frontiers | Frontiers in Sustainable Food Systems

TYPE Original Research
PUBLISHED 09 December 2024
DOI 10.3389/fsufs.2024.1436214

OPEN ACCESS

EDITED BY
Raquel Santiago Barro,
Universidade Federal de Viçosa, Brazil

REVIEWED BY
Tanice Andreatta,
Federal University of Santa Maria, Brazil
Pablo Murta Baião Albino,
Universidade Federal de Viçosa, Brazil

*CORRESPONDENCE
Corrado Ievoli
✉ ievoli@unimol.it

RECEIVED 21 May 2024
ACCEPTED 30 October 2024
PUBLISHED 09 December 2024

CITATION
Belliggiano A, Ievoli C, Bispini S and Conti M (2024) Food value chains configurations and resilience of rural mountain communities: three dairy business models in central Apennines (Italy). *Front. Sustain. Food Syst.* 8:1436214. doi: 10.3389/fsufs.2024.1436214

Food value chains configurations and resilience of rural mountain communities: three dairy business models in central Apennines (Italy)

Angelo Belliggiano, Corrado Ievoli*, Sara Bispini and Mauro Conti

Department of Agricultural Environmental and Food Sciences, University of Molise, Campobasso, Italy

The research was held in "Alto Molise," a mountain area embedded in a small region of southern Italy, focusing on the dairy value chain of the "caciocavallo cheese," historically rooted in the socio-ecological system of the mountain reference landscape. The local production system connects the environmental setting (i.e., permanent grasslands and meadows), livestock farming skills (linked to the pastoral heritage like traditional transhumance practice), the production of dairy goods (still partially made with craft techniques), and socio-cultural heritage (e.g., mountain farming and artisan culture). In particular, the focal value chain of caciocavallo cheese in Alto Molise involves local natural and socio-cultural resources, it is also linked to other value chains (such as tourism and meat production), and its development can contrast socio-environmental depletion of the territorial capital in Alto Molise, according to the different business models operating in the value chain. This chain is organized around the cheesemakers who hold a market power compared to others, even though the breeders are the ones to rely on the uniqueness of the natural resource units. This form of governance leads to high value creation but with a low efficiency of value distribution. Indeed, the market structure and power relations for each stage of the chain process resulted in oligopsony for milk production and milk collection, while the milk processing has the characteristic of monopolistic competition. The analysis resulted in a strong weakness of the farmers, which may threaten the very economic sustainability of the value chain. In order to represent the situation, the research identified three ideal types of business models to outline their interaction with the socio-ecological system at different stages of the value chain (production, processing, retailing, and consumption) and their impact on territorial capitals and on the resilience of mountain rural communities, including adaptation to climate change and reverse depopulation: *model A—Network* var*iant*: cheesemakers use only local raw milk establishing fair economic and social collaboration with local breeders; M*odel B—Market* var*iant:* cheesemakers use pasteurized milk produced in the area, in Italy or in the UE for a more "industrialized" production process, *model C—Autonomy* var*iant*: breeders/milk producers are also cheesemakers in this case. At the production level, the environmental capital and the socio-cultural capital and intangible cultural heritage enter the value chain mainly through business models A and C. Business model B allows this connection and valorization only based on the specialization and dairy enterprise reputation, connects with territorial capital of the production stage of experiential tourism and meat value chains, and the actors as processors and family businesses, but not on the territorial capital of the production stage as landscape based on the interaction of agriculture with

the natural habitats. This implies a shift in the production model toward a more industrialized one with raw materials from outside the area and stable farming models with common permanent grassland and meadows less engaged in the chain.

KEYWORDS

food value chain, rural development, socio-ecological systems, assemblage, dairy, livestock farming and pastures

1 Introduction

Development of rural areas is a key underpinning focus of the EU: recently, the European Commission adopted a 'long-term vision for rural areas'[1] which aims to develop strategies to make rural Europe 'stronger, connected, resilient, and prosperous' by 2040 by strengthening synergies between territorial cohesion and agricultural policies. Many of the most deprived and underdeveloped rural areas are also mountain areas; indeed, our research focuses on mountain value chains and their impact on processes of socioeconomic regeneration in the framework of the VII goal of the rural vision (entrepreneurial, innovative, and skilled people, co-creating technological, ecological, and social progress).

Mountain regions provide a large amount of goods and services whose benefits reach not only communities living within the mountains but also in their area of influence (Egan and Price, 2017). All these elements could be strategic resources for local economic actors for market competition, whereas the peculiar environment and distinctive processing conditions make mountain foods special high-quality goods, while mountain landscapes and nature are relevant tourist attractions. Nevertheless, mountains are fragile areas affected mainly by two problems: depopulation and climate change. On the one hand, the population decrease is a long-standing occurrence that is reducing the human presence in these areas, affecting not only mountain agricultural production but also the ecological balance of mountains. On the other hand, climate change is a quite recent event that is redefining temperature and rainfall regimes, with consequences for the vegetative cycles of plants influencing, for example, agricultural production, the health of livestock, wildlife, and pollinating insects. For this reason, climate change is also a driving factor that increases the depopulation trend, accelerating the damage to these areas with significant consequences in the mountains but also in valleys and cities.

Our research builds on the conceptual and analytical framework (CAF) of the project MOVING (Mountain Valorization through INterconnectedness and Green growth)[2] (Moretti et al., 2023) that supports the empirical analysis of contribution of value chains to the development of mountain areas through identifying potential leverage points for resilience and sustainable development combining Ostrom (2007)'s socio-ecological system (SES) and value chain analysis (VCA), as the material flows that value chains mobilize originate within an SES.

Mountain areas can be described as SES, a complex set of relationships and connections involving not only natural aspects but also human communities with their culture and economic activities strictly related to the local environmental conditions.

When applied to complex systems such as food systems (Ostrom, 2009; McGinnis and Ostrom, 2014), the SES framework needs to be broadened to include value chain activities beyond primary transformation activities (Marshall, 2015). Indeed, food production and distribution systems, and their internal food chains, are paradigmatic examples of SES that are complex and dynamic, influenced by humans, and which result from the interaction between the environment, ecosystems, and social institutions (Ericksen, 2008).

In the proposed CAF, VCA generalizes the mutual influences among actors and value creation in local SES through practices at different stages of the value chain (production, processing, retailing, and consumption) assuming that the extent of the value that actors can create is influenced by the economic, social, and ecological resource systems of the area, which determine the territorial capital, composed by economic capitals, social capitals, and environmental capitals.

This paper integrates the CAF with a VC analysis through business models (BM) to provide a concrete basis for understanding the contribution of value chains to the sustainability and resilience of mountain SES and to facilitate the identification of reference points to stimulate transformations in value chains that increase the resilience of SES in mountain areas through specific BMs. The VC analysis through business models incorporates and combines environmental, social, and economic dimensions over a long-term perspective toward sustainability. The framework of components—value proposition, value creation and delivery, and value capture—can then be used to structure environmental, social, and economic activities within the business model and position them for improved sustainability (Knudson, 2023).

Business models describe the design or architecture of the value creation, delivery, and capture mechanisms employed (David, 2010; Osterwalder and Pigneur, 2010) and the business logic of an underlying company by a combination of interdependent offering, market, internal, and economical business model components in a static and dynamic way beyond the company's borders (Burkhart et al., 2011). Indeed, when applied to food systems, there is an increasing development of BM based on innovative producer–consumer relationships (f.i. presumption in Ziemba and Eisenbardt, 2015); in particular, Boschma (2005) gives particular emphasis to the issue of consumer trust as an element that can change the dimension of organizational proximity (Ievoli et al., 2018).

1 https://rural-vision.europa.eu/rural-vision/shared-goals_en

2 The project has been coordinated by the University of Cordoba, more details can be found here: https://www.moving-h2020.eu/ (accessed on 1 October 2023).

The inclusion of the territorial capitals in the business models can be reconducted into a new form of business model innovation (BMI) that in recent years has occurred by incorporating the sustainability concept into the goals and processes of the firm. Sustainable business model innovation (SBMI) (Ferlito and Faraci, 2022) brings a change in how a firm operates to create positive impacts or reduce negative consequences for the environment and society. In the specific case of this paper, the territorial capitals are assumed as a starting point, so the research focuses on the impact of different business models on territorial capitals and SES and how it affects the competitiveness of the VC.

Into this extended CAF, the research also integrates an assemblage theory approach to understanding complex systems that emphasize fluidity and relationships between entities (Moretti et al., 2023).

The resulting approach is an 'extended' value chain analysis based on business models that takes a holistic view of how the social practices are assembled within sectoral or subsectoral value chains and business models as part of wider rural development processes (Fabre et al., 2021) aiming at identifying micro(economic) foundations (BM) of intermediate structures (value chains) affecting the resilience of the mountain SES. From this perspective, the SES approach offers a promising opportunity for effective integration of climate change impacts and responses in development planning and increases SES resilience to climate change in society, with positive effects on population loss.

