

**AGRICULTURAL COOPERATIVES AND FARM SUSTAINABILITY – A LITERATURE REVIEW**

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**Abstract**

*We present a literature review of the role played by agricultural cooperatives in influencing farm sustainability. We first focus on the theoretical literature to highlight the various economic behaviours of cooperatives. Then we investigate all three dimensions of sustainability in developing and developed countries. We aim at linking the empirical findings to the theoretical understanding of cooperatives, in particular members' heterogeneity. This paper shows that cooperatives play a non-negligible role in farm economic sustainability and in the adoption of environmentally friendly practices, suggesting that both public policies and private initiatives in cooperatives may be complementary. As regards social sustainability, there are only a few studies existing on the role of agricultural cooperatives. The trade-off between economic and environmental sustainability in cooperatives would need to be further investigated..*

**INTRODUCTION**

The supply of agricultural goods that are more sustainable is expected to increase in response to increasing consumer sensibilities and governments' initiatives in the future (Saitone and Sexton, 2017). In this context, farmers are expected to produce in a sustainable way, reconciling all dimensions of sustainability, namely, economic, environmental and social. Assessments of farm sustainability, as well as of the underlying factors, are numerous in the empirical literature (Dessart et al., 2019). These factors relate to farmers' sociodemographic characteristics (e.g. age, education), farm's characteristics (e.g. organizational structure, size, indebtedness, main production), and external factors such as the type of supply chain, market prices and government interventions (Rasmussen et al.,

2017; Hansson et al., 2019; Malak-Rawlikowska et al., 2019). However, the role of supply chain organization has been under-investigated so far, in particular as regards environmental and social sustainability. We contribute to the literature by considering agricultural cooperatives, key actors in food supply chains.

Agricultural cooperatives have substantial market shares in agri-food supply chains in western countries [40% in agri-food sectors in the European Union (EU) in 2010]. Within the EU, the cooperatives' market share for the whole agricultural sector exceeds 50% in Austria, Denmark, Finland, France, Ireland, the Netherlands and Sweden (Bijman and Iliopoulos, 2014). Moreover, in the case of highly perishable products, farmers may be even more likely to engage in vertical integration via cooperatives (57% and 42% in the dairy and fruit and vegetable sectors, respectively, in the EU) (Bijman et al., 2012). In the USA, dairy cooperatives marketed more than 75% of the milk produced in the country in 2017 (Wadsworth, 2019). Moreover, the market shares of cooperatives differ considerably with respect to sectors and countries. In 2010, in the olive oil sector, the Spanish cooperatives' market share was 70%, while in Italy it was 5%. In Denmark and France, the market shares of pig meat cooperatives reached 86% and 94%, respectively, while in the other EU countries, the figures were much lower (Bijman et al., 2012).

Thus, cooperatives cover a large part of the agricultural sectors, and could therefore play a role in the improvement of farm sustainability. Through their close relationships with farmers, agricultural cooperatives may be key actors in supply chains to help farmers change their agricultural practices and to favour the adoption of more sustainable practices. Cooperative values such as democratic decision-making, equality and solidarity give cooperatives a unique identity, which differentiates them from other types of enterprise and implies that they have a distinct organizational characteristic (ICA, 2020). Solidarity within the cooperative enables farmers to cope with market risks and favours investment by sharing fixed costs. As cooperatives' members are the owners, investors and users of the cooperative, agricultural cooperatives have thus a large spectrum of action. They can design incentives to encourage farmers to change their practices through the services provided, a stronger market position and the pooling of investments resulting in cost sharing among members. Cooperatives may also promote the adoption of these practices by decreasing farmers' perceived risks and by making investment more feasible. However, some deficiencies exist in cooperatives' governance, especially in monitoring and management that can impede the changes. The unique governance structure of cooperatives may then have mixed effects since the majority of members might not favour the changes needed. Membership heterogeneity may even diminish farmers' incentives.

Our main objective is to review and discuss the literature on the role played by agricultural cooperatives in farm sustainability. Our contribution to a better understanding of agricultural cooperatives is twofold. First, we gather a diversified set of theoretical models to examine how the economic behaviour of agricultural cooperatives differ from other organizations. As no unified modelling of the economic behaviour of cooperatives exists, we discuss the different features of the cooperatives' behaviour and we explain their main theoretical weaknesses. Second, we provide insights about how agricultural cooperatives may influence farm sustainability. The empirical literature is rich, however unbalanced between developing and developed countries. We specifically investigate the three dimensions of sustainability and we highlight the topics that are scarcely covered.

