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Lock-ins to transition pathways anchored in contextualized cooperative dynamics: Insights from the historical trajectories of the Walloon dairy cooperatives

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ABSTRACT

Drawing on a historical study of the Walloon dairy cooperatives, this paper analyses how complex cooperative dynamics define lock-ins in their trajectories. We consider cooperatives as firms active on markets and as structures of collective action gathering farmers-members around common strategic goals. Williamson's framework from *New Institutional Economics* accounts for the embeddedness of firms' strategies and governance in their wider context of development. Under the influence of this context of development, Ostrom's IAD (Institutional Analysis and Development) and SES (Social-Ecological Systems) frameworks, merged in a so-called CIS framework, capture the dynamic interplay between the components of cooperatives. Resorting to a combination between these frameworks, this paper discusses how the interplay between the components of the cooperatives' social-ecological system unfolded in the trajectories of the Walloon dairy cooperatives over the last sixty years. We uncover a double social dilemma at play. On the part of the farmers, the social dilemma anchors itself in the tension between their short-term interests as milk supplier over those of principal investor. On the part of the cooperatives' directors, the social dilemma anchors itself in the features of linking and bridging social capital in the region, unfavourable to inter-cooperative dialogue. In the Walloon Region, these social dilemma constituted a structural driver of the competition between dairy cooperatives and the subsequent inability to cooperate and invest towards successful long-term diversification pathways. We discuss how contextual factors, in particular market features, regulatory frameworks, socio-political features, and institutional support to dialogue, may aggravate, or conversely mitigate the effect of these social dilemma on cooperatives' trajectories. We call for more historically-informed studies on the impact of context on cooperative dynamics and stress the relevance of contextualized approaches to unlock prospective dynamics of collective agency in transition pathways.

1. Introduction

As is the case for food production systems in general (Markard et al. 2012), the dairy value chain faces critical issues in its transition towards sustainability. These issues range from the environmental impact of farm models (Steinfeld et al., 2006; Greenpeace 2019; Swagemakers et al., 2019) to working conditions (Hostiou et al., 2020), mitigation of milk price volatility and fair payment of dairy farmers (European Milk Board, 2017; Reviron and Python, 2018; Markova-Nenova and Wätzold, 2018).

Milk processing is mainly organized through dairy cooperatives (Bijman et al., 2012; Copa-Cogeca 2015). Cooperatives are key components of the dairy value chain. They make choices on strategy, allocation of resources and redistribution of the added value (Grashuis and Cook 2017; Reviron and Python, 2018; Ajates 2020). As user-owned enterprises, cooperatives may connect farmers to other value chain stakeholders around development goals supporting innovative and sustainable agrifood practices (Micheels and Nolan 2016; Swagemakers et al., 2019; Bauwens et al. 2022). Hence, attention to the particular challenges faced by these organisations in processes of transition

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towards sustainability is required (van Bers et al., 2019; Ajates 2020).

Dairy cooperatives may, for instance, respond to the above-mentioned issues by elaborating new supporting roles towards farmers with diverse environmental-friendly practices (Herrera-Reyes et al. 2018; Atkociuniene and Balkibayeva, 2019; Swagemakers et al., 2019; Runhaar et al., 2020). In some cases, the transition towards more sustainable practices at farm level and the ability to support these practices with a higher remuneration of farmers ties in with the exploration of higher added value agri-food marketing pathways (Swagemakers et al., 2019; Runhaar et al., 2020; Pachoud et al., 2020; De Herde, Baret, and Maréchal 2020).

However, agri-food cooperatives, as structure of collective action, may be hindered in their transitional path towards sustainable farming practices and/or diversification towards higher added value products by lock-ins emerging from the interplay between their governance structure (the organisation of collective decision-making and strategic steering), and the individual agency of farmers. Farmers, in cooperatives, are suppliers of raw material, principal investors and residual claimants of the beneficiary margin (Apparao et al. 2019; Michaud and Audebrand 2022; Hernández-Espallardo et al., 2022). As suppliers, farmers may consider that they do not receive enough incentives to invest on-farm on changes of practices. Statutory rules of equal remuneration and/or the inability to discuss remuneration on equal terms with their cooperative play a role in this regard (Borgen 2011; López-Bayón et al., 2018). As investor and residual claimants, farmers may act from an "opportunistic" standpoint, favouring their short-term remuneration over investments in new development pathways (Cook and Iliopoulos 2000; Hernández-Espallardo et al., 2022; De Herde, Baret, and Maréchal 2020).

Building on a case study of the historical trajectories of the Walloon dairy cooperatives, this paper explores how the interplay between the cooperatives' governance structure and the individual agency of farmers unfolds under the influence of market, regulatory and socio-political context. By unravelling how this interplay takes place and what its implications are, we intend to contribute to the comprehension of cooperative dynamics and of the circumstances under which these dynamics generate lock-ins to collective agency in transition processes.

Several key dimensions have been identified as factors likely to reduce the farmers' opportunistic behaviour and increase their commitment to the cooperative's long-term development goals. Beyond adaptations to the statutory rules and new types of contractual relationships with the farmers (Chaddad and Cook 2004; Borgen 2011; Grashuis and Cook 2017; Hernández-Espallardo et al., 2022), these key dimensions are often considered in terms of social capital: a heterogeneous set of features "such as norms, values, trust, networks and communication" favouring the farmers' commitment to cooperatives (Apparao et al. 2019, 45). Regardless of the importance of social capital, the roots of cooperation also often stem from a complex and contextualized combination of institutional and political features which support collective action (O'Rourke 2007; Henriksen et al. 2012; McLaughlin and Sharp 2015; Henriksen et al. 2015; Apparao et al. 2019). For instance, an often overlooked dimension of studies approaching farmers' commitment to cooperatives is in how the cooperative's strategies in a given market context build upon and contribute to feedback positively on the farmers' commitment (Henriksen et al. 2015; Martino 2017).

Commitment influences "the willingness of members to invest equity, improve product quality, or commit supply" (Grashuis and Su 2019, 90). It is hence a mediator of long-term performance (Grashuis and Su 2019). How a cooperative's long-term performance may be influenced by a given external political or cultural context remains nevertheless empirically underresearched (Grashuis and Su 2019; Spicer and Kay 2022). In the field of social economy, revival of cooperatives as vehicle to sustain sustainability transitions gets increasing attention (Bauwens et al. 2022). Understanding how cooperatives, as a structure of collective action, may be influenced in their trajectories by the interplay between their governance structure, the individual agency of farmers and influence the farmers' commitment to the cooperative project in a given context of development, is hence of relevance when considering their future pathways.

Accordingly, our aim is to develop a deeper understanding of how the farmers' commitment to cooperative action interplays with the cooperative, and with the way the cooperative is steered strategically in a given context. The paper discusses the impact of context on the interactions between the Walloon dairy cooperatives and their farmers-members. The paper identifies patterns of path dependency as an emergent property of cooperative dynamics in a given context, which are of relevance for the future development of agri-food cooperatives.

2. Theoretical framework

Dairy cooperatives are legally framed structures gathering individual agents, the farmers - members of the cooperatives, around a series of shared goals (Grandori 2017; Chlebicka et al. 2017). Cooperatives also act as agents on the markets with requirements of economic profitability (Hansmann 1996; Schneiberg et al. 2008).

To understand the full complexity of cooperative governance (the structural organisation of collective decision-making) and its impact on trajectories in a given context, we resort to a combination of theoretical foundations. To account for the internal network and interaction dynamics between the cooperative and its members, the first theoretical corpus on which we rely in this analysis, is that of social capital. To embed the enactment of cooperative governance and its interplay with social capital in a given context, we combine two theoretical corpus accounting for the impact of context on governance and strategies, respectively in firms (O.Williamson) and institutions of collective action (E.Ostrom's Social-Ecological Framework). Ultimately, to discuss the impact of the interplay between context, governance and social capital on trajectories, we connect our findings to the literature on lock-ins in transition processes.

Social capital is an overarching concept covering the complex combination of internal and external connection features of the cooperative ensuring its long-term performance as network and democratic organisation of individual members (Apparao et al. 2019; Deng et al. 2021). Social capital is a concept receiving growing attention in organisation studies (Alan and Köker, 2021) and in sustainability transitions (Garrigos-Simon et al. 2018). Drawing on heterogeneous theoretical foundations (Sobel 2002; Ponthieux, 2006), researchers mobilized the concept to study respectively the resources individuals or collectives extract out of a network for business optimization (Ismaili et al. 2009; Rodrigo-Alarcón et al., 2014; McKitterick et al., 2016; Ruiz-Ortega et al., 2017; Yang et al. 2018; García-Villaverde et al., 2018; Rodrigo-Alarcón et al., 2018; Olawuyi and Mushunje 2019; Fait et al., 2019), the features of social connectedness which supposedly favour trust, and in turn commitment and cooperation (Chloupkova et al., 2003; Bertolini and Giovannetti 2006; Bojar and Drelichowski, 2008; Crespo et al. 2014; Vecchio et al., 2020), or the conditions supporting a shared understanding about goals and an inclusive participation in a cooperative project (Wynne-Jones and Sophie, 2017; Saint Ville, Hickey, and Phillip 2017; Ramirez et al., 2018; Gallego Bono and Tapia Baranda, 2019).