The objective of the paper was to verify the explanatory capacity of the conceptual framework summarized above in the case of a mountainous area in central southern Italy with reference to the cheese of caciocavallo, a cured product obtained from a specific processing of spun paste derived from cow's milk.

From the processing of spun paste, fresh and cured products (f.i. caciocavallo) are obtained.

2 Materials and methods

2.1 Research framework for analysis of value chain within the MOVING project

The empirical results presented below are based on the guidelines developed under WP4 of the MOVING project, aiming at analyzing the current diversity of VCs (as part of socio-ecological assemblages) in Europe to assess their potential contribution to the sustainability and resilience of different regions.

The MOVING approach goes beyond the conventional VCA to a more extended VCA approach that focuses on the assemblage of actors and practices within an SES. The boundary of the specific local system is the 'Mountain Reference Landscape' (MRL).

The value chain is composed of a network of organizations that are involved in a variety of activities that are required to bring a product or service from design to delivery to final consumers (Christopher et al., 2004). A value chain is the mesolevel perspective between individual firms and the abstracted economic sector. The key elements of focus include contextual understanding; structural analysis (using diagrams); analysis of economic, socio-cultural, and environmental valorization practices; and understanding of specific governance and institutional arrangements in the MRL.

The extended value chain analysis looks beyond the 'farmgate' to understand the manufacturing, service, and policy practices that influence how value is added through the process of converting mountain assets into a final product sold in the market. VCA seeks to understand how these practices have economic, social, and environmental consequences as part of wider rural development processes (Fabre et al., 2021).

Therefore, the research starts with asking for an overall narrative of the current VC performance and how it is related to the specific mountain territorial capital, before diving into data collection, to allow this holistic vision to guide the data collection.

The investigation adopted the 'Russian Doll' approach—whereby all partners produce relatively simplified representations of their value networks but are encouraged to supplement the simple overviews with more detailed analysis of particular aspects of interest that advance the MOVING objectives and interests of their multi-actor platform (MAP) (Feo et al., 2022) as defined later on.

It is important that the final VCA describes the current performance of the VC in each MRL in a way that can be understood and used by the relevant local stakeholders.

The methodology used comprehends three overall methodological steps:

a. An extended value chain analysis through desk review and interviews,
b. Participatory workshops with the actors, and.
c. A vulnerability and sustainability assessment.

The extended value chain analysis is built on:

a. Desktop review to generate an overview of the current performance of the VC in the MRL, its interactions with other VC(s) in the MRL/MRR (Mountain Reference Region), the larger area, however homogenous, within which the MRL is located.

The desk review focused on a description of the value chain performance and the analysis of its results through a qualitative analysis of the available information on the characteristics of the dairy value chain, such as the focal product and its typicity, the local context of the value chain, its impacts and secondary quantitative data presented as descriptive statistics[3] that provide a factual basis for understanding VC performance. Following the desktop review, interviews not only fill in information that was not available via secondary sources but also explore perceptions and preferences of specific local actors in the MRL that may not be captured in published material.

b. Interviews: the primary data were then collected through 16 semi-structured interviews conducted between January and February 2022 in the municipalities of the MRL. The

3 ISTAT—Italian National Institute of Statistics; ISMEA—Institute of Services for the Agricultural and Food Market; ASREM—Molise Regional Health Authority; AIA (Italian Breeders Association) Bulletin.

interviews aimed to explore the multi-relevant perceptions and preferences of specific local actors and were focused on understanding the structure of the focal value chain (FVC)[4], with practices, actors, flows and outcomes (Figure 1), as well as its conducive enabling environment, spatial analysis, and tele-coupling and interactions with other value chains. The interviews were conducted with a common outline and were transcribed and then organized in homogeneous tables.

c. Participatory workshop: Main aim of the workshops is to verify and add findings created through the fieldwork with a specific emphasis on understanding diverse groups of actors and to establish where additional information or divergent views arise from a collective discussion compared to the scientific analysis of the information before the workshop. The workshop is not supposed to substitute the data collection process that should be carried primarily through fieldwork before the organization of the workshop.

Furthermore, a participatory workshop was implemented, where 17 local and regional stakeholders were also involved. The workshops took place in the municipality of Agnone (29 May 2022). In addition, the actors were divided between members of the multi-actor platform (MAP) and non-local actors. The multi-actor platforms are defined as a space of interaction among different stakeholders, with different interests. The interactions can not only create both tension and conflicts but also give opportunities for mutual understanding, building confidence, social learning, and engaging in joint action to achieve common goals.

The two groups followed different methodologies: MAP members (9) were expected to provide knowledge on the FVC functioning through a group discussion on the findings from the desktop analysis and interviews. The non-local actors (8) brought specific knowledge to cover the gaps (e.g., activities outside the MRL that are important to discuss) through a presentation distributed in electronic form. The information gathered in the in-presence participatory workshop was further supplemented by conducting interviews with four experts from different sectors (animal husbandry, cheese-making, policymakers, and consumer associations), external to MAP, who constitute an additional component of the group of non-local actors who participated in the in-presence workshop. All the interviews and workshops were audio recorded after giving consent, and the data obtained were coded and analyzed on Excel and Word documents.

d. Vulnerability, Sustainability Assessment, and Resilience Appraisal: According to the Intergovernmental Panel on Climate Change—IPCC, vulnerability to climate change is defined as 'the propensity or predisposition to be adversely affected' (IPCC, 2022). Vulnerability includes many other concepts and elements, including sensitivity or susceptibility to harm and a lack of capacity to cope and adapt through enhancing social–ecological resilience and ensuring social and economic development while maintaining ecosystem services across different scales (IPCC, 2022). In November 2022, a workshop on Vulnerability, Sustainability Assessment, and Resilience Appraisal was held relating to stages of VCA often referred to as 'opportunities and constraints' or 'risk assessments' and relates to the fact that increasingly VCA supplements 'functional' or 'performance' analyses with wider social and environmental assessment of impacts. The general objective of this task was to evaluate the vulnerability and resilience of the value chain assemblage to climate and other changes in the socio-ecological systems within the MRL by assessing responses to drivers in the past and up to the present day.[5]

2.2 Business model framework

As indicated in the introduction, the MOVING approach was cross-pollinated with the business model (BM) framework. Indeed, in the context of the MOVING project, BM represents an innovative relational space realized through the assemblage of actors and the creation of novel practices related to the quality of connections, within the framework of (neo)-endogenous development in which relational spaces are key elements of development itself. BM generates value as an intrinsic characteristic in the management and innovation of a VC, also connecting technology opportunities to market needs.

In order to identify a BM, the conceptual framework proposed in literature suggests considering key resources and competencies, organization (key activities, key partnerships, and networks), and value proposition (customer needs and interaction, channels, and pricing logic) to identify BM through the main empirical methodologies: content analysis, discourse analysis, or surveys.

These different elements defining a value chain, and the data collected on the field during the research have been grouped into ideal types of business models that can describe the different kind of connections and trends inside the FVC and their impact on the SES. It is worth noting that ideal types of business models do not necessarily correspond to business cases found in the field, nor to a quantitative comparative analysis of the businesses.

Indeed, the research assumes a broader and more sociological approach considering the ways in which configurations of practices

4 The Focal Value Chain relies on the focus product and practices that are involved in adding value to the territorial capital of SES (Marshall, 2015).

5 Vulnerability assessment is composed by different steps: Step 1 - identify drivers of change, recognized as threats in our study, are natural or human-induced factors that directly or indirectly cause changes in the system. Step 2: Identifying exposure and adverse effects: identifies the main elements of the VCs and MRL that are exposed and sensitive to the effects of the threats (identified within Step 1). Step 3: Verification of the impacts on VC-A. The narrative of adverse effects primarily reflects the researchers' point of view. The first part of the workshop will therefore be used for verifying the narrative of adverse effects through facilitated discussion with participating stakeholders. Step 4: Exploring adaptive capacity identify the necessary preconditions for the development of the adaptation of the system of VC-A in the context of MRL facing the selected threats for key VC-A elements. It is important to evaluate these preconditions in relation to the possibilities of stakeholders to fulfil these preconditions with the use of endogenous resources (i.e. ability to mobilize), in order to reduce the vulnerability of the VC-A.