The paper is structured as follows. The next section gives background on the economic behaviour of agricultural cooperatives and on criticisms faced by them. The third section reviews the empirical studies that examine how cooperatives may favour sustainable practices. The last section concludes.

## ECONOMIC BEHAVIOUR OF AGRICULTURAL COOPERATIVES

The theoretical literature about the economic behaviour of cooperatives has been built through several waves since the seminal work of Nourse in 1922 and followed by the work of Philipps (1953) and Helmberger and Hoos (1962) which present two contrasting strands: the cooperative as an extension of individual farms and the cooperative as a firm. Since then, three waves of literature have enriched the understanding of cooperatives' economic behaviour: the first one in the eighties (Levay, 1983; Staatz, 1983; Vitaliano, 1983; Sexton, 1986), the second one at the end of the nineties (Cook, 1995; Fulton, 1995; Hart and Moore, 1996; Albæk and Schultz, 1998; Zago, 1999; Fulton and Giannakas, 2001), the last one in the 2010s (Rey and Tirole, 2007; Bontems and Fulton, 2009; Hovelaque et al., 2009; Saiton and Sexton, 2009; Pennerstorfer and Weiss, 2013; Agbo et al., 2015; Fulton and Pohler, 2015; Hueth and Marcoul, 2015; Mérel et al., 2015; Liang and Hendrikse, 2016; Peng et al., 2018). This section presents the theoretical background on the behaviour of cooperatives from the most recent ones, the second and third waves, followed by an explanation of their main theoretical weaknesses as found in the agricultural economics literature. First, the well-known weaknesses are described, then we focus on the specific issue of farmer heterogeneity.

### Theoretical Background

In the economics literature, there are various attempts to define a cooperative as a different form of economic organization (Cook et al., 2004; Soboh et al., 2009). There is no agreement amongst scholars about the economic definition of agricultural cooperatives (Tortia et al., 2013). Depending on theoretical reasoning, economists develop different models to assess cooperatives' economic behaviour. The difference between cooperatives and investor-owned firms is usually tied to the governance structure (Hendrikse and Bijman, 2002; Bontems and Fulton, 2009; Hueth and Marcoul, 2015; Peng et al., 2018); that is to say, to the decision-making process. Table A1 presents a synthesis of the different economic objectives. Cooperative members may independently decide on the quantity and quality they choose to deliver to the cooperative. In this case, the decision-making process is 'decentralized', meaning that the cooperative does not have any restrictive power on the quantity supplied by individual farmers (Albæk and Schultz, 1998). Alternatively, decision-making can be taken as 'centralized' in which cooperatives maximize their profit under additional constraints as compared with investor-owned firms. Marketing cooperatives can be regarded as a constrained supply chain; that is to say that the cooperative must buy all raw material delivered by its members (Hovelaque et al., 2009).

Some scholars investigate in more detail the governance structure in cooperatives by introducing a board of directors and/or managers into theoretical frameworks using principal-agent models (Fulton and Pohler, 2015; Hueth and Marcoul, 2015). They define cooperatives as a form of coalition among farmers with similar objectives (Hueth and Marcoul, 2006; Hueth and Marcoul, 2015). In this coalition approach, the cooperative is regarded as a nexus of contracts in which farmers engage in a collective effort. This approach offers insightful results especially as regards members' involvement in the

cooperative's investment choices. As [Hueth and Marcoul \(2015\)](#) point out, cooperative members face a trade-off between direct involvement in monitoring activity and working with a professional manager. The investment activity in the cooperative depends then on the farmers' monitoring choice, which depends on the cost structure of agent monitoring. Farmers' involvement in the monitoring activity may give the cooperative an advantage that is linked to incentive complementarity.