Recent reviews aimed at clarifying and classifying social capital's multiple dimensions in cooperatives (Apparao et al. 2019; Deng et al. 2021). Deng et al. (2021) distinguishes internal social capital, "the aggregate form and value of social relationships among organisational members", from external social capital, "the social linkages between the organisation and other external actors" (Deng et al. 2021, 302).

Internal social capital covers a structural dimension, a cognitive dimension and a relational dimension. The structural dimension consists of the patterns of connections (networks and communication) among the members, and between the members and their cooperative. The cognitive dimension refers to the nature of the shared representations among the cooperative members. The relational dimension refers to the

trust, shared norms and feeling of mutual obligation of the cooperative members (Deng et al. 2021; Apparao et al. 2019).

External social capital may hold the same structural, cognitive and relational dimensions. Additionally, we may also conceptualize external social capital on the nature and heterogeneity of the external actors with whom the cooperative or its members interacts. External social capital will be "bonding" or "bridging", depending on whether the connexion is based – or not - on common characteristics, e.g. a common political background. When the connexion relates to non-similar actors, for example political or financial institutions, the term "linking social capital" is used. It defines the relationship between the cooperative and these actors and the services granted from these relationships (Grootaert 2004). External social capital, its bridging component in particular, plays a determining role for the long-term success and innovative potential of business models oriented on sustainability trajectories (Velter et al., 2020). Bridging networks can be cohesive or diverse, and their innovative potential is dependent upon the political, regulatory and cultural context in which these networks evolve (Kraft and Bausch, 2018).

A recent meta-analysis concluded that there was a positive link between social capital and the sustainable character of a business model (Kluza et al. 2021). In cooperatives, in particular, social capital offers a comparative advantage, as it may support strategies oriented on the fulfilment of the cooperatives' social foundations and goals (Deng et al. 2021; Puusa and Saastamoinen 2021). A recent study however identified a threshold effect: an excess of internal social capital can be detrimental to objectivity and adequate monitoring of the cooperative's and directors' activities, also described as the "dark side" of social capital (Hernández-Espallardo et al., 2022). Social capital may also evolve over the cooperative's lifetime, for example because of the cooperative's structural evolution and upscaling. It is hence more a dynamic than a fixed feature of a cooperative organisation, and its concrete effect may depend from its interplay with the cooperative governance and its context of development (Deng et al. 2021; Bauwens et al. 2022). Hence, we can only understand the impact of social capital on cooperative trajectories by contextualizing it, alongside governance features (see Wang and Chen, 2021 discussing this endeavour in the field of research on common pool resources).

Two frameworks adapted to consider how social capital, alongside governance features, co-evolve in a given context, and influence trajectories, are those of Williamson from New Institutional Economics (Williamson 2000) on the embeddedness of resource allocation in firms, and Ostrom's Social-Ecological framework (McGinnis and Ostrom 2014).

According to Williamson's framework (represented in Fig. 1), firms allocate their resources (level 4) because their choices are embedded within and determined by the governance structure (level 3) they adopted. The way this governance structure determines how some strategic choices are more efficient than others, and which governance structure will achieve the given strategic goals, depends on the regulatory framework at hand (level 2), and on the effect of the broader cultural norms and customs (level 1). As an analytical tool, this framework may give interesting insights into the drivers that have influenced the pathways of development of dairy cooperatives, as it considers the interplay between strategy and governance, and accounts for their embeddedness within a broader context. In the field of historical study, several authors have used it in order to evaluate the complexity of issues

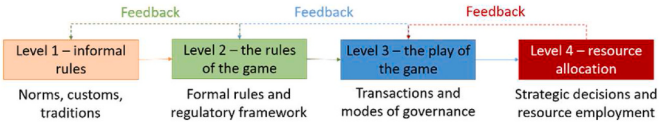

Fig. 1. Representation of the four levels of analysis of resource allocation in firms (Williamson 2000).

surrounding the market failure or success of dairy cooperatives in various European countries (Henriksen et al. 2012; McLaughlin and Sharp 2015; Henriksen et al. 2015).

As cooperatives are hybrids, we need a theoretical frame accounting for the fact that its internal organisation may be under the influence of network and democratic mechanisms characterizing collective action (Weinstein 2013). Ostrom's SES framework enriches the perspective in this regard, by considering cooperatives not only as firms, but as complex social-ecological systems interacting with their broader context of development (McGinnis and Elinor, 2014; Cole et al. 2019). This social-ecological system includes the following components: the resource system (e.g. human constructed facilities, like milk processing plants), the resource units (e.g. dairy products developed), the governance systems managing these resources (e.g. cooperatives), and the actors (e.g. farmers-members and directors) involved in this management. Cooperatives are, in this regard, structures where member jointly manage common-pool assets, i. e resource units and systems (Cornée et al. 2020).

The SES framework classically focusses on the detailed analysis of the SES components, as a way to identify the social and ecological conditions of systems. Recent theoretical considerations advocated for the mobilization of this framework also for the analysis of processes, by considering how these social and ecological components contribute to action-situations and how these action-situations shape social and ecological variables in feedback processes (Cole et al. 2019). The SES framework then integrates the dynamic attributes of its parent IAD framework in an IAD-SES combination (also called CIS framework). This combination accounts for the interactions of the components of the social-ecological system in action-situations, and for the feedback effects shaping these components (Cole et al. 2019).

By considering how the actors' features (e.g. social capital) interplay with other components of the social-ecological system in action-situations, the CIS framework can, for instance, capture how the social dilemma characteristic of collective action unfold (Weinstein 2013). A social dilemma occur when partners in a collective scheme are tempted to adopt a strategy detrimental to long-term collective benefits to pursue individual short-term benefits. When the outcomes of this attitude also affect the individual partners' long-term benefits, the situation qualifies within the general category of game theory's "bad prisoner dilemma" (O'Rourke 2007; Weinstein 2013; Farjam et al., 2020). Social dilemma in cooperatives anchor themselves in the multiple roles of the farmers in cooperatives and the related tensions between their short-term interests as suppliers and residual claimant and their long-term commitment as investors (Cook and Iliopoulos 2000; Michaud and Audebrand 2022). Social dilemma may also occur at the level of collaborating organisations, for example two cooperatives engaged in partnerships. The short-term interests of one of the partners may prevail over the collaboration goals, for example when partners remain competitors for resources (Ménard 2017; Hobbs 2017).

The dynamic feature of the CIS framework favours its compatibility with Williamson's framework (Schlager and Cox 2018). This compatibility also makes sense considering the common institutional roots of both frameworks (Weinstein 2013). The components of the social-ecological system (resource systems and units, governance and actors) contribute to the play of the game (level 3 of Williamson's framework), and interact in action-situations (level 4 in Williamson's framework). The strategic decisions made in terms of resource allocation (level 4) further build up this social-ecological system (level 3) in feedback, under the influence of social, political and economic settings (levels 1 and 2 of Williamson). A given action-situation, where the components of the social-ecological system interact can hence be analysed in the light of the governance systems, resource systems, resource units, and actors' experience and social capital resulting from previous processes of decision-making (Cole et al. 2019). Fig. 2 illustrates the integration of Williamson's framework within the CIS framework that we intend to mobilize in this study.

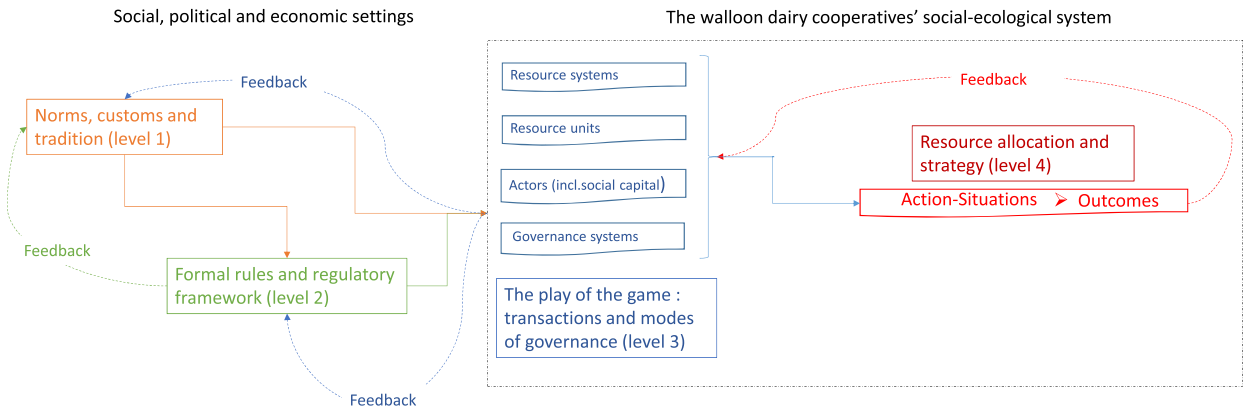

Fig. 2. Integration of Williamson's four levels of institutional analysis in the CIS framework.

Our chosen framework of analysis acknowledges that the outcomes of a given action-situation lie under the influence of multiple levels, from the micro-level actors' interactions in governance structures (level 4 and 3) to the meso-level regulatory frameworks (level 2) and the macro-level normative settings (level 1). This framework is hence a relevant analytical tool to uncover path dependency and lock-in effects in the evolution of the Walloon dairy cooperatives, linked to its properties of structure of collective action.