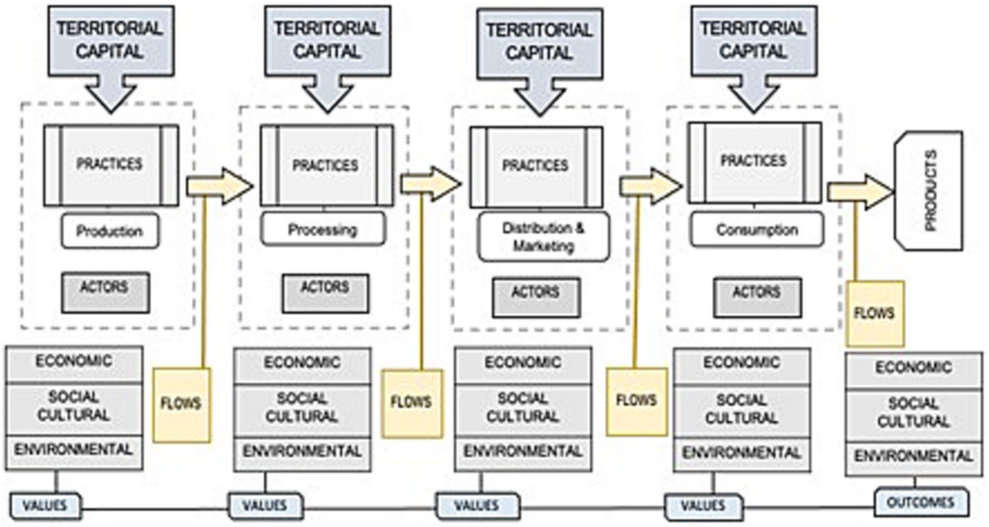

FIGURE 1
Focal value chain framework.

undertaken by actors added value to the full range of mountain territorial capitals and how these flowed across the VC stages (Deans et al., 2018).

The paper presents the context and the socio-ecological system (SES) (3.1) of the caciocavallo cheese value chain in Alto Molise (3.2), including the different stages or sub-systems (3.2.1 production, 3.2.2 processing, 3.2.3 marketing and distribution, 3.2.4 consumption) and the cross-cutting issues (3.3).

Section 4 discusses the main findings of the research and identify the different ideal types of business models active in the focus value chain and in the assemblage value chains and their interaction with the SES. Finally, Section 5 presents the main conclusions, challenges, and policy recommendations emerging from the research.

3 Results

3.1 Context and the socio-ecological system (SES)

Dairy productions characterize several mountain areas of the central Apennines in Italy. The local production system connects the environmental setting (i.e., permanent grasslands and meadows), livestock farming skills (in some cases linked to the pastoral heritage like traditional transhumance practice that has almost disappeared), the production of dairy goods (still partially made with craft techniques), and socio-cultural heritage (e.g., mountain farming and artisan culture).

The empirical research took place in the territory of Alto Molise, a mountain small area embedded in a small region of southern Italy, focusing on the dairy value chain of the "caciocavallo cheese," a symbol of the MRL.

The Alto Molise area suffers from a depopulation trend that, together with difficult soil and climate conditions and the distance from main markets, has an impact on the fragility of its agriculture, as also reported in the analyses carried out in the preparation of the SNAI Alto Medio Sannio and the Local Development Plan of the Alto Molise Local Action Group (De Rubertis and Belliggiano, 2023; Scotti et al., 2023). The noticeable slowdown of the population observed, since the beginning of the 1980s, was reflected in the strong downsizing of the number of farms registered in the same years, generating a negative spiral mutually fed by the two phenomena. The *modernist productivism* of the 1970s and 1980s changed the productive paradigm of the area, introducing and spreading an extractive culture (Wilson, 2001), still perceptible in the MRL. This productive approach influences farmers/breeders in resisting organizational innovations oriented to sustainable rural development, such as diversification aimed at reducing the intensity of production and increasing the quality of the same (Wilson, 2008).

Molise is the second smallest Italian region (NUTS 2 level), belonging to Southern Italy (NUTS 1 code: ITF). The MRL consists of five municipalities (LAU, local administrative units): Agnone, Capracotta, Carovilli, Pescolanciano, and Vastogirardi; all of them are included in the province of Isernia (NUTS 3 level). At the end of 2021, the Resident population of MRL was 8,235 inhabitants. The main part of this area (82.35%) has an average altitude between 600 and 1,200 m.a.s.l.

According to the Eurostat (2020) in the MRL, the utilized agricultural area (UAA) is little more than 7,000 hectares, with a decrease of 8.5% if compared to the 2010 Census, and the predominant part of UAA (approximately 4,000 ha) is permanent grassland and grazing (decreased by 32% compared to 2010).

According to the Census, there are 511 farms (decreased by 12% from 2010) with an average UAA of 14.22 ha, significantly above the regional mean (9.94 ha). Part of these farms directly process their milk into "local" cheese; others sell milk to dairy firms. Overall in the MRL, there are 128 cattle farms with 2,920 head of cattle. There are 52 dairy farms with 1,505 head, 48 beef farms with 835 head, and 28 mixed farms with 607 head.[6]

6 www.vetinfo.it.

3.2 The focus value chain of Caciocavallo

The paper analyzes the dairy value chain in the Alto Molise, focusing on the "caciocavallo cheese," a symbol of the Mountain Reference Landscape. The enhancement and valorization of this value chain involve several local economic actors strictly linked to VC (e.g., breeders, cheesemakers, suppliers of goods and services such as vets and consultants). In addition, local institutions (municipalities, the regional government, and the LAG—local action group) play a role as, for instance, municipalities allocate access to common pastures. Furthermore, this VC is also linked with the tourism sector due to winter/mountain tourism (e.g., in Capracotta town) and rural tourism.

The dairy value chain is historically rooted in the socio-ecological system of the Alto Molise area and the predominant governance of the dairy VC we identify is the small family business governance model. This model uses local resources by organizing the VC around a key actor who holds a market power compared to others, typically the cheesemakers, despite the fact that the breeders are the ones to rely on the uniqueness of the SES resource units, composed of endogenous varieties of botanical grass that characterize the present national grassland resource system (Dean et al., 2021) and the historical addition of the transhumance culture that has produced a unique stock of local knowledge and expertise (Bindi et al., 2022) with positive effect on climate change.

The certification schemes are an important element for the discussion on the FVC: the PDO (Protected Designation of Origin) of Caciocavallo Silano (in whose area of origin the MRL municipalities are included) on one side, or the (Italian) PAT (Traditional Italian Food Product) label (Didonna et al., 2023), or Municipal Origin Denomination (or De.CO.) the municipal certification mark for local food products or gastronomies (D'Antuono, 2013; Fontefrancesco and Zocchi, 2020). These schemes could represent different product differentiation strategies for some breeders and cheesemakers operating in the area.

Indeed, according to ISME (2020) Qualivita Report, the PDO and PGI cheese sector in Italy shows an increase in consumption by 5% and a contribution to the value of production up by 10% compared to the year before the reference year (2018).

The consumption trend on the large-scale retail trade side is increasing for PDO and PGI products, both in fixed and variable weight (2.9%) and in fixed weight (4.6%). In the first half of 2020, these values show a strong increase of 8.3 and 12%, respectively (perhaps also due to the pandemic distortions of the market). The demand for cheese and milk products represents 82% of the total domestic consumption of milk and dairy products in 2020, of which 28.5% is purchased in traditional shops.

3.2.1 Production

At the production stage, pasture meadows are the main and strongly characterizing element of the spun paste products.

Milk production is allowed partially by tacit knowledge and livestock culture, as well as local and traditional practices related to pasture, such as haymaking, grazing, animal nutrition, milking, milk management and milk delivery, and finally direct milk processing. The main actors of the phase are farmers and breeders working on small family farms where everyone knows how to do everything, sufficiently interchangeable, and in some cases directly transform at least part of their production.

It is important to stress that, although grazing characterizes livestock farming in the area, this practice is being reduced in favor of stable farming models. For this reason, the most commonly used cattle breeds are Friesian cows and Alpine Brunette, and natural resources, specifically common permanent grassland and meadows, are less engaged in the VC.

At the same time, however, all this results in a massification of the product, which, as it no longer comes from animals that are taken to pasture and by an integrated diet with feed coming from outside the area, does not retain the organoleptic characteristics derived from the territory and does not preserve local biodiversity, increasing the risk of extreme weather events.

So, the FVC partly favors the use of grassland and extensive agriculture (for cereal cultivation) and also requires increasing use of water and other external inputs as resources.

The VC of experiential tourism and meat is also assembled at the FVC, in fact, the landscape that is ensured by the subsistence of traditional spun paste production, an abundant biodiversity reserve (enhanced by the nearby UNESCO-MAB reserve), the reputation of traditional practices of dairy and cuisine and transhumance traditions that consumers recognize to the MRL.

The FVC can share, in the production phase, the same practices, territorial capital, and actors with the production of meat VC, which uses the 'beef' product as input for the processing phase, allowing income diversification, as milk production alone does not provide income suitable for farm survival.

3.2.2 Processing

The processing of milk and the production of spun paste is a historical form of livestock product transformation in the MRL. At the processing stage, dairy culture and reputation play an important role in production specialization and relationships.

In most cases, milk collection is carried out by the cheesemakers, using their own means. In other cases, third-party collectors are used to collect the milk from the smaller farms and transport it to the processing establishment, where it is processed or stored. In a few cases, the milk also comes from collection centers outside the MRL area both to reach the critical mass of raw material needed by some companies in the area and to facilitate the realization of the Caciocavallo Silano PDO, whose specifications include the territory of the MRL as well as that of the region, together with that of the other four regions of the central southern Apennines.

The spun paste cheese obtained (mainly mozzarella, stracciata e caciocavallo) goes to the next stage in order to be purchased and sold but can also be directly sold from cheesemakers in their farm and/or specialty shops. In addition, milk processing enables the preservation of traditions about dairy production and the creation of employment.