Theoretical works to assess the economic characteristics of cooperatives' decision-making focus on the farmers' specific role in cooperatives. As member-owned and democratically ruled enterprises, cooperatives are expected to prioritize their members' economic gains. Indeed, in contrast to investor-owned firms, the cooperative's objectives are generally not limited to profit maximization. In the pioneering work of [Helmberger and Hoos, 1962](#)), the cooperative maximizes the price paid to farmers while the cooperative profit is equal to zero. Hence, the specificity of cooperatives refers mainly to the pricing strategy for the raw product delivered by their members. Cooperatives do not consider the price paid to farmers as a simple cost variable. Members are expected to receive higher prices from cooperatives than investor-owned firms ([Sexton, 1990](#); [Fulton and Giannakas, 2013](#)). Accordingly, cooperatives behave like non-profit organizations that aim to improve members' welfare. Cooperatives maximize members' benefits under the constraint of ensuring their viability. In the literature, this viability condition is written as the break-even constraint. That is to say, the cooperative operates with zero profit, which ensures the compensation of the cooperative's production and operational costs. At the same time, the higher prices paid to farmers by cooperatives may force other firms to raise the prices of farmers' products, a mechanism called the competitive yardstick effect ([Liang and Hendrikse, 2016](#); [Carletti et al., 2018](#)). Intuitively, the yardstick effect may be beneficial in coping with the monopsonistic power of firms by improving farm level prices. In this case, investor-owned firms are forced to increase the prices paid to farmers in order to compete with the cooperatives.

In an imperfect competition setting, cooperative members supply more raw product than other farmers who supply through investor-owned firms ([Helmberger and Hoos, 1962](#); [Albæk and Schultz, 1998](#); [Pennerstorfer and Weiss, 2013](#)). [Albæk and Schultz \(1998\)](#) claim that this particularity of cooperatives may give them market power in the case of oligopolistic competition, and the cooperative might dominate the market in the long-run. [Bontems and Fulton \(2009\)](#) investigate input procurement in two separate cases: a cooperative that maximizes member welfare; and an investor-owned firm that maximizes profit. Farmers' heterogeneity is characterized by the cost structure. The authors show that, when the cooperative and its members' objectives are aligned, the cooperative is more efficient than the investor-owned firm. [Agbo et al. \(2015\)](#) construct a theoretical model in which cooperative members have the opportunity to sell their product directly in a local market. They show that the coexistence of both options of selling directly through the local market and selling via a cooperative improves farmers' welfare. The originality of this study is that the local market scenario is taken to be an imperfect competition situation in which the quantity produced impacts market prices, while the cooperative is a price-taker in a completely competitive market.

Finally, agricultural cooperatives may also be defined as vertically integrated organizations which aim at maximizing members' welfare ([Soboh et al., 2012](#)). Agricultural

cooperatives, however, should be distinguished from traditional vertical integration since farmers can behave differently in these two organizational schemes. Farmers who become vertically integrated with investor-owned firms become employees and thus have fewer incentives to improve product quality (Reimer, 2006). Incentives might be even lower with asymmetric information because of the principle-agent problem. In the case of vertical integration via cooperatives, however, farmers' economic incentives for innovations that improve quality can be preserved. More precisely, farmers who wish to improve product quality may be more numerous in the case of production via cooperatives. Hence, the creation of an agricultural cooperative provides a more efficient way of vertical coordination in terms of adoption of new farm-level practices. The theoretical literature on agricultural cooperatives explores quality choices (Hoffman, 2005; Saitone and Sexton, 2009; Pennerstorfer and Weiss, 2013; Mérel et al., 2015). Product differentiation often consists of two products with different quality levels. Hoffmann (2005) analyses the endogenous quality choice in an oligopolistic market, with a model of duopolistic competition (investor-owned firm versus cooperative) with differentiated products. In the case of convex variable cost with respect to product quality, the cooperative produces higher quality than an investor-owned firm. Pennerstorfer and Weiss (2013), who investigate quality choice in cooperatives, show that if the marginal return in quality improvement is increasing with total quantity supplied, the issue of overproduction of agricultural cooperatives may give them an advantage in quality improvement. The relationship between quantity–quality decisions can thus create a positive feedback effect. Giannakas and Fulton (2005) and Drivas and Giannakas (2010) investigate the innovation decision in duopolistic competition between an investor-owned firm and a cooperative. The authors examine theoretically market mechanisms with the introduction of an innovation. They show that the presence of profit maximizing investor-owned firms and member-welfare maximizing cooperatives can increase the innovation activity in the market. Thus, the presence of a cooperative may be welfare enhancing and socially desirable. More precisely, the involvement of the agricultural cooperative in innovation increases with producers' heterogeneity and with the level of fixed costs.