Lock-ins classically define self-reinforcing mechanisms that may support the dominance of a certain technology or practice over time, despite a possible long-term path-inefficiency. These mechanisms derive from the fact that the returns of adoption of a certain technology or practice may be increasing when the technology or practice is widely adopted by agents (leading for example to decreasing information costs, increasing network externalities) (Kuokkanen et al., 2017). These mechanisms contribute to the further adoption of that technology or practice, a pattern qualified under the concept of path dependency. In the interdisciplinary field of transition studies, lock-ins and path dependency are explored from a systemic perspective. Lock-ins result from interactions among agents and between agents and the rules and regulatory frames that these interactions contribute to build (Vanloqueren and Baret 2009; Lamine et al., 2012; Aarset and Jakobsen 2015; El Bilali, 2019; Vermunt et al., 2020). This includes, for example, processes of path dependency supported by "cognitive structures and shared beliefs" (Vermunt et al., 2020) or actors' roles and identities (Burton 2004; Sutherland and Darnhofer 2012; Sutherland et al., 2012). Path dependency are the outcome of development trajectories driven by agents, resulting in "adaptation-constrained spaces" displaying lock-ins (Gajjar et al. 2019).

The level of collective action, its impact on individual representation (Paschen and Ison, 2014) and the interplay between collective structure and individual agency (van Bers et al., 2019) are stressed as an adequate level of analysis to consider the (in)ability to adapt and transform over time. Considering the context-sensitivity of cooperative dynamics seen from a social-ecological perspective (Bauwens et al. 2016), we ambition in this study to consider the lock-ins acting on the dairy cooperatives' trajectories from a perspective of complexity. Rather than seeking for rationally decomposable and analysable cause-effects relationships (Darnhofer et al. 2012), our exploration aims mainly at considering which complex combination of elements influence cooperative dynamics in the definition of trajectories.

A historical investigation can underpin an abductive process likely to shed light on these complex combinations of factors impacting cooperative dynamics in transition pathways. The next section exposes the features of the historical epistemology and the relevance of the Walloon Region as case study in this regard.

3. Sources and methods

3.1. The added value of a historical epistemology

The state of an organisation may be the result of a more complex combination of drivers than individual or collective economic optimization alone, acting on the organisation's long-term trajectories (Hansmann 1996; Schneiberg et al. 2008; Ménard 2017; Apparao et al. 2019). The historical epistemology provides, in this regard, a source-based narrative that unravels the drivers influencing the organisations' trajectories. A historical analysis considers, in particular, how time and context influence organisational dynamics (Lippmann and Aldrich 2014; Maclean et al. 2016).

The added value of considering this epistemological approach to enrich the study of organisations from an interdisciplinary perspective has been stressed (Lippmann and Aldrich 2014; Maclean et al. 2016). Our approach fits well into the recent expanding field of historical studies on food systems considering the interplay between individuals, organisations and the impact of the broader cultural and political framework in evolving food systems (Scholliers 2007; Brassley 2009; Segers et al. 2009). Such an approach may provide potentially meaningful insights related to the research question: how the long-term interaction between farmers and farmers' cooperative has influenced the latter's strategies, depending on its context of development.

The evidence produced on the base of a historical investigation does not fall under the common heuristics of inductive and deductive processes, which respectively provide probable and necessary inferences and test their validity for generalizable theorization by means of experimental testing protocols (Shook 2016; Shani et al. 2020). A historical investigation indeed provides an evidence-based set of "conjectures about possible reasons for an observed fact (in need of being explained)" (Witt 2009, 364; see also Rowlinson et al. 2014). On the base of the gathered historical material, the investigation provides an "inference to the best explanation" to this phenomenon (Folger and Stein 2017, 308). Abduction processes, in this regard, act on the register of speculation and fallibility rather than certainty (Catellin 2004; Folger and Stein 2017). However, such heuristic processes plays a role in defining further lines of inquiry, by outlining "what kinds of evidence might increase the prospects of further insights" into a phenomenon (Folger and Stein 2017, 307). In particular, abduction is a necessary heuristic process to identify sets of causes to a phenomenon that we may not derive directly from observation or experience (Catellin 2004). The process may, in this sense, challenge existing frames of thought by bringing forward novel inferences on causal patterns (Witt 2009; Thieme 2018). The case of the Walloon dairy cooperatives provides, in this regard, an interesting case study.

3.2. The case of the Walloon dairy cooperatives

A contextualized analysis of the long-term interactions between farmers and cooperative regarding the latter's definition of strategies, is of particular relevance when we consider the case of the dairy cooperatives of the Walloon Region. The Walloon Region is the southern part of Belgium and covers over about 17000 square kilometres. Current milk collection in the Walloon Region is based on five dairy cooperatives which collect 97% of the milk produced. Following a wider European trend, four of these cooperatives have gone through consolidation processes over the last 30 years in an effort to face the globalization of markets and the increased concentration of the distribution sector (Filippi et al. 2008; Juliá-Igual et al. 2012). This includes upscaling and mergers, which in two cases involved a multinational dairy cooperative and the partial or total cession of processing tools to a multinational dairy group (Chaddad and Cook 2004; Mauget 2008; Filippi et al. 2008).

Of particular relevance for the Walloon Region, is the possible diversification of products away from UHT (ultra-high temperature processed) consumption milk, milk powder and butter – at present 80% of the dairy products of the region (based on the figures from Maquet (2012)) - towards a larger variety of dairy products. We understand diversification, the term usually used in agri-food studies, as the extension of the range of commodities produced, in particular by evolving towards more highly valued products (FAO 2004; Memedovic and Shepherd 2009; Stefan and Ferto, 2018; Heck et al., 2020). The profile of dairy production within the region does indeed appear less diversified than at the Belgian level or in neighbouring countries, regardless of the diversity of the consolidation trajectories in these countries (IFCN 2014; Statbel 2017; CNIEL 2020). Furthermore, it is important to know that the region holds a diversity of dairy farm models, from intensive maize and grass silage based production to extensive pasture-based models (Lebacq 2015; Petel et al. 2019). A variety of milk processing models may act upon and further support this diversity of farm models (Touzard and Fournier 2014; Perrot et al., 2017; Reviron and Python, 2018; De Herde, Maréchal, and Baret 2019).

The important question that follows is why this diversification did not occur earlier, and which drivers led to the present configuration of dairy production within the region. As a starting hypothesis, we think that drivers other than individual and collective economic optimization may have taken place in the development of Walloon dairy cooperatives, as well as in the interaction between the farmers and the dairy cooperatives. To uncover these drivers, we conducted a historical investigation, with the objective to analyse in what way these drivers they may have constituted lock-ins to some trajectories (i.e. diversification towards higher added value products).

3.3. An analytically structured historical investigation in two steps

This investigation endorses an interdisciplinary approach described as *analytically structured history* (Clark and Rowlinson 2004; Rowlinson et al. 2014; Lippmann and Aldrich 2014; Leblebici 2014; Maclean et al. 2016). On the one hand, the micro-scale historical narrative grounded in evidence emerging from primary sources brings any presuppositions through the "test for authenticity" (Maclean et al. 2016, 16). On the other hand, the confrontation of the historical investigation to a chosen theoretical frame provides a new lens in which to connect the historical narrative to present and prospective issues – in our case cooperative dynamics in transition pathways (Maclean et al. 2016; Lippmann and Aldrich 2014).

The first step of the investigation hence consisted in the collection and analysis of the historical sources needed to retrace the trajectories of the Walloon dairy cooperatives and identify the drivers that influenced these trajectories. The outcome of this first step of investigation was the redaction of a thorough and source-based descriptive historical narrative (De Herde, 2020), on which the analysis presented in this paper is based.

We purposely limited our analytical scope to the period of evolution ranging from the end of the Second World War until today. This timespan was indeed appropriate to enlighten the drivers of the cooperatives' trajectories that were explanatory of the current landscape of dairy productions in the Walloon Region and likely to feed a broader discussion on cooperative dynamics in prospective development pathways.

Identifying the primary sources relating to the evolution of the Walloon dairy cooperatives was a challenge, considering that the field of historical study on food processing is underdeveloped in the Walloon Region (Vanhaute and Van Molle, 2006; Matthys and Lefebvre 2006). A close-reading of the main agricultural journal (Les éditions rurales, 1964) and contemporary publications (De Baere, 1973; Saldari, 1978) allowed us to identify all accessible archival funds related to the evolution of the Walloon dairy cooperatives: governmental sources at national and regional level and archives of former dairy directors. The latter not only contained material related to the dairy cooperatives to which the directors were associated, but also numerous reports of exchanges between dairy directors, the agricultural unions, covering a period dating from the 1960s to the 1990s. The insights from these sources was complemented by a series of published sources (Union de l'industrie laitière belge, 1962, 1966, 1970b ; Verkinderen and Ackerman 1964; Ackerman, 1966, 1971; Algemeen Verbond der Coöperatieve Zuivelfabrieken, 1974; Van Hecke, 1976; Institut National de Statistique 1976; Office National du Lait, 1970, Office National du Lait, 1977; Debergh 1992).