Since the actual small family business governance model organizing the FVC around the cheesemakers as key actors who holds a market power compared to others, dairy culture and reputation play an important role in production specialization and relationships.

About assemblage the FVC in this stage connects with experiential tourism VC based on dairy tradition and reputations, craftsmanship, and ancient family businesses, LAG and municipal institutions for local promotion (pro-loco) and associations and on Consumption (experience in mountains), local experts, environmental, and hiking guides.

These connections rely mainly on the reputational and traditional aspects of cheese-making and the environmental aspect linked to the traditional model of production and processing. In this context, the self-processing of milk (which we later defined as model C—autonomy variant) has a crucial role in promoting the assemblage with experiential tourism and meat VC practices.

3.2.3 Distribution and marketing

For what concerns distribution practices, almost all the analyzed firms have a farm shop on the same site as the dairy or a sales point in the village or in other municipalities, where the direct sale of products takes place, thus creating a short supply chain. In the case of supplying specialty shops, non-contractual relations are identified, as for relationships established with local customers, based on interpersonal ties, on the reputation built up, and on customer loyalty, while contractual relationships (e.g., the most important processors of the reference area) are established with large-scale distribution and "extended" relationships, which involve shipments in Italy and abroad.

After packaging, the product is distributed in the following possible combinations:

a. At the company's points of sale, forming the so-called short supply chain practices established in this stage regarding direct sale (both for local and touristic consumers) and tasting, as well as retailer network organization, e-commerce, and traditional trade.
b. At specialty shops, also through the mechanism of attempted sales, often developing informal relationships, as for relationships established with local customers, based on interpersonal ties, on the reputation built up, and on consumer loyalty.
c. At large retailers, developing formal relationships on a large-scale distribution involving shipments in Italy and abroad, again developing a short supply chain, establishing direct contact between producer and consumer.
d. Through the e-commerce channel, allowing for an enlarged market toward foreign countries and sales diversification.

Regarding marketing practices, two types have been identified: (a) traditional marketing, which coincides with the sales practices listed above and with the tendency to create stable contracts and (b) relational marketing, which is instead more consumer-centered marketing and the practice of welcoming, exercised above all in the two principal dairies but also with a lot of potential in the emerging small businesses. The two most important dairies use relationship marketing to establish relations with visitors by opening the doors of their dairy plants. These relational marketing approaches promote the territory, participation in the production process, and experiential approach ending in consumer loyalty.

The assemblage value chain on experiential tourism focuses on the relational marketing practices of direct sales and tasting coupled with e-commerce, mainly promoted as a family business with a strong focus on the emerging small businesses allowing to spread out the experiential tourism in the territory through farmhouses and bed and breakfast models. The territorial capitals on product reputation and naturalistic value of the area enter into the distribution and marketing stage of both value chains.

3.2.4 Consumption

Consumption practices generate reputational feedback and involve actors such as regulars and tourists. The demand for spun paste cheese from Alto Molise mostly comes from Italy.

With regard specifically to consumers of Alto Molise dairy products, from the interviews conducted, different types of consumers emerged, which can be classified as follows:

Local clients: loyal to a specific dairy, who consume both fresh and cured products and who, during periods of crowding due to tourism, have priority for the purchase of products.

Tourists: who often ask for the cured product because it is easy to transport and who tend to consume the fresh only during the days they stay overnight. They often place orders online once they return.

Customers of the specialty stores: that are aware of the product's origin and quality. These are often delicatessens, where it is possible to find traditional products of the Apennines.

Contests and trends of Gourmet consumers oriented by cheese contests that encourage internalization.

Large-scale distribution clients: the large-scale distribution sector is evolving in the direction of traditional products (setting up spaces for traditional specialties).

The consumption practices of VC products are identified as follows:

At the place where the consumption takes place, two types of consumption exist: domestic, whose supply takes place on the local market and occurs either daily or occasionally, and non-domestic consumption, which, for example, takes place in local restaurants.

These activities can increase milk requests that may stress the local environment or increase the stable farming model. It is also possible that market attention on "tradition" will put the relevance of the new small businesses more integrated into the socio-ecological system and dairy VC in the area.

3.3 Cross-cutting findings

In organization and promotion, actors from the FVC relate to the tourism VC ones concerning guided tours of the cheese factories; events with tasting of cheeses and other products of the territory (cold cuts, etc.); and cultural events related to traditions or other experiences associated with pastoralism. In addition, the flow of milk and cheese of the FCV Production stage enriches the tourism services flows of the accommodation countering depopulation.

The assemblage with an additional value chain on experiential tourism (Figure 2) focuses on territorial capital, actors, and practices in common between the consumption stage of the FVC and the experience in mountains stage of the additional VC on experiential tourism.

The territorial capitals on food traditions and pastoral culture of the FCV are shared with the territorial capitals of the additional VC as food traditions, sheep tracks, and historical sites.

The local consumers, gourmet/foodies, and tourists of the FVC are connecting with the environmental and tour guides, local experts, and historical companies of the experiential tourism VC, in order to connect ethical consumption and excursions, including visiting workshops and laboratories (Figure 3).

Most part of the market value of the FVC is added during the processing phase, considering that at the point of sale the price of

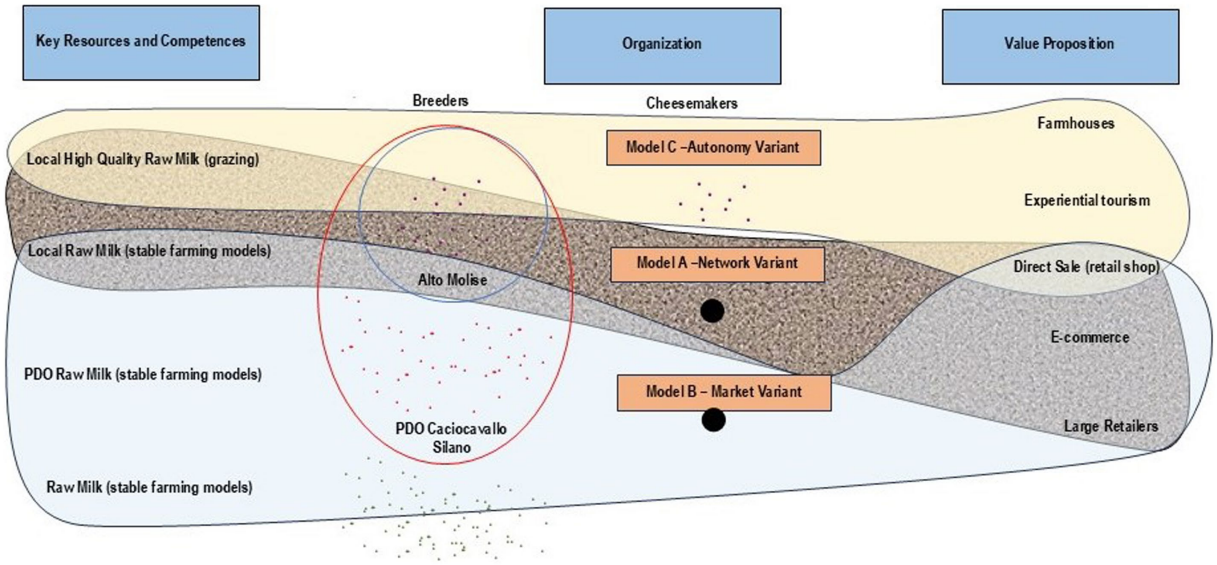

FIGURE 2
Focal value chain—assemblage consumption with different stages.

