisation within contemporary food systems is not primarily a consequence of agronomic or technical limitations, but of how value is constructed, mediated, and recognised across inter-connected actors. The findings suggest that conventional framings of supply chains as linear and efficiency-driven systems are insufficient to explain the dynamics of minor crop integration. Instead, the value chains observed here operate as relational infrastructures, where trust, informal coordination, and flexibility are not peripheral features but central mechanisms through which uncertainty in supply, pricing, and demand is actively negotiated.

In this context, gastronomy emerges not as a downstream endpoint, but as a critical site of value translation (see Fig. 2). Independent chefs function as intermediaries who convert agronomic diversity into culturally and sensorially legible forms, thereby reshaping consumer expectations and legitimising previously marginalised crops. This reframes flavour from a passive product attribute into an active driver of system change, through which broader values such as seasonality, locality, and heritage are materially experienced. The findings therefore challenge the tendency within existing literature to privilege nutritional or agronomic traits, highlighting instead the underexplored role of sensory and experiential dimensions in enabling food system diversification.

Furthermore, the study complicates the assumed tension between economic viability and ethical commitment. The observed practices, such as strategic cost absorption, long-term supplier investment, and selective partner alignment, indicate the emergence of hybrid value chain models that integrate commercial and value-driven logistics. These findings suggest that the reintegration of forgotten crops is contingent not only on market development, but on the capacity of actors to sustain relational and ethical commitments over time. As such, diversification should be understood as a socio-cultural and organisational process, rather than solely a technical or policy challenge.

3.8. Study limitations

A primary limitation of this research is its reliance on a single case study design. Given the inherent complexity and dynamic nature of the

Implications to gastronomy

This study demonstrates how gastronomy can operationalise agrobiodiversity. Independent chefs act as change agents who translate crops into flavourful dishes, building demand and normalising seasonal and local procurement. Trust based and flexible relationships across growers, wholesalers and kitchens stabilise and de-risk the very fragmented value chains and help to absorb price shocks - key for sustainable supply chains. For food science, these findings point to needs in sensory characterisation, nutritional profiling and postharvest research on minor crops to support forecasting, pricing and quality at scale. Diversifying crop portfolios increases micronutrient access and buffers disruptions linked to commodity concentration, advancing food security and public health. Practically, there are three key levers to utilise: targeted education for consumers and culinary professionals, investment in flexible procurement and fair pricing, and cross-sector partnerships linking growers, chefs, consumers and policy makers. Positioning chefs and flavour as evidence-based levers can accelerate the integration of forgotten crops into mainstream diets while progressing sustainability, resilient food supply, food security and nutrition.

food systems, such an approach may restrict the generalisability of the findings (Chowdhury, 2023). However, the selected case is considered representative of the niche sector in which it operates within the United Kingdom, offering valuable insights that can inform broader discussions on sustainability and value chains in similar contexts. Another limitation is linked to the nature of the data generated, as its analysis, interpretation and presentation can be subjective in nature due to its qualitative form. Future studies in this area should focus on the exploration of similar businesses in other countries to facilitate a more cross sector understanding of the phenomenon. Furthermore, future studies could also be based on a cross-value-chain analysis, interviewing various actors from farm to fork along the supply chains, such as chefs.

4. Conclusions

A better understanding of the barriers and facilitators to the diversification of food systems with forgotten crops can not only raise their visibility among stakeholders but also guide researchers and policy-makers towards more effective interventions. This study identified key challenges such as mismatches between supply and demand and the lack of clear pricing structures, both of which limit the broader uptake of minor crops.

Yet, the informal and flexible nature of these value chains allows for adaptive and creative utilisation as well as preservation due to continued engagement and use. Many minor crop cultivars perform well commercially when utilised by creative and independent chefs through innovative menu creation, facilitated through effective inter-sectoral communication, trust and farm to fork relationship building. All the actors from along the food systems, specifically growers, farmers, wholesalers, retailers, chefs, and consumers can reduce risks and strengthen diversification efforts through more tailored, context-aware value chains designs.

This understanding also equips local governments and policymakers with clearer direction on where to focus support, ensuring that food systems diversification contributes to greater food and nutrition security, economic opportunity, and cultural preservation. While the potential of forgotten crops is evident, it can only be realised by addressing the persistent structural and institutional barriers that continue to limit their use.

CRediT authorship contribution statement

Szymon Wojciech Lara: Writing – review & editing, Writing – original draft, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization, Visualization. **Amalia Tsiami:** Supervision, Project administration, Methodology, Investigation, Formal analysis.

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Non applicable.

Ethical statement

Full ethical approval was provided by the University of West London Ethical Committee (UREC).

Funding statement

This research has not received any funding and was completely self-funded by the authors.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors acknowledge the input from colleagues and PhD supervisors received throughout the manuscript preparation.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijgfs.2026.101688>.

Data availability

The data that has been used is confidential.

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