Additionally, 15 interviews with oral sources identified as key-persons active in the dairy and agricultural sector, from the seventies until the nineties, were also conducted, in October and November 2017:

- Three officials from the Ministry of Agriculture (m1-m3);
- Two persons active in the direction of the farmers' unions at regional level (u1) and in the western part of the Region (u2);
- Two farmers and chairpersons of the administrative board of dairy cooperatives in the central and eastern part of the Region (p1 and p2);
- Six former directors of dairy cooperatives from the eastern (d1, d3, d5) central (d6) and western (d2, d4) parts of the Region;
- One former director and owner of an investor-owned dairy situated in the central part of the Region (d7);
- One member of the board of directors of one of the dairy cooperatives situated in the eastern part of the Region (a1).

The diversity of historical sources (public and private archives, oral sources from various stakeholders in the dairy sector, published sources) and of documents (official reports, minutes of meetings, correspondence between actors, retrospective oral accounts) allowed us to unravel and analyse the historical evolution of the Walloon dairy cooperatives from a variety of perspectives. This enriched the historical narrative (De Herde, 2020) by bringing contrasts into the approach of issues.

4. Chronological overview of the evolution of the Walloon dairy cooperatives

The current situation of the Walloon dairy cooperatives is the result of a consolidation process (defined, drawing on Shields (2010), as the shift to fewer and larger firms). This consolidation took place in a landscape of technological advances in milk processing equipment (automation and increased capacity) and within the context of an evolving European Common Agricultural Policy De Baere, 1973.

From 1945 onwards, the numerous dairies active within the territory of the Walloon Region (about 68 between 1945 and 1965) went through various phases of consolidation. Between 1945 and 1980, most investor-owned dairies ceased production or became absorbed into the consolidation processes of the dairy cooperatives (Union de l'industrie laitière belge, 1962,1966, 1970b; Office National du Lait, 1977). Milk still

collected by investor-owned dairies in the Walloon region was insignificant in the 1980s (McKinsey and Company 1984b).

From the 1940s to the 1960s, the processes of consolidation followed the technological evolution of milk processing and aimed at bundling resources for investments. The upscaling of the production tools was considered as inevitable (Union de l'industrie laitière belge, 1965), given the fact that:

- The recourse to workforces remains high despite technological evolution;
- The margins between the price paid to farmers and the price at factory gate were narrow.

As from the 1970s, the motivation for consolidation is expressed not only in terms of cost optimization and investment, but also to gain competitive and negotiation power on the markets of products in front of increasingly concentrated competitors and distributors (Union de l'industrie laitière belge, 1970a; Algemeen Verbond der Coöperatieve Zuivelfabrieken, 1974; Champagne 1981; McKinsey and Company 1984b; Calicis 1988).

The different phases of consolidation took place in an evolving European Economic Community Common Agricultural Policy (EEC CAP) framework. That framework influenced the context in which the dairy cooperatives evolved and made their strategic choices of investment. As the European Community set up intervention measures on milk powder and butter as from 1964De Baere, 1973, the investments made by the dairy cooperatives at the time oriented the production of the region towards milk powder (+314% between 1964 and 1968) and butter (+40% between 1964 and 1968) (Union de l'industrie laitière belge, 1966, 1970b). Soon after, the Mansholt plan was set up in 1968 at European level to curb dairy overproduction. The plan included incentives to convert the herds for meat production and on-farm use of milk (milk used to feed other animals, or directly processed into end-products on-farm) (Ledent and Burny 2002). These measures had success in the western and central parts of the Walloon Region that hosted mixed herds and had, until 1965, a high percentage of on-farm milk use (more than 75% in the western and central parts of the region (Ackerman, 1966; De Baere, 1973). The subsequent decrease in milk delivery affected the profit margins of investments calibrated for a given quantity of milk, in a context of rising production costs due to increasing oil prices (interviews p1, d2) (Union de l'industrie laitière belge, 1970a; Calicis 1973). Additionally, the low herd aspect (mixed breeds, low herd density) made milk collection more costly (Ministère de l'agriculture, 1975). Milk and cream collection areas overlapped, and no cooperation took place to optimize milk collection. The competition on the market of milk consumption and butter was strong. The dairy cooperatives faced heavy financial charges linked to their investments (Calicis 1973).

Dairy cooperatives in economic difficulty, all situated in the western and central part of the Region, unsuccessfully attempted to coordinate production and milk collection (Lanotte, 1975; Ministère de l'agriculture, 1975; Ministère de l'agriculture and Secrétaire d'état à l'économie régionale wallonne, 1973). The ministry of agriculture later steered the merging of these cooperatives into a single cooperative in 1975. Its activities were centralized in one milk processing plant producing milk powder, butter and consumption milk (Annexe au Moniteur belge, 1975; Ministère de l'agriculture, 1975).

In the 1980s, a report written for the regional ministry of agriculture identified that structural vulnerabilities (low herd density leading to costly milk collection) were still present in most parts of the Walloon region (McKinsey and Company 1984b). In addition, the introduction of the milk quota in 1984 induced competition for the milk supply and a trend of rising milk prices paid to the farmers (Algemeen Verbond der Coöperatieve Zuivelfabrieken, 1988, 1991). The report written for the regional ministry of agriculture stressed that milk processing in the Walloon region was barely oriented towards added value products. The production of yoghurt and cheese did not match the volumes required by the distribution channels, and the production sites were not strategically located. This, together with the amount of debt the dairy cooperatives faced, hampered investment. The report called for more coordination between the nine remaining dairy cooperatives or, alternatively, for a merger under centralized management (McKinsey and Company 1984b). Several discussions and plans to coordinate or merge the dairy cooperatives in anticipation of the upcoming European single market (CRISP 2020) did not lead to any concrete advance (McKinsey and Company, 1984a; Lutgen and Anselme, 1990). Dairy cooperatives separately sought investors to modernize their production plants and diversify their products, sparking a competition between French dairy groups (Besnier and the Union Laitière Normande). These groups ultimately held majority control over the Walloon milk processing plants (Debergh 1992) against guarantees in terms of milk prices paid to the farmers (interview p1). The Walloon dairy cooperatives remained active on milk collection only (Lutgen and Anselme, 1990). At the beginning of 2000, the gradual increase of the quota diminished the tension on the milk collection market (Confédération belge de l'Industrie Laitière, 2016). The French dairy group disengaged from milk processing plants, for which they had made limited investment in (interviews d3, d5). The remaining Walloon dairy cooperatives adopted three strategies in order to adjust to this new context, leading to the present landscape: remain small-scale and target local processors; join a European dairy group; or merge to buy the only existing large-scale industrial milk processing plant still judged apt to guarantee a position on the market, centred on the production of milk powder, consumption milk and butter.

Fig. 3 illustrates this chronological overview under the form of a timeline.

5. Factors impeding cooperation in diversification pathways

A plea to consider the diversification of dairy products to compensate for production costs was made very early on (Office National du Lait 1970; Algemeen Verbond der Coöperatieve Zuivelfabrieken, 1974) - as well as the plea for the dairy cooperatives to consider how to better coordinate their efforts and their investments (Union de l'industrie laitière belge, 1970a, 1974). However, the Walloon dairy cooperatives failed to reach agreement on the consolidation model that would allow joint investment in concerted diversification and market strategies (; InterSud, 1978; Ministère de l'agriculture, 1975; Lutgen and Anselme, 1990 (interviews m1, m3, p2, d1, d2, d3, a1, d5, d6, d7).

Two main models of consolidation exist: the coordination of activities between independent dairy cooperatives on the one hand; the integration of all dairy cooperatives under a centralized management on the other. The coordination of activities between independent dairy cooperatives can take different forms, from a decentralized coordination of investments and commercial strategies of each dairy cooperative involved, to a joint investment in a common processing plant and/or marketing. These consolidation models were discussed among stakeholders within the sector (Berque et al. 1963; Commission Nationale du Lait 1971; Vancauwenberghe and Lambert 1974; McKinsey and Company 1984b; Calicis 1988) and were present throughout the above-described evolution. In some cases, the coordination of dairy cooperatives through joint investments was a step towards the merger of the participating dairy cooperatives under a centralized management (interview d6) (Union de l'industrie laitière belge, 1966, 1970b). In other cases, the consolidation strategy was based on coordination aimed at keeping the dairy cooperatives as independent organisations cooperating on investments and commercial strategy (interviews d2, d6) (Coferme 1988a).