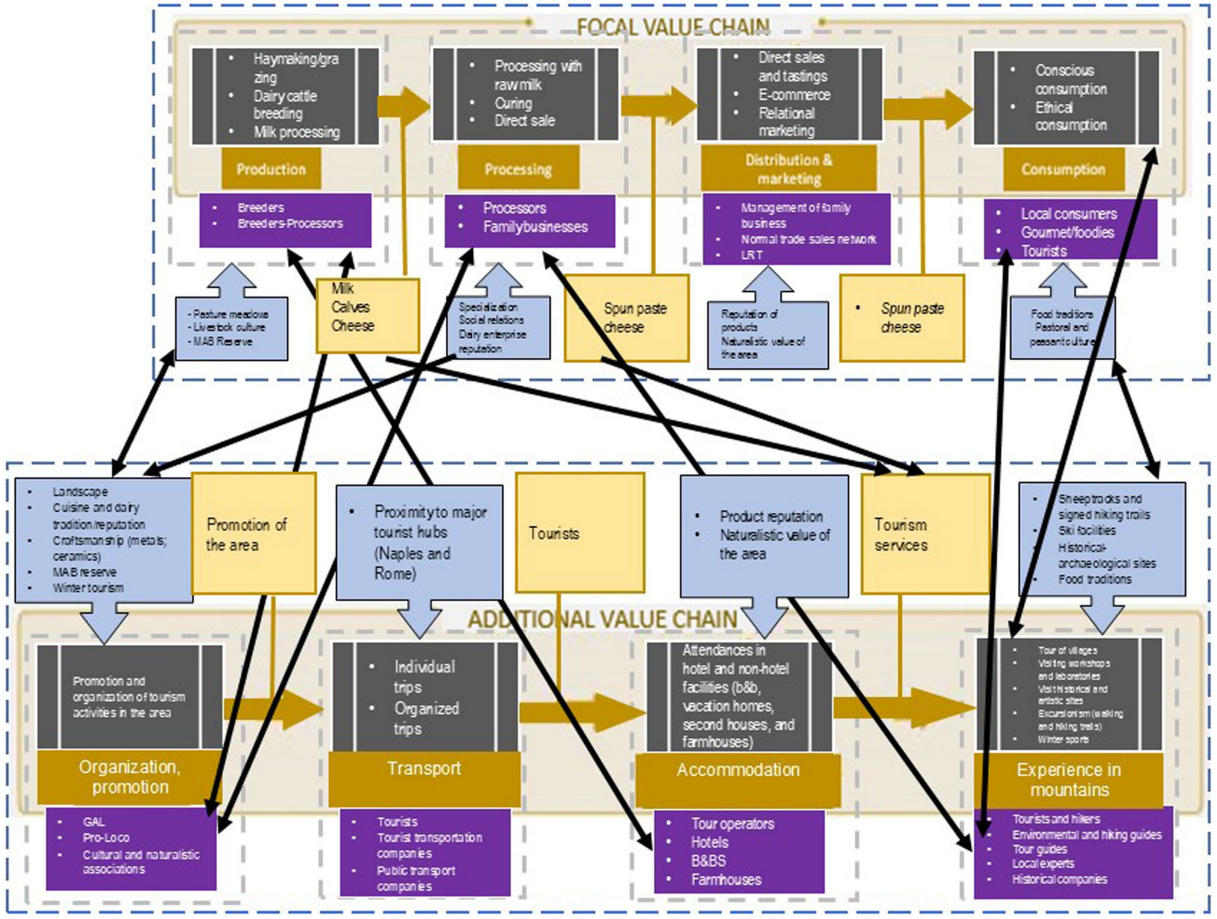

FIGURE 3
Focal value chain analysis through business models.

10.3389/fsufs.2024.1436214

caciocavallo is approximately 13 euros/kg and the cost of milk is 0.5 euros. While at the production stage, the added value is less than 25%, and in the distribution and marketing phase, it depends on the channel: large-scale retail trade, the margin of processors decreases due to asymmetric market power, downloading backward on the prices of the raw material. Therefore, livestock breeding as only activity is not a guarantee of livelihood viability, unless the farmers expand the stables to achieve economies of scale or work on the assemblage value chains. It is possible to make a living from cheese production, its success is also affected by the degree of product differentiation and effective marketing strategies.

From the interviews, the estimation is that the production of raw material is localized in Alto Molise for 25%, and in the rest of Molise and the nearby region of Abruzzo for almost 50%, while the 25% left is coming from the rest of Italy. Processing, distribution, and marketing are localized in Alto Molise while consumption has a strong local component 40% in Alto Molise and similarly 35% in Molise with less than 25% in both Italy and abroad.

Downstream the flows of "fresh" cheese leave MRL to be placed in shops localized in nearby cities, while the flows of "caciocavallo" also reach very distant cities, sometimes abroad, due to its greater shelf life.

An important aspect of analysis is to consider the proportion of economic, socio-cultural, and environmental outcomes for each stage according to the tele-coupling as making visible the connections and flows of materials, information, or money between apparently distant or disconnected socio-ecological systems: (a) the economic outcomes for processing are concentrated in the MRL (Alto Molise), while they are almost equally spread at the regional (Molise) and national level for the production, distribution, and marketing and consumption level; (b) the socio-cultural values are highly concentrated in the MRL for production and processing, with some aspect related to the region of Molise, while the distribution and marketing involve also the national level as the consumption involves the international one; (c) the environmental values are mainly concentrated in the MRL for production, processing, and distribution and marketing.

In milk production, distribution, and consumption practices, there is widespread knowledge of the methods of rearing, grazing, and feeding livestock, together with skills related to milking, of the reference markets, and of traditions, customs, and habits to which the consumption of dairy products and cheese in general is associated. Even in cheese-making practices, there is a greater diffusion of knowledge, but the required skills are practiced by few, so much so that it is becoming difficult to find someone who knows how to do the job of cheesemaker: the practice of cheese-making is widespread, but not everyone has been able to start a process of qualifying the practice. The transfer of knowledge is quite relevant for the inter-generational transition as some companies, however, blame the problem on the lack of interest in the business on the part of the next generation who, driven by other interests or by the low profitability of the company at present, are not willing to follow in the footsteps of their parents or grandparents. This, in some cases, translates into low investment and low motivation on the part of the processors to continue the business.

4 Discussion

The selected dairy value chain in Alto Molise involves local natural and socio-cultural resources, it is also linked to other value chains (such as tourism and meat production), and its development can contrast socio-environmental depletion of the territorial capital in Alto Molise, according to the different business models operating in the value chain, with positive effect countering extreme weather events and depopulation. The marketing strategy stresses the link between the dairy productions and Alto Molise's cultural and mountain rural traditions (e.g., the transhumance tradition) rooted in local natural resources and traditional cheese-making knowledge and skills.

Indeed, local milk production has a vital role in the reputation of FVC that requires and encourages access to natural resources for grazing and haymaking, partly favoring the use of grassland and extensive agriculture (for cereal cultivation) and the use of water as a resource with positive effects on the dynamic management of biodiversity. In addition, the FVC encourages the use of livestock breeds adapted to the conditions of both intensive and non-intensive farming systems. Hence, all four stages of the FVC highly contribute to the existing landscapes.

The main cheesemakers promote innovation processes in dairy VC, particularly in the marketing strategy. In some cases, these actors established a linkage with the haute cuisine sector, hosting activities, and tourism (festivals, tours, etc.). These activities can increase milk requests that may stress the local environment or increase the stable farming model. It is also possible that market attention on "tradition" will put the relevance of new forms of governance model redefining the socio-ecological system and dairy VC in the area.

A risk factor relies on the fact that, although grazing characterizes the livestock farming in the area and the quality of milk, this practice is being reduced in favor of stable farming models. For this reason, the most used cattle breeds changed for some years in favor of Friesian cows and Alpine Brunette, resulting in common permanent grassland and meadows being less engaged in the VC. Currently, there is a trend to return to traditional breeds.

The FVC has a predominantly relational governance model (high complexity of transactions, low ability to codify transactions, high supply base capability, and medium power asymmetry) with high asymmetry of market power, which in part brings it close to the captive model (high complexity of transactions, high ability to codify transactions, low supply base capability, medium to high power asymmetry) and, in some cases, achieves forms of hierarchical vertical integration (high complexity of transactions, low ability to codify transactions, low supply base capability, high power asymmetry) (Gereffi et al., 2005). The crucial transaction concerns raw material milk: not all product specifications can be codified, and some milk characteristics require a level of quality that implies complex interactions between milk suppliers and buyers (Van den Pol et al., 2016). Governance is often managed through family ties or mutual dependency, with spatial proximity playing an important role in building the reputation of the VC. In some relevant cases, there is a high asymmetry that drags the relationship toward forms of dependency (captive) and in some cases even hierarchical dependency.

The dichotomy of production (fresh spun paste cheese/cured cheese) is also reflected in the competition space where the large-scale retail trade

(except specialty cases) provides consumer products at a lower price through industrial production of semi-processed products, preventing the entry of fresh spun paste products in the market. For the semi-cured spun paste cheese, instead, the competition moves toward the company dairies, that is, toward the activity of milk transformation connected to the primary activity of the breeding. Often, the increasing request for cheese in this area brought those who carry out the transformation to do so with too little experience, not caring about the quality of the milk and/or the technical expertise, offering the product as typical of Alto Molise, but at a lower price and not always respecting the quality standards or the artisan practices of production.

The research on the market structure and power relations within it for each practice at the production stage of the VC process resulted in oligopsony for grazing, haymaking, and milk production, all asymmetrical with a high asymmetry for the milk production. For the milk collection, the identified market structure is oligopsony and a high asymmetry in competition, while the milk processing has the characteristic of monopsonistic competition with medium asymmetry (Cavicchioli et al., 2022; Di Marcantonio et al., 2020; Grau and Hockmann, 2018; Madau et al., 2016; Zavelberg et al., 2015; Perekhozhuk et al., 2014; Cechura et al., 2015). The analysis resulted in a strong weakness of the farmers, which may threaten the very economic sustainability or existence of the VC.

This form of governance leads to high-value creation, but with inequity of value distribution: on the one hand, farmers complain that they acquire a small share of the value, which does not correspond to the costs incurred; on the other hand, the value generated by the chain is largely acquired by the downstream segments (Deconinck, 2021; Meyer and von Cramon-Taubadel, 2004; Lee and Van Cayseele, 2022).

In order to represent the situation, it is possible to identify three business models of the FVC, even though each single case can have elements of grazing, housing, milking practices, distribution, and marketing that are typical for different models, covering in different manner the different stages of the VC:

4.1 Model A—network variant

Cheesemakers use only local raw milk establishing fair economic and social collaboration with local breeders. Breeders supply milk according to high-quality standards. Producers prefer raw milk from pasture-based livestock, and its cheeses are in some cases labeled as PAT (traditional Italian food product). Cheese-making knowledge/skills are mostly standardized and acquired through training activities. Relevant sale channels are cheesemakers retail shops, e-commerce, and a sales network in neighboring areas, mainly in the Molise region. In some cases, they promote tourism activities in the area, above all sensorial experiences.

4.2 Model B—market variant

Cheesemakers use pasteurized milk produced in the area, in Italy or in the UE for a more "industrialized" production process. Market relationships characterize connections with local breeders or milk providers. Producers sell different cheeses; local traditional cheese certified DOP (Protected Designation of Origin) mainly for the GDO and standard Italian cheeses (e.g., ricotta or scamorza cheeses). Cheese-making knowledge/skills are mainly standardized and acquired through training activities. Relevant sale channels are cheesemaker retail shops, e-commerce, an own sales network in neighboring regions, and large-scale retail trade.

4.3 Model C—autonomy variant

breeders/milk producers are also cheesemakers in this case. Here, we observe a "deepening" process (Van der Ploeg et al., 2012), a (re) appropriation of downstream phases of the cheese-making process by farmers, rather than by cheesemakers (as per the other models). They mainly use their milk production for the cheese-making process; in some cases, they collaborate with other breeders for milk supply. Traditional cheeses and some standard Italian cheeses characterized their dairy production. The relevant sales channels are their farm shops and, in some cases, e-commerce. Their market area is mainly local or regional.

The certification process could play a role in the differentiation among the three business models and their connections with the territorial capital, but it results in a marginal approach. In principle, the regional and quality assurance processes are the TAP could serve the model A—network variant; while the PDO of Caciocavallo Silano could serve the model B—market variant (but it is utilized only sometimes with the GDO) and, in some cases, voluntary certification is being established to attest to the origin of the milk and the traditional ways of milk processing to connecting directly with the production process for the model C—autonomy variant.

From the research on the four stages of the FVC and the opportunities for assemblage with the Experiential Tourism VC, the TAP could better connect with the territorial capitals of the Alto Molise (MRL). Indeed, at the production level the environmental capital (grassland, permanent mesotrophic pastures and aftermath-grazed meadows, interaction of agriculture with the natural habitats) and the socio-cultural capital and intangible cultural heritage (knowledge and skills about breeding and milking and craftsmanship) are entering the VC mainly through the network and autonomy variant (business models A and C). Model B allows this connection and valorization only based on the specialization and dairy enterprise reputation, connects with territorial capital of the production stage of experiential tourism and meat VCs, dairy tradition and reputations, craftsmanship, and the actors of the FVC as processors and family businesses, but not on the territorial capital of the production stage as landscape based on the interaction of agriculture with the natural habitats. This implies a shift in the production model toward a more industrialized one with raw materials from outside the MRL and stable farming models that accelerate the reputational risk of Alto Molise on the quality of milk. This risk affects the distribution and marketing stage of the FVC and of the assemblage with additional value chains as the representation and reputation of Alto Molise strongly rely on the environmental capital, which only the business models A and C can valorize. Assuming the socio-ecological systems (SES) approach, where human communities with their culture and economic activities are strictly related to the local environmental conditions, the environmental capital plays a crucial role that cannot be overshadowed and disconnected from the socio-cultural one. At the same time, the economic relevance of the localized processing connecting with economic values outside of the MRL has to be taken into consideration to balance the promotion of the FVC.

Tourism, especially in recent years, is a valuable assemblage to the FVC, including in the sense of experiential tourism, which allows the tourist to learn about the area and get in touch with the elements of

territorial capital involved in the value chain (Ruiz Morales et al., 2024; Milojković et al., 2023; Belliggiano et al., 2021; Mihalic, 2016; Saxena et al., 2007). Assemblage with tourism VC is recognized by producers as being increasingly carried out and covers all stages of the focal VC (production, processing, distribution, and consumption), focusing more on the distribution and consumption ones. In particular, at the production and processing stage, agritourism and educational farms have been observed as the emergence of structures following changes in the use of farms (Grillini et al., 2024; Hochuli et al., 2021; Pitrova et al., 2020; Giaccio et al., 2018). At this stage, tourism contributes to the knowledge of the products and consequent direct or distance purchase. However, such assemblage is not entirely spontaneous: for example, the infrastructure network, both road and accommodation, must be intensified. As far as assembly practices are concerned, the ability to build a good tourism product (a multidimensional product integrated with local dairy production) and its promotion is very important.

The assemblage with the meat value chain is the result of traditions that have always seen cheese consumption associated with meat consumption; in fact, the joint production of meat has a centuries-old tradition and is related to transhumance traditions. Assemblage with meat production requires adaptation: a return to semi-extensive forms of livestock breeding using dual-purpose breeds (Orikhivskyi et al., 2022) is called for, and links with the processing phase must be improved, as well as a different type of business structure (diet and animal categorization) and market positioning. At the same time, assembling with meat VC does not create significant conflicts, except for those arising from the greater resistance to milk price fluctuations for farmers engaged in the VC (Zanon et al., 2020; Zanon et al., 2023; Gazzarin and Jan, 2024; Schulze et al., 2023).

While the assemblage with the tourism chain implies complex, bidirectional relationships, connecting different socio-ecological systems, the assemblage with meat involves simpler, often unidirectional relationships: from the focal VC to the meat chain, exclusively with a view to income differentiation, provided that the producers themselves are not also milk processors.

The effects of assemblage on focal VC outcomes on the economic, socio-cultural, and environmental dimensions are different: assembling tourism and meat VCs lead to greater demand (which translates into increased economic value); allow the traditions related to pastoralism and cheese-making to reach more people—also leading to a greater awareness of the focal VC products as tourists who access environmental capital understand its importance and become aware of its conservation and preservation; and allow one to get to know the environment and landscape within which the focal VC practices take place. At the same time, the focus on tourism risks trivializing local traditions and cultural heritage and leading to significant environmental impacts on one side but assembling with tourism can counteract the progressive loss of cultural identity and the productive traditions and know-how characteristic of the area (Belliggiano et al., 2020).

Assembling with other VC practices can lead to considering new actors not being considered in the focal VC, especially with reference to the tourism one (as tour operators; touristic guides; experts of local culture, guesthouse owners, chefs, etc.). Among the actors of the FVC, there is a low level of trust, sharing and participation in decision-making of the same sector, these are quite rare, so everyone just carries on with their own activities, but there is a tendency, also linked to competition mechanisms, to see a tacit 'coalition' of the 'old' companies (models A and B), which have existed for many years, against recently born companies (model C—autonomy variant), which do not come from a tradition of processors and have been supported by RDP funds allowing direct processing of milk by farmers and increasing competition within the MRL. The dispute focuses on respecting traditional production practices, risking ruining the reputation of Alto Molise products.

This lack of trust and cooperation derives from the small family business governance model centered on the dairies, which manage the supply and price of milk, as well as the types of distribution and markets. Public actors play very little part in the strategies, while providing various types of support and aid linked to European and regional programs. The lack of cooperation allowed no innovation in the way the VC is managed due to a strong individualism; however, there is a perceived interest or urgency to identify forms of interactions of a participatory nature. In particular, a cooperative attitude was observed among the main processors both for the valorization of the traditional fresh product (*stracciata*) and on cooperation attitudes in the procurement of raw materials in the condition of crisis (i.e., energy crisis).

5 Conclusion

The research aims at identifying which business model builds a structure of value chain to strengthen the link with the SES.

The three main business models (A—network, B—market, and C—autonomy) that operate in the focus value chains have a different level of sustainability in terms of territorial capitals on the different stages of the FCV, despite the fact that in many cases they are all identified as caciocavallo di Agnone, rather than following other certification schemes.

Indeed, while business models A and C are building on the territorial capitals of the production and processing stages of the FVC, business model B focuses mainly on the territorial capitals of the FVC connected to the processing stage.

In the specific case of the model B—market variant, milk comes from collection centers outside the reference area, and the GDO commercialization relies upon the disciplinary of production of the Protected Designation of Origin "Caciocavallo Silano" that allows using territorial capital and resources outside the Alto Molise. Hence, local raw materials produced in Alto Molise do not characterize the final product, but they are integrated into the product at the same level of dairy production from other areas of the PDO. This results in the fact that raw materials are not selected based on the territorial capitals of Alto Molise, but they are supplied from a broader area (PDO Caciocavallo Silano and abroad) resulting in cost competition and a loss in value of Caciocavallo from Alto Molise.