While the implementation of a diversification strategy may occur through one or other consolidation model, disagreements on the choice of consolidation model that would support such a strategy occurred in the seventies (in the western and central parts of the Region) and in the eighties (at the scale of the Walloon Region). Concertation took place between the directors of the dairy cooperatives, who agreed on the need

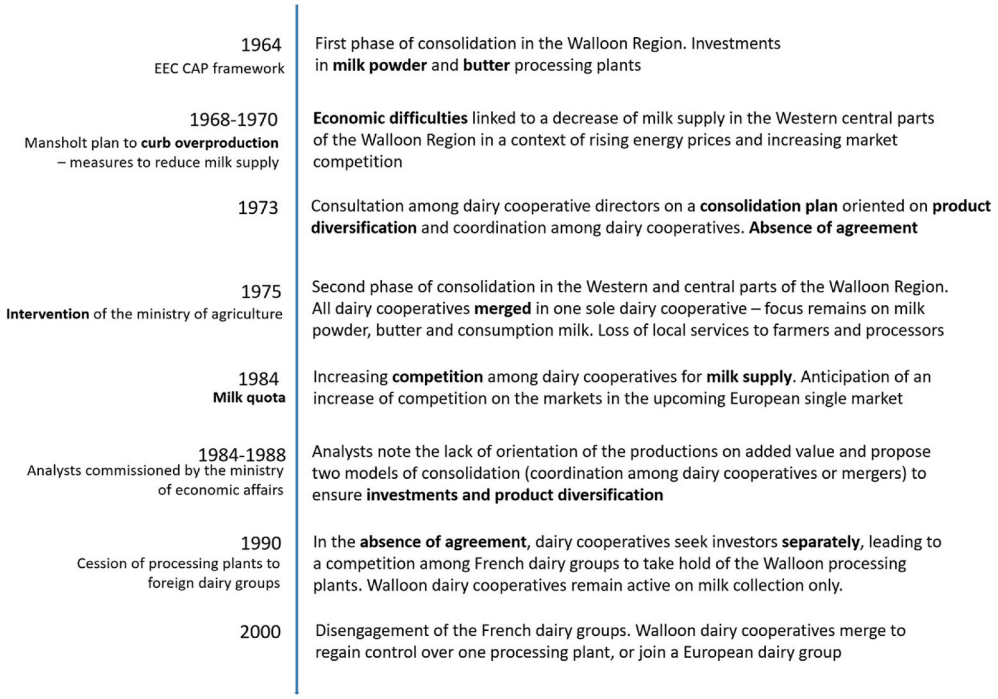

Fig. 3. Timeline summarizing the described chronological overview.

to diversify towards higher added value products other than milk powder and butter. Most of the disagreements had to deal specifically with the enactment of the consolidation process that would support this diversification strategy (Groupe d'étude Avenir des Laiteries du Sud, 1973; McKinsey and Company, 1984a).

This subsection reports the conjunction of factors mentioned in the archives and by the oral sources as having hampered cooperation between dairy cooperatives on diversification strategies throughout the studied decennia. In the above-mentioned context of tensions/intense competition in terms of milk collection linked to the EEC CAP policies, these factors relate to the structural features of milk production in the region (5.1), the effects of above-mentioned context of tensions/intense competition in terms of milk collection linked to the EEC CAP policies (5.2), the attitude of the boards of directors towards consolidation (5.3), the farmers' attitude towards the cooperative (5.4) and their reactions towards consolidation (5.5), and finally to the specific philosophical and institutional background in which the dairy cooperatives evolved (5.6). Following these sub-sections, Table 2 summarizes these elements and classifies them according the theoretical framework exposed in section 2.

5.1. Structural features adverse to cost optimization and industrial profitability

The eastern part of the Walloon Region presented a high herd density and specialized dairy herd (De Baere, 1973; Ministère de l'agriculture, 1975; Van Hecke, 1976). Conversely, low herd density, herd features, milk use on-farm in the western and central parts of the Region (detailed in Table 1) were not favourable to the cost optimization of industrial milk processing plants (Ministère de l'agriculture, 1975; Vancauwenberghe and Lambert 1974).

The pre-eminence of dairy cooperatives over private investment firms in most parts of the Walloon Region can be considered in light of these features non-favourable to industrial profitability, according to one interviewee (interview d2). Apart from the eastern part of the Walloon Region, where two industrial private operators in milk powder and milk fat derivatives were identified (Union de l'industrie laitière belge, 1962), it can be observed that no private operators realized similar investments in the western and central part of the Walloon region at the time. The low benefit margins and high risks of these investments in dairy processing plants were acknowledged, at the time, at the level of the sectoral organisation representing dairy industries (Union de l'industrie laitière belge, 1965).

5.2. Economic difficulties and competition for milk supply in the European context

The EEC intervention mechanisms on milk powder and butter (De Baere, 1973) influenced the focus of production and the scale of the investments in dairy processing plant in the Walloon Regions (Interview d7). Analysts consider that the management of dairy cooperatives relied too much upon EEC intervention mechanisms and insufficiently explored the possibilities of dairy products with a higher market value, other than milk powder and butter (McKinsey and Company 1984b; Vancauwenberghe and Lambert 1974; Debergh 1992). Oral sources from the farmers' union at the time attribute this to an insufficient schooling of dairy directors and a lack of culture in business matters and entrepreneurship (interview u1, a1). However, one public analysis (Office National du Lait 1970) highlighted the inability of dairy cooperatives to consider changes of strategic orientation due to the adverse effects of competition for milk supply on their investment capabilities. The effect of the competition for milk supply on the investment capabilities was again stressed in the 1980s (interviews u1, p2, d1). Additionally, this competition for milk supply and the associated economic difficulties, weighed strongly on the ability to consider a cooperation among dairy cooperatives competing against each other for milk (interview d1).

5.3. An ambivalent attitude of the management towards consolidation

Some early sources express the adverse attitude of the directors of dairies towards consolidation in the sixties (Various correspondence, 1962; Berque et al. 1963). In the seventies and in the eighties, however, concertation took place over a consolidation strategy as a way to support diversification towards higher added value products (Groupe d'étude Avenir des Laiteries du Sud, 1973; McKinsey and Company, 1984a).

Table 1
Factors linked to herd and farming system features that affected the profitability of investments in milk processing tools in cooperative dairies in the 1960s, 1970s and 1980s in the western and central parts of the Walloon Region (Ackerman, 1966; De Baere, 1973; Ministère de l'agriculture, 1975; Van Hecke, 1976).

Structural factor	Characteristics	Aspect of the milk processing workflow affected	Impact on the aspect identified in the previous column
Geographical herd density	Production per square kilometre represented 93000 L/km^2, much lower than in the eastern part of the Region (141000 l/km^2)	Milk collection	More expensive (higher distance/litre milk collected)
Herd features	Dual-purpose breeds with a lower milk production per cow	Milk collection	More expensive (higher distance/litre milk collected)
Herd features combined with the farming system based on grassland	Dual-purpose breeds with a stronger seasonality of milk production	Profitability of transformation equipment	Variability of the quantity of milk transformed around the year, leading to losses in profitability of the processing tools
Percentage of on-farm milk use (of significance in the 1960s)	Up to 75% during the 1960s	Milk collection and strategic planning of processing plants	Vulnerability to the changes in EC policies (Mansholt plan) favouring on-farm milk-use – subsequent decrease in milk collection
Collection of cream and milk by the farmers (until the 1980s)	Until the 1980s, the dairy cooperatives separately collected milk and cream from farmers who used skimmed milk on-farm	Milk collection	More costly (double collection)

When discussions focussed on the concrete enactment of this consolidation, and in particular on a given consolidation model, some voices privileged the merger of cooperatives under a unique board of direction, whereas other voices pleaded for a coordination among independent dairy cooperatives (McKinsey and Company 1984a; Goffin 1984). These diverging views opposed the comparative benefit of the centralized strategic steering coming out from a merger of cooperatives, on the one hand, to the comparative benefit of sub-regional autonomy in strategic steering coming out from a coordination among cooperatives on the other hand (Goffin 1984; Groupe d'étude Avenir des Laiteries du Sud, 1973; McKinsey and Company, 1984a). Beyond these considerations linked to the cooperative model that could enact the contemplated consolidation, it seems that the failure to reach an agreement was also rooted in personal issues. According to interviewees, the position that directors were able to gain through consolidation, had an overriding impact on any approval they might give to the consolidation process (interview d1, p2, d3), a cause of the failure to reach an agreement between dairy cooperatives during the 1970s and 1980s (interviews d2, d3, p2). An additional aggravating factor seems to be an alleged lack of mutual trust between the managers of the dairy cooperatives in the above-mentioned context of milk competition (Coferme 1988a; Calicis 1988).

5.4. Farmers acting mainly as milk suppliers

Dairy cooperatives acted out a competitive dialogue in front of dairy farmers, and along with EEC directives, in particular the Mansholt plan in 1968 and the introduction of the milk quota in 1984, the result was competition for the milk supply and a trend of rising milk prices paid to farmers (Algemeen Verbond der Coöperatieve Zuivelfabrieken, 1988, 1991). Analysts described "a shopping mindset" in the Walloon Region, with farmers leaving one dairy cooperative in favour of another when the latter offered a higher price for the milk (Berque et al. 1963; Vancauwenberghe and Lambert 1974). Dairy cooperatives favoured paying dairy farmers high farm-gate prices in an effort to prevent them from leaving their own cooperative for others which offered a better price. This decreased the profit margins of the dairy cooperatives and their investment capacities, whilst increasing the competition in milk collection (interviews p2, d3) (Office National du Lait 1970).

The statutes of some cooperatives foresaw a period of minimum-term membership – for example for a period of ten years (Annexe au Moniteur belge, 1975), and although dairy farmers did leave dairy cooperatives in favour of others which they found more lucrative (interviews p1, d2), we found no traces of any legal enforcement of the period of minimum-term membership.

Until 1968, dairy farmers received a guaranteed farm-gate milk price, replaced in 1968 by an indicative price (De Baere, 1973; Vancauwenberghe and Lambert, 1974). This prompted more focus on the price received by dairy cooperatives and a logic of competition between dairy cooperatives (Office National du Lait 1970). The EEC intervention mechanisms led farmers to believe that there were guaranteed market outcomes, hence no issues in terms of milk processing and marketing to consider (interview d1). Interviewees (p2, d1) described their inability to communicate to farmers the need to be aware of these issues, and for them to place the importance of investing the benefits generated in strategic development above the higher farm-gate price that farmers received.