As was discussed in the different stages of the VC, the FVC is characterized by the quality of milk, relying on grazing in the area for livestock farming, so encouraging access to natural resources of Alto Molise for the supply of grassland and promoting extensive agriculture with livestock breeds adapted to the conditions of both intensive and non-intensive farming systems. Model B—market variant does not rely on the traditional model of production based on grazing, but rather accelerates the tendency to install stable farming models that imply that the most used cattle breeds are changing in favor of Friesian cows and natural resources, specifically common permanent grassland and meadows, are less engaged in the FVC. In this case, when the PDO certification is used, it does not

involve the local identity of caciocavallo cheese production as in model C, for instance.

The tension between the production and the processing stage of the FVC has to do with the "patronage governance model" organizing the VC around the cheesemakers as key actors who hold a market power compared to others and compete at the lowest price through the market variant, allowing for the introduction of raw material from other areas.

At the processing stage of the FVC, dairy culture and reputation play an important role in production specialization and relationships, most of them are made possible due to family businesses and skilled labor.

In addition, milk processing enables the preservation of traditions in dairy production, as cheese-making is an artisanal practice, in many cases handed down from generation to generation, but this tradition is an intangible heritage acquired by the transformation of local raw materials based on the territorial capital of Alto Molise, while the cheese-making not relying on the local traditional productive context based on territorial capitals is downgrading the perception of Caciocavallo as a high-quality product deriving from local traditions.

Although the market position based on the reputation of traditional cheese dairy for high quality is threatened by the exhaustion of the traditional production model based on local territorial capital. This reputational risk also affects the distribution and consumption stages of the focal value chain, where it is crucial the Alto Molise representation and reputation based on the environmental capital of local grazing, on socio-cultural capital of intangible cultural heritage based on tratturi, stories, and oral tales and the economic capital based on local farmers and entrepreneurs.

In addition, the assemblage of FVC with the VC of experiential tourism and meat relies mainly on the reputational and traditional aspects of cheese-making and the environmental aspect linked to the traditional model of production and processing rooted in the pastoral culture. So, the practices of spun paste production, haymaking, dairy cattle breeding, and milk processing promote tourism in the area. The local consumers, gourmet, foodies, and tourists of the FVC are connecting with the environmental and tour guides, local experts, and historical companies of the experiential tourism VC, in order to bridge ethical consumption and excursions, including visiting workshops and laboratories.

More in general, the assemblage with the Experiential Tourism VC and the loss of value of Caciocavallo can increase milk demand with the consequence of stressing the local environment or increasing the stable farming model: in this sense, research as part of the MOVING Horizon 2020 aims at informing the discussion on the Value Chains policy (as the definition of one or multiple PDO) to intervene in order to see how the model B—market variant could complement the competitivity of the FVC and explore how the focus on local "tradition" and resources could overcome the duopoly of the network and market variant to harmonize them with the emerging "autonomy variant" through a new model of governance redefining the relationship among socio-ecological system and dairy VC in the area. In conclusion, the coexistence of different business models allows for increasing the territorial processing capacity and more opportunities for farmers to increase quantities or differentiate through quality products, while ensuring the consolidation of the "Alto Molise" brand also through conventional distribution channels.

The study has limitations due to the data constrained and the limited time window of the research period that would require a comparative and evolutionary analysis over a longer period.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical approval was not required for the studies involving humans because Ethical aspects were dealt with for the H2020 MOVING project as a whole and submitted to the European Commission in a separate deliverable (D 9.1). The summary of these aspects can be found in deliverable 8.3 of the H2020 MOVING project, available at the following link: https://www.moving-h2020.eu/wp-content/uploads/2021/09/D8.3-Data-Management-Plan_Initial.pdf. Therefore, the issues related to consent and data processing strictly followed these guidelines, in particular those provided for WP4, to which this paper refers. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

AB: Conceptualization, Investigation, Methodology, Validation, Writing – review & editing. CI: Conceptualization, Funding acquisition, Investigation, Methodology, Supervision, Validation, Writing – review & editing. SB: Data curation, Investigation, Validation, Writing – review & editing. MC: Conceptualization, Data curation, Methodology, Writing – original draft.

Funding

The author(s) declare that financial support was received for the research, authorship, and/or publication of this article. This research was funded under the MOVING project (Mountain Valorisation through Interconnectedness and Green growth—www.moving-h2020.eu) as part of the Horizon 2020 Programme (grant agreement no.: 862739). The views expressed in this article are solely those of the authors.

Acknowledgments

The authors are thankful to the blind reviewers for their constructive comments and feedback on previous drafts of the paper.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

Belliggiano, A., Bindi, L., and Ievoli, C. (2021). Walking along the sheeptrack… rural tourism, ecomuseums, and bio-cultural heritage. *Sustain. For.* 13:8870. doi: 10.3390/su13168870

Belliggiano, A., Garcia, E. C., Labianca, M., Valverde, F. N., and De Rubertis, S. (2020). The "eco-effectiveness" of Agritourism dynamics in Italy and Spain: a tool for evaluating regional sustainability. *Sustain. For.* 12:7080. doi: 10.3390/su12177080

Bindi, L., Conti, M., and Belliggiano, A. (2022). Sense of place, biocultural heritage, and sustainable knowledge and practices in three Italian rural regeneration processes. *Sustain. For.* 14:4858. doi: 10.3390/su14084858

Boschma, R. (2005). Proximity and innovation: a critical assessment. *Reg. Stud.* 39, 61–74. doi: 10.1080/0034340052000320887

Burkhart, T., Krumeich, J., Werth, D., and Loos, P. (2011). *Analyzing the business model concept — A comprehensive classification of literature*. Shanghai, China: Conference: Proceedings of the International Conference on Information Systems, ICIS 2011.

Cavicchioli, D., Cacchiarelli, L., Sorrentino, A., and Pretolani, R. (2022). Should we cry over the spilt Milk? Market power and structural change along dairy supply chains in EU countries. *Sustain. For.* 14:4756. doi: 10.3390/su14084756

Cechura, L., Kroupová, Z. Z., and Hockmann, H. (2015). Market power in the European dairy industry. *AGRIS Line Pap. Econ. Inform.* 7, 39–47. doi: 10.7160/aol.2015.070404

Christopher, M., Lowson, R., and Peck, H. (2004). Creating agile supply chains in the fashion industry. *Int. J. Retail Distrib. Manag.* 32, 367–376. doi: 10.1108/09590550410546188

D'Antuono, L. F. (2013). Traditional foods and food systems: a revision of concepts emerging from qualitative surveys on-site in the Black Sea area and Italy. *J. Sci. Food Agric.* 93, 3443–3454. doi: 10.1002/jsfa.6354

David, J. T. (2010). Business models, business strategy and innovation. *Long Range Plan.* 43, 172–194. doi: 10.1016/j.lrp.2009.07.003

Dean, G., Rivera-Ferre, M. G., Rosas-Casals, M., and López-i-Gelats, F. (2021). Nature's contribution to people as a framework for examining socioecological systems: the case of pastoral systems. *Ecosyst. Serv.* 49:101265. doi: 10.1016/j.ecoser.2021.101265

Deans, H., Ros-Tonen, M. A. F., and Derkyi, M. (2018). Advanced value chain collaboration in Ghana's cocoa sector: an entry point for integrated landscape approaches? *Environ. Manag.* 62, 143–156. doi: 10.1007/s00267-017-0863-y

Deconinck, K. (2021). "Concentration and market power in the food chain" in *OECD food, agriculture and fisheries papers*, vol. *151* (Paris: OECD Publishing).

De Rubertis, S., and Belliggiano, A. (2023). "La despoblación en Italia. El caso del área interna del Alto y Medio Sannio (Molise)" in *Despoblación y Mundo Rural Europeo Mediterráneo* (Valencia, Spain: Tirant Humanidades), 53–82.

Didonna, A., Renna, M., and Santamaria, P. (2023). Traditional Italian Agri-food products: a unique tool with untapped potential. *Agriculture* 13:1313. doi: 10.3390/agriculture13071313

Di Marcantonio, F., Ciaian, P., and Fałkowski, J. (2020). Contracting and farmers' perception of unfair trading practices in the EU dairy sector. *J. Agric. Econ.* 71, 877–903. doi: 10.1111/1477-9552.12388

Egan, P., and Price, M. (2017). *Mountain ecosystem services and climate change: A global overview of potential threats and strategies for adaptation*. Paris: UNESCO.

Ericksen, P. (2008). Conceptualizing food systems for global environmental change research. *Glob. Environ. Chang.* 18, 234–245. doi: 10.1016/j.gloenvcha.2007.09.002

Eurostat (2020). *Agricultural Census*. Available at: https://ec.europa.eu/eurostat/web/agriculture/information-data/agricultural-censussource: www.vetinfo.it

Fabre, P., Dabat, M. H., and Orlandoni, O. (2021). Methodological brief for Agri-based value chain analyses. Frame and tools: key features. In: *COMMISSION*. ed. A. F. E. (Paris, France: Agrinatura EEIG Rue Scheffer), 42.

Feo, E., Spanoghe, P., Berckmoes, E., Pascal, E., Mosquera-Losada, R., Opdebeeck, A., et al. (2022). The multi-actor approach in thematic networks for agriculture and forestry innovation. *Agric. Food Econ.* 10:3. doi: 10.1186/s40100-021-00209-0

Ferlito, R., and Faraci, R. (2022). Business model innovation for sustainability: a new framework. *Innov. Manag. Rev.* 19, 222–236. doi: 10.1108/INMR-07-2021-0125

Fontefrancesco, M. F., and Zocchi, D. M. (2020). Reviving traditional food knowledge through food festivals. The case of the pink asparagus festival in Mezzago, Italy. *Front. Sustain. Food Syst.* 4:596028. doi: 10.3389/fsufs.2020.596028

Gazzarin, C., and Jan, P. (2024). Sustainable intensification of grass-based beef production systems in alpine regions: how to increase economic efficiency while preserving biodiversity? *Agric. Syst.* 214:103837. doi: 10.1016/j.agsy.2023.103837

Gereffi, G., Humphrey, J., and Sturgeon, T. (2005). The governance of global value chains. *Rev. Int. Polit. Econ.* 12, 78–104. doi: 10.1080/09692290500049805

Giaccio, V., Giannelli, A., and Mastronardi, L. (2018). Explaining determinants of Agri-tourism income: evidence from Italy. *Tour. Rev.* 73, 216–229. doi: 10.1108/TR-05-2017-0089

Grau, A., and Hockmann, H. (2018). Market power in the German dairy value chain. *Agribusiness* 34, 93–111. doi: 10.1002/agr.21529

Grillini, G., Streifeneder, T., Sacchi, G., and Fischer, C. (2024). Comparative analysis of alpine agritourism in Trentino, Tyrol, and South Tyrol: regional variations and prospects. *Open Agricul.* 9:20220281. doi: 10.1515/opag-2022-0281

Hochuli, A., Hochuli, J., and Schmid, D. (2021). Competitiveness of diversification strategies in agricultural dairy farms: empirical findings for rural regions in Switzerland. *J. Rural. Stud.* 82, 98–106. doi: 10.1016/j.jrurstud.2021.01.021

IPCC (2022) in *Climate change 2022: Impacts, adaptation and vulnerability. Contribution of working group II to the sixth assessment report of the intergovernmental panel on climate change*. eds. H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck and A. Alegríaet al. (Cambridge, UK and New York, NY, USA: Cambridge University Press), 3056.

Ievoli, C., Basile, R. G., and Belliggiano, A. (2018). The spatial patterns of dairy farming in Molise. *European Countryside* 9, 729–745. doi: 10.1515/euco-2017-0041

ISME (2020). *Rapporto Qualivita*

Knudson, H. (2023). "Business models for sustainability" in *Business transitions: A path to sustainability*. ed. A. M. Fet.

Lee, H., and Van Cayseele, P. (2022). *Market power, markup volatility and the role of cooperatives in the food value chain: evidence from Italy*. European Review of Agricultural Economics, Oxford University Press and the European Agricultural and Applied Economics Publications Foundation, 51, 844–894.

Madau, F. A., Furesi, R., and Pulina, P. (2016). The existence of buyer power in the Italian fresh milk supply chain. *Br. Food J.* 118, 70–82. doi: 10.1108/BFJ-12-2014-0395

Marshall, G. (2015). A social-ecological systems framework for food systems research: accommodating transformation systems and their products, September 2015. *Int. J. Commons* 9, 881–908. doi: 10.18352/ijc.587

McGinnis, M. D., and Ostrom, E. (2014). Social-ecological system framework: initial changes and continuing challenges. *Ecol. Soc.* 19:30. doi: 10.5751/ES-06387-190230

Meyer, J., and von Cramon-Taubadel, S. (2004). Asymmetric Price transmission: a survey. *J. Agric. Econ.* 55, 581–611. doi: 10.1111/j.1477-9552.2004.tb00116.x

Mihalic, T. (2016). Sustainable-responsible tourism discourse—towards 'responsustable'tourism. *J. Clean. Prod.* 111, 461–470. doi: 10.1016/j.jclepro.2014.12.062

Milojković, D., Nikolić, M., and Milojković, H. (2023). Walking tourism management based on tourists' needs for indoor and outdoor activities in the function of sustainable local economic development. *RSEP* 8, 1–18.

Moretti, M., Belliggiano, A., Grando, S., Felici, F., Scotti, I., Ievoli, C., et al. (2023). Characterizing value chains' contribution to resilient and sustainable development in European mountain areas. *J. Rural. Stud.* 100:103022. doi: 10.1016/j.jrurstud.2023.103022

Orikhivskyi, T. V., Fedorovych, Y. I., Mazur, N. P., and Kryshtal, O. S. (2022). Breeding and genetic features of simmental animals of different production types. *Scient. Mess. LNU Vet. Med. Biotechnol. Ser.* 24, 191–202. doi: 10.32718/nvlvet-a9732

Osterwalder, A., and Pigneur, Y. (2010). *Business model generation: A handbook for visionaries, game changers, and challengers: (self-published)*.

Ostrom, E. (2007). *Sustainable social-ecological systems: An impossibility?*

Ostrom, E. (2009). *A general framework for analyzing sustainability of social-ecological systems science 325*, Issue pp. 419–422 doi: 10.1126/science.1172133

Perekhozhuk, O., Glauben, T., Teuber, R., and Grings, M. R.-L. (2014). Analysis of Oligopsony power in the Ukrainian dairy industry. *Can. J. Agric. Econ. Rev. Can. D'agroecon.* 63, 43–76.

Pitrova, J., Krejčí, I., Pilar, L., Moulis, P., Rydval, J., Hlavatý, R., et al. (2020). The economic impact of diversification into agritourism. *Int Food Agribus Manag. Rev.* 23, 713–734.

Ruiz Morales, F. D. A., Cruz Moriana, V., Bermúdez Rus, M., Mancilla-Leytón, J. M., and Ureña Cámara, L. P. (2024). Exploring Andalusia's rich heritage through surveys:

pastoral livestock farming as a tourist attraction resource. *Animals* 14:468. doi: 10.3390/ani14030468

Saxena, G., Clark, G., Oliver, T., and Ilbery, B. (2007). Conceptualizing integrated rural tourism. *Tour. Geogr.* 9, 347–370. doi: 10.1080/14616680701647527

Schulze, M., Kühl, S., and Busch, G. (2023). We have some calves left! Socially accepted alternatives to the current handling of male calves from dairy production. *Food Ethics* 8:11. doi: 10.1007/s41055-023-00122-w

Scotti, I., Ievoli, C., Bindi, L., Bispini, S., and Belliggiano, A. (2023). Facing climate vulnerability in mountain areas: the role of rural actors' agency and situated knowledge production. *Sustain. For.* 15:15877. doi: 10.3390/su152215877

Van de Pol, M., Bailey, L., McLean, N., Rijsdijk, L., Lawson, C., and Brouwer, L. (2016). Identifying the best climatic predictors in ecology and evolution. *Methods Ecol. Evol.* 7, 1246–1257.

Van de Pol, M., Bailey, L., McLean, N., Rijsdijk, L., Lawson, C., Brouwer, L. (2016). Identifying the best climatic predictors in ecology and evolution. *Methods Ecol. Evol.* 7, 1246–1257.

Van der Ploeg, J. D., Jingzhong, Y., and Schneider, S. (2012). Rural development through the construction of new, nested, markets: comparative perspectives from China, Brazil and the European Union. *J. Peasant Stud.* 39, 133–173. doi: 10.1080/03066150.2011.652619

Wilson, G. A. (2001). From productivism to post-productivism… and back again? Exploring the (un) changed natural and mental landscapes of European agriculture. *Trans. Inst. Br. Geogr.* 26, 77–102. doi: 10.1111/1475-5661.00007

Wilson, G. A. (2008). From 'weak'to 'strong'multifunctionality: Conceptualising farm-level multifunctional transitional pathways. *J. Rural. Stud.* 24, 367–383. doi: 10.1016/j.jrurstud.2007.12.010

Zanon, T., Degano, L., Gauly, M., Sartor, P., and Cozzi, G. (2023). Case study of the market situation of calves from alpine dairy farms and the effect of dams' grazing during the last three months of gestation on auction parameters. *Ital. J. Anim. Sci.* 22, 925–933. doi: 10.1080/1828051X.2023.2251988

Zanon, T., König, S., and Gauly, M. (2020). A comparison of animal-related figures in milk and meat production and economic revenues from milk and animal sales of five dairy cattle breeds reared in Alp's region. *Ital. J. Anim. Sci.* 19, 1318–1328. doi: 10.1080/1828051X.2020.1839361

Zavelberg, Y., Wieck, C., and Heckelei, T. (2015). "How can differences in German raw milk prices be explained? An empirical investigation of market power asymmetries," in *2015 AAEA & WAEA Joint Annual Meeting, July 26-28.* San Francisco, CA: Agricultural and Applied Economics Association, 26–28, 1–15.

Ziemba, E., and Eisenbardt, M. (2015). Prosumers' participation in business processes. *Online J. Appl. Knowl. Manag.* 3, 114–127.