5.5. Dairy farmers reacting adversely to the consolidations

As early as the 1960s, letters and reports indicate that farmers did not consider the consolidated dairy cooperative as their own: the cooperative threatened their interests (for example by internalizing the milk analysis determining the amount they paid for milk) (Correspondence, 1968; Fédération nationale des UPA, 1968). Reports mention similar concerns after the creation of a unique dairy cooperative in the western and central parts of the Region in 1975 (Le Sillon Belge, 1977; Dom Guerric Baudet 1978). Farmers also considered that the mergers of dairies diminished their ability to allow dairies to compete for the milk they sold (Correspondence, 1968; Unions professionnelles agricoles, 1968). Let us note the paradox of these observations, as the cooperative form is theoretically a mutually beneficial answer to alienating negotiations between production and processing levels (Hansmann 1996). In particular, in 1975, the mistrust of farmers was allegedly grounded in the fact that it was a top-down merger operation in which farmers lost the services previously offered by their cooperative (supplies and assistance) (Dom Guerric Baudet 1978) (interview d2). As a whole, farmers tended to be lacking in the culture of cooperation (Coferme 1988b) (interviews u1, p2) and, as previous consolidations had not brought the hoped for profit margins, farmers tended also to be sceptical about any further attempt of consolidation (Vancauwenberghe and Lambert 1974).

5.6. An absence of coordination and support mechanisms in a heterogeneous philosophical landscape

The Belgian "cooperative organisations operated along religious lines due to socio-religious confessionalisation" (Henriksen et al. 2015, p.41). In the northern part of the country, for example (the Flemish Region), the cooperative agricultural sector was organized within the Catholic pillar. The Flemish main agricultural union, the *Boerenbond*, acted also as a financial and counselling power. The *Boerenbond* granted

Table 2
Summary of the elements identified in the historical investigation as having hampered cooperation between dairy cooperatives on diversification strategies throughout the studied decennia. The (sub)sections detailing these elements are under brackets. The column headings and the text in italics refer to the theoretical framework outlined in section 2.

Level 1 – informal rules (norms, customs, traditions)	Level 2 – the rules of the game (formal rules and regulatory framework)	Level 3 – the play of the game (transactions and governance)	Level 4 – resource allocation (strategic decisions and resource employment)
Technological evolutions – industrialization of milk processing (section 4)	EEC CAP framework - intervention mechanisms on milk powder and butter (5.2)	Cooperative governance – farmers as milk suppliers and principal investors (5.1) *Governance – collective choice rules* Industrial focus on milk powder and butter (5.2) *Resource units*	Competition for milk supply – associated economic difficulties (5.4) *Outcome*
	EEC policies to curb overproduction (Mansholt plan – milk quota) (5.1)	Structural herd features (low density and seasonality). Traditions of on-farm use of milk (5.1) *Resource systems - sectoral features*	
Socio-political heterogeneity (pillarization) (5.6)	Absence of unicity in socio-political support (5.6)	Lack of trust between cooperatives' directors (5.6) *Actors - bridging social capital* Lack of counselling power (5.6) *Actors - linking social capital*	Absence of agreements – limited diversification towards higher added value (5.3) *Outcome*
Lack in culture of cooperation (5.5)		Absence of enforcement of binding agreements (5.4) *Governance -monitoring*	Previous consolidations do not bring the hoped for profit margins (5.5) *Outcome (feedback on level 3)*
	Former guaranteed farm-gate price (5.4)	Shopping mindset of the farmers (5.4) *Actors - internal social capital – relational dimension* Lack of trust in consolidations – scepticism about further attempts of consolidation (5.5) *Actors - internal social capital – relational dimension*	Loss of services to farmers in consolidations (5.5) *Outcome (feedback on level 3)*
	EEC intervention mechanisms (perception of guaranteed market outcomes) (5.4)	Insufficient communication towards the farmers on strategy (5.4) *Actors - internal social capital – structural dimension*	

loans to dairy cooperatives and to farmers and organized counselling services (Algemeen Verbond der Coöperatieve Zuivelfabrieken 1981; Van Molle, 1990).

In contrast, the Walloon landscape was less unified and coordinated. Some dairies were closer to the liberal pilar and its farmers' union the UPA (*Unions Professionnelles Agricoles*), whilst other dairy cooperatives were closer to the catholic pilar and the smaller Boerenbond-related Walloon Union AAB (*Alliance Agricole Belge*) (interview u2), or the Boerenbond's *AVCZ* (Algemeen Verbond der Coöperatieve Zuivelfabrieken 1981). Contrary to the situation in the neighbouring Flemish Region (Algemeen Verbond der Coöperatieve Zuivelfabrieken 1981; Van Molle, 1990), the Walloon unions did not have the means to offer similar support (interviews u1, a1). This heterogeneity of the landscape in terms of political ideology did not favour an attitude of trust between the management of the dairy cooperatives when discussing merger operations (interview d2).

Table 2 summarizes the combination of factors identified in the results as having impeded cooperation between dairy cooperatives in diversification pathways. This table classifies them according to the theoretical framework exposed in section 2, in anticipation of the dynamic representation of their interplay in section 6.1 of the discussion.

6. Discussion

Sections 4 and 5 provide, from an abductive perspective, insights into the complex combination of factors that influenced the Walloon dairy cooperatives' trajectories. This section discusses how these findings inform theory on cooperative dynamics in transition pathways. Section 6.1 exposes, in the theoretical framework outlined in section 2, the dynamic interplay between the factors that influenced the Walloon dairy cooperatives' trajectories. Section 6.2 discusses the influence of context on this interplay, and which internal dynamics of the cooperatives' social-ecological system the studied context reveals. Section 6.3 expresses these internal dynamics of the cooperatives' social-ecological system as a double social dilemma – on the part of the farmers and on the part of the cooperatives' directors. This sub-section discusses which internal features of the cooperatives' social-ecological system (internal and external social capital) are likely to influence these social dilemma. The weight of market and regulatory context on these social dilemma is addressed in section 6.4. Section 6.5 stresses the need to acknowledge that cooperatives act under the influence of complex and contextualized dynamics, and should thus be studied accordingly to understand how to manage blocking mechanisms to transition pathways.

6.1. Failure to change trajectories grounded in a complex combination of factors

Throughout the evolution of the Walloon dairy cooperatives, a recurring pattern of economic difficulties can be observed. This pattern can be linked to the structural vulnerabilities affecting the industrial profitability of the processing plants, in particular in the western and central part of the Region: low herd density, high seasonality of production, and the financial weight of previously made investments. The pre-eminence of cooperatives under such circumstances of structural vulnerabilities, appears as a logical outcome when considering the long-term and risky character of these investments (Williamson 1987). In addition, cooperatives benefited from public subsidies and favourable loan regulations (Hansmann 1996) for which the Walloon dairy cooperatives did indeed apply in the European context (De Herde, 2020).

The empirical material reveals a pattern of recurring failure to amend these economic difficulties through concerted strategies of investment aimed at increasing the end-product margins and reducing the weight of the cost-inefficient structural vulnerabilities. Of significant

importance here, seems to have been the adverse attitude of the co-operatives' management to cooperate on a consolidation strategy, in a context of strong competition among dairy cooperatives for milk. This lack of cooperation occurred despite the fact that there was an agreement on the need to consider consolidation in order to support diversification towards higher added value products (Groupe d'étude Avenir des Laiteries du Sud, 1973; McKinsey and Company, 1984a).

Fig. 4 illustrates, in the CIS theoretical framework, the conjunction of factors mentioned in the archives and by the oral sources as having hampered cooperation between dairy cooperatives on diversification strategies throughout the studied decennia. From an abductive perspective, the failure to agree on consolidation schemes appears linked to a combination of factors, rather than to separable cause-to-effect lock-in mechanisms, as exposed hereunder.

From previous interactions and action-situations in the Walloon dairy cooperatives' social-ecological system in the EEC Common Agricultural Policy context, the dairy cooperatives hold industrial resource units (level 3), oriented on milk powder and butter. The sectoral and structural herd features in many parts of the region are unfavourable to industrial profitability. The EEC measures to curb overproduction (level 2) induce economic difficulties linked to a decrease in milk supply, generating processes of competition among dairy cooperatives (level 4). Farmers lacking culture of cooperation (level 1) contribute to this competition by adopting a shopping mindset (level 3 – internal social capital), which cooperatives do not counteract by enforcing binding agreements (level 3 – governance).

When directors negotiate agreements on consolidation and investments on a diversification of productions (level 4), they act in a heterogeneous socio-political landscape (level 1) that provides little support (level 2) for counselling power (level 3 – linking social capital) and does not favour trust among them (level 3 – bridging social capital). Failures to reach agreements feedback on production profiles (feedback from level 4 to level 3), which remain undiversified. Top-down steered consolidations lead to losses of services to the farmers, further feeding their shopping mindset (feedback from level 4 to level 3). Recurrent economic difficulties feed their lack of trust in consolidation (feedback from level 4 to level 3). As cooperatives lack communication with the farmers on strategies (level 3 – internal social capital), farmers keep lacking in culture of cooperation (feedback from level 3 to level 1).

The outcomes of this process locked-in the dairy cooperatives in a divided and undiversified production landscape. This divided landscape, as well as the separate deals with groups of a much larger scale at the eve of the 1990s (section 4), did little to empower the dairy cooperatives when it came to negotiation.

6.2. *Lock-ins as outcomes of contextualized cooperative dynamics*

This historical investigation relates to past decennia, and concerns a time period offering a different market context and regulatory framework, compared to current times. The abductive investigation process however revealed how lock-ins to changes of trajectories may result from an interplay between various components of cooperative socio-ecological systems, under external socio-political and regulatory influences.

In our results, a reinforcing dynamic between the components of the social-ecological system hampered agreements on, and enactment of diversification trajectories. These trajectories remained unexplored because the components of the social-ecological system acted in conjunction, in a given context and reinforced themselves through feedback effects. In recent literature on dynamics of transition, these reinforcing mechanisms between components of social-ecological systems are also addressed as "blocking mechanisms" (Vermunt et al., 2022).

Our findings match up with comparative studies conducted on the influence of the institutional, political and cultural context on the economic performance of dairy cooperatives in Ireland at the end of the 19th century (O'Rourke 2007; McLaughlin and Sharp 2015). These studies analysed how heterogeneous landscapes, in particular political divide, generated tensions adverse to cooperation among dairy co-operatives. Unenforced binding contracts with farmers led, in this

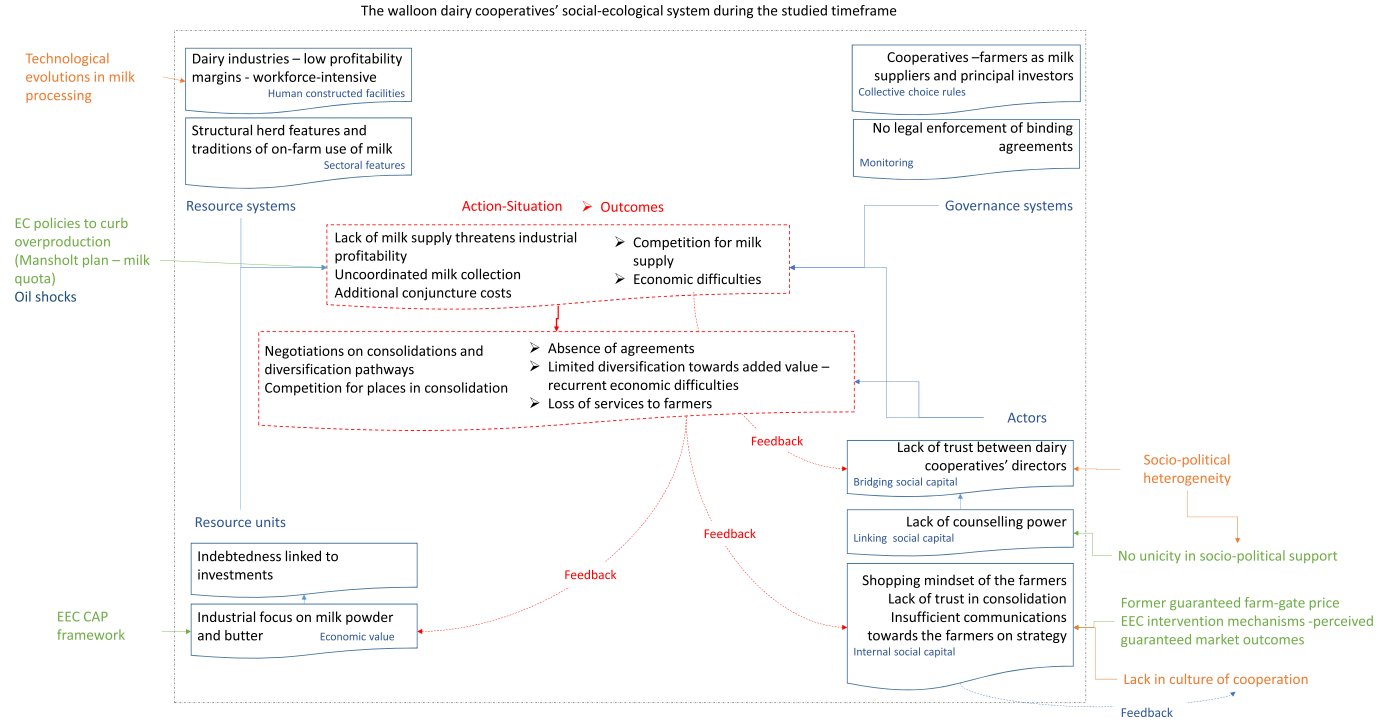

Fig. 4. Illustration of the factors identified in the historical investigation. The colors refer to the four levels of Williamson: level 1 – informal rules and customs (orange), level 2 – the rules of the game – regulatory framework (green), level 3 – the play of the game (blue), and level 4 – resource allocation and strategies in action-situations (red). (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

context, to competition among dairy cooperatives, which alimented failures to reach agreements of coordination on quality standards up until the 1960s (Henriksen et al. 2015).

At the level of the farmer, we observe, in our results, feedback effects reinforcing their lack in culture of cooperation. These feedback effects derive from the poor economic performances of the consolidated cooperative, and the loss of services previously offered to the farmers in top-down steered consolidation process. Farmers, as actors in the cooperatives' social-ecological system, also remain blocked in a mindset adverse to cooperation that the components of the social-ecological system and contextual features of the ECC Common Agricultural Policy contribute to maintain.

These blocking mechanisms bring forward a paradox. Agreements among cooperatives in consolidation processes on strategies of product diversification towards added value may have improved both the farmers' and the cooperatives' long-term prospects, both economically and strategically. From the historical sources, it appears that the awareness of this potential was present, at least at the level of cooperatives' directors. We may hence re-express this lock-in dialectic mechanisms as a pseudo-double bad prisoners' dilemma.

6.3. *A pseudo-double bad prisoners' dilemma emerging from the social-ecological system*

"Collective-action problems occur when individuals choose actions in an interdependent situation. If each individual in such situations select strategies based on a calculus that maximizes short-term benefits to self, individuals will take actions that generate lower joint outcomes than could have been achieved" (Ostrom 2010, 155).

The lower joint outcomes in our cases result from two mutually reinforcing loops (illustrated in Fig. 5) linked respectively to the farmers' social dilemma and to the cooperatives' directors' social dilemma. The former relates to the tension between the short-term interests of the farmers as milk supplier over those of principal investor in the cooperative's long-term development. The latter relates to the inability of directors of the dairy cooperatives to go over competition logics to reach agreements on joint trajectories in diversification pathways.

These mutually reinforcing loops illustrate a pseudo-bad prisoner dilemma, as they do not reflect the exact conditions in which such a game formally unfolds. Formal models of social dilemma are indeed based on the assumptions that "all participants have common knowledge of the exogenously fixed structure of the situation and of the payoffs to be received by all individuals under all combinations of strategies". Additionally, "no external actor (or central authority) is present to enforce agreements among participants about their choices" (Ostrom 2010, 156). In the studied circumstances, we have no evidence that these conditions were met, as testimonies of oral sources point out towards an insufficient communication on strategies and constraints towards the farmers, and as we have evidence of top-down ministerial intervention in some consolidation processes (section 4).

Notwithstanding these deviations from theory, the drivers of this social dilemma offer a relevant angle of analysis of the conditions that may influence its enactment. "The context in which individuals face social dilemmas is more important in explaining levels of collective action than relying on a single model of rational behaviour as used in classical noncooperative game theory" (Ostrom 2010, 160). In an adaptive framework of human behaviour, norms and emotional state built up from previous experience may play a role towards cooperation. What drives individuals towards cooperation is trust, reinforced by collective norm-associated reputation effects and by the confidence in a reciprocal engagement from others. An absence of communication, heterogeneity, and knowledge about past actions may play adversely on these drivers of cooperation. Linkage structures, for instance how individuals are linked to others in networks, may play positively on these drivers of cooperation (Ostrom 2010).

In our case, the lack in culture of cooperation among farmers renders them unlikely to act upon norms that defines as bad behaviour a defection from the cooperative or the pursuit of short-term interests on remuneration as milk suppliers. The lack in culture of cooperation also means that they are unlikely to expect other farmers to reciprocate with a cooperative attitude. Their previous experience of consolidation processes, characterized e.g. by losses of services, and the insufficient communication with the cooperatives, can weaken their trust.

At the level of cooperatives' directors, the socio-political heterogeneity and related lack of linking and bridging social capital is likely to have played a similar role on this norms-trust-reciprocity mechanisms of cooperation among dairy cooperatives.

These considerations based on our results are illustrated in Fig. 6.

There are, hence, dimensions of the cooperatives' social-ecological system that are likely to influence the dynamics of trust and reciprocity driving the farmers and the dairy cooperatives' directors' social dilemma. In terms of cooperative governance, first, service to farmers (Filippi et al. 2008), communication and democratic representation (Hansmann 1996; Michaud and Audebrand 2022) are likely to influence the dynamics of the social dilemma (see also Cechin et al., 2013; and Grashuis and Su 2019 for a state of the art of the efficiency of market, hierarchy and democratic mechanisms likely to influence the above-detailed dynamics of cooperation). At the level of the interactions between cooperatives second (bridging social capital), recent literature stresses the necessity of dialogue for mutual alignment in inter-organisational ventures and the need for support tools and

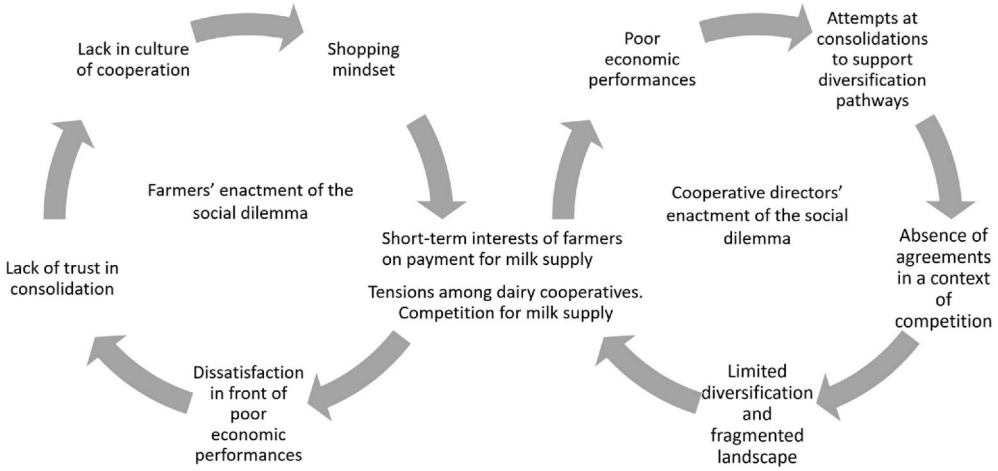

Fig. 5. Representation of the enactment of the farmers' and the cooperative directors' social dilemmas in our case study.

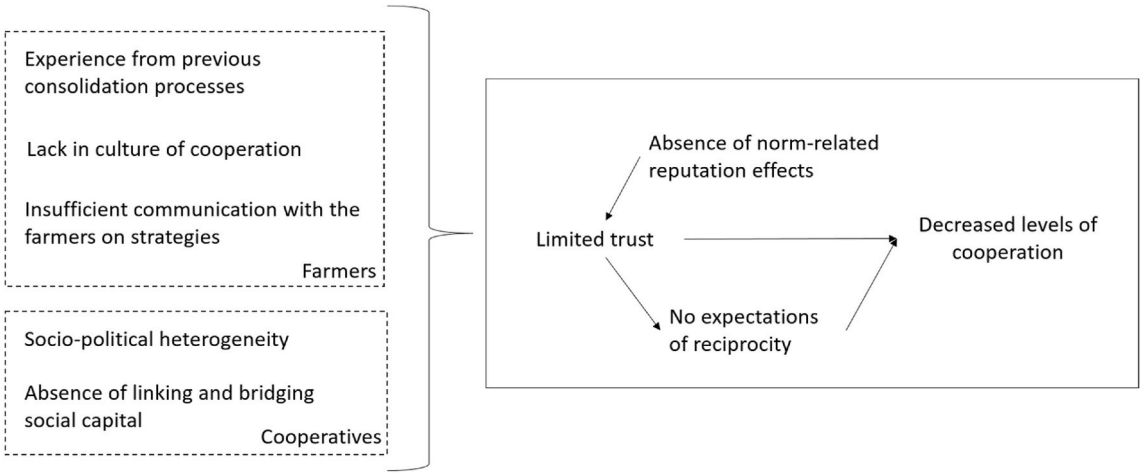

Fig. 6. Representation of the variables influencing the conditions of the social dilemma in cooperatives in our results (based on E. Ostrom's (2010) framework.

methods in this regard (Velter et al., 2020). Adequate support provided as linking social capital may hence compensate the challenges linked to socio-political heterogeneity. Partners in consolidation schemes may also adopt measures to curb the competition effects likely to feed the social dilemma. For example, they may coordinate and share anticipatively the resources that are likely to be the object of competition logics, should the market context evolve (Bauwens et al. 2022). One remaining question is, in this regard, whether the socio-political heterogeneity may not feed a "dark side" of internal social capital, adverse to dialogue and collaboration between partner-cooperatives (Hernández-Espallardo et al., 2022). This dimension did not appear clearly in our results, beyond allusions of oral sources to the difficulties to bridge socio-political divides. Targeted comparative studies on the impact of pillarization on social capital could bring clarifications on that dimension of influence of the farmers' and cooperatives' social dilemma.

6.4. *Regulatory and market context as aggravating or mitigating factor of adverse cooperative dynamics*

The dilemma uncovered in our research are fed not only by feedback dynamics resulting from the interactions of the components of the cooperatives' social-ecological system. These dilemma appear to be driven also by changes in regulatory and market context. In our case study, the industrial configuration of the dairy cooperatives, given sectoral features of low production density and on-farm use of milk, rendered them vulnerable to changes in regulatory frameworks leading to scarcity of milk as raw material. These regulatory frameworks contributed to feed the cooperatives' social dilemmas by generating competition effects and alimenting the farmers' shopping attitude.

More broadly, regulatory frameworks, by defining constraints and potentialities on legal forms, internal governance, technological investments, access to capital, may impact social-ecological systems, the social capital of its actors, and their ability to evolve in given directions (Chloupkova et al., 2003; Bauwens et al., 2016; Spicer and Kay 2022). Depending on the impact of these constraints on inter-cooperative dialogue or cooperatives-farmers dialogue, regulatory frameworks may hence mitigate or conversely aggravate social dilemma.

Regarding prospective pathways in cooperative social-ecological systems, an adaptation of regulatory frameworks to polycentric "inter-organisational coordinated actions" could, for instance, frame the local adaptability of rules and the formalization of network-dynamic supporting bridging social capital and inter-organisational dialogue (Bauwens et al. 2016, 146). These adaptations may hence help manage social dilemma in inter-cooperative settings by accounting for "local institutional settings" in bottom-up-driven transition of practices (Vermunt et al., 2020, 246).

6.5. *Lessons for research on cooperative dynamics in transition pathways*

The main outcome of our historical investigation is the consideration of the complex interplay between the components of the cooperatives, seen as social-ecological systems, and the context in which the cooperatives evolve, as driver of trajectories. Our research connects, in this regard, with other historical studies (Chloupkova et al., 2003; O'Rourke, 2007; McLaughlin and Sharp 2015; Henriksen et al. 2015) as well as with research on current and prospective dynamics of cooperative and collective action, in the agri-food sector and beyond (Bauwens et al. 2016; Velter et al., 2020; Bauwens et al. 2022; Spicer and Kay 2022). The main lessons we identify for research on cooperative dynamics resonate with what Wang and Chen (2021) stressed about common-pool ressources: "specific types of institutional arrangements and different context work together, rather than in isolation" (Wang and Chen, 2021, 329). Seen as structures managing common-pool assets (Cornée et al. 2020), cooperatives hence may adopt certain strategies and encounter success or failure in their trajectories in relation to a complex interplay of factors. These factors are internal to the social-ecological system and relate to the interplay of resources systems, actors, and governance. The contextual factors, like the regulatory frames, the broader socio-political background, influence this interplay. They may aggravate or mitigate social dilemma, intrinsic and inevitable features of common-pool assets (Cornée et al. 2020).

This study hence calls for a deeper understanding of the impact of context on cooperative dynamics. Further mobilizing the historical epistemology to this end, may, in particular, help "understanding the nuances in the diverse relationships and the complex interconnections of institutional arrangements and contextual settings" in cooperatives (Wang and Chen, 2021, 331). On the base of archival material and large-scale approaches of farmers as oral sources, historical studies may re-contextualize social dilemma and link their enactment to patterns of socio-political evolution or changes in market conjuncture.

Of importance for prospective pathways of transition, is the understanding of blocking mechanisms to changes of pathways (Vermunt et al., 2022). Opening up and improving cooperation towards transition pathways requires approaching lock-ins as being a complex and contextualized conjunction of factors, acting jointly and reinforcing themselves at different levels. Similarly to recent studies and reflections on agri-food transition dynamics (Farstad et al., 2020; Vermunt et al., 2020; Conti et al. 2021), our research stresses the need to consider these complex dynamics of change under the eye of their context of development and temporality, as a way to uncover leverages for intervention.

7. Conclusion

This study revealed, through the case study of the historical evolution of the Walloon dairy cooperatives, the importance of the interplay between farmers and cooperatives in trajectories of collective agency. On the base of a theoretical framework defining cooperatives as complex social-ecological systems, we analysed how this interplay unfolded and influenced the cooperatives' trajectories in a given socio-political and regulatory context. In particular, we outlined two social dilemma mutually reinforcing each other, driving the farmers and the cooperatives toward their short-term interests to the detriment of inter-cooperative agreements on diversification pathways. Of significance for cooperative dynamics in transition pathways, is the further understanding of the way context influences the enactment of this double social dilemma intrinsic to cooperatives as common-pool assets. This study stresses the relevance of historical analytically-structured approaches in this regard, and calls for a further comprehension of blocking mechanisms to cooperatives' transition pathways under the eye of these complex dynamics.

Autorship statement

Véronique De Herde: conceptualisation; data curation; investigation; formal analysis; methodology; project administration; writing – original draft; writing – review & editing. Yves Segers: conceptualisation; methodology; writing – review & editing. Kevin Maréchal: writing – review & editing. Philippe V. Baret: writing – review & editing.

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