## Major Challenges Faced by Cooperatives

### *Recognized Economic Weaknesses*

Despite their above-mentioned economic advantages, cooperatives have long been criticized in the economic literature (Cook and Chaddad, 2004). They have particularly been criticized in terms of their poor economic performance (Porter and Scully, 1987; Fulton, 1995; Notta and Vlachvei, 2007; Hirsch et al., 2020). This is linked to the fact that agricultural cooperatives have limited powers to restrict the quantity supplied by farmers. In the case of imperfect competition, the cooperative has a tendency to oversupply since individual farmers do not bear the full marginal profit loss when they increase their production level (instead, they share it at the cooperative level).

A crucial weakness is that overproduction may arise when the cooperative is a price maker in the final market (Albæk and Schultz, 1998). Open membership in agricultural cooperatives is thus viewed as a deficiency, which reduces the competitive power of cooperatives because of the adverse selection problem. More precisely, the output-pooling mechanism in cooperatives may increase the number of low-quality producers who benefit from average quality level (Saitone and Sexton, 2009). However, this negative effect of open memberships is mitigated by the competitive yardstick effect. Mérel et al. (2015) investigate

the trade-off between these two effects. They compare situations of open membership and closed membership in a differentiated product setup. They show that in the open membership case, the farmers benefit from the risk-reducing advantage of the cooperative and from higher product prices.

Finally, the horizon problem in cooperatives implies that they may suffer from underinvestment issues related to intergenerational conflicts (Rey and Tirole, 2007; Giannakas et al., 2016). In the case of an investment that becomes profitable in the long run, older farmers tend to disagree with younger members about the implementation of such investment, because the former are close to exiting farming activities, meaning that they would not benefit from the realized investment. Therefore, in the context of innovative investment, the horizon problem may limit the cooperative's performance. This problem is directly linked to non-transferability issues in the cooperatives, in the sense that the members of cooperatives cannot easily liquidate their previous investment if they withdraw from the cooperative.

### ***Member Heterogeneity: A Key Underpinning Issue***

Farmers' heterogeneity, giving rise to governance issues in cooperatives, is a key underpinning issue of the above-mentioned weaknesses. Farms and farmers indeed have different characteristics, creating information asymmetry and discrepancies among members. Farmer heterogeneity in agricultural cooperatives is characterized differently in the literature (Höhler and Köhl, 2018). This heterogeneity may come from various factors such as farm size and cost structure (Plakias and Goodhue, 2015), type of product (Mérel et al., 2015) or members' personal characteristics such as age, risk aversion, preferences (Elliott et al., 2018). Membership heterogeneity also leads to governance issues (Hansmann, 1988; Hart and Moore, 1996; Zago, 1999; Deng and Hendrikse, 2015). In an early work, Hart and Moore (1996) construct a model which examines farmer heterogeneity in a cooperative. In this approach, the dominant farmer group takes the decision about the final quality by maximizing the profit of their group. Zago (1999) develops a theoretical framework to examine the quality of the final cooperative product. The heterogeneity of farmers delivering higher quality product may influence the decision-making of the cooperative. In a setup with the 'one member-one vote' principle, the member group which is in the majority dominates the cooperative's choice of the quality level. In this respect, farmers with similar objectives may positively influence the cooperative's economic performance (Bontems and Fulton, 2009). Farmers may have different preferences, objectives, and goals but the most cited types of member differences that can be observed or measured are when members differ in farm level characteristics (e.g. size, leverage, and efficiency), geography and personal characteristics (e.g. socioeconomic status, age and risk aversion).

Theoretical literature about the quality decisions in cooperatives provides useful insights into the advantages and drawbacks of cooperatives in terms of quality improvement. In these studies, special attention is given to farmer heterogeneity (Hart and Moore, 1996; Zago, 1999; Saitone and Sexton, 2009). The general finding regarding this issue is that cooperatives' decisions with respect to product quality are dependent on the dominant farmers' group. The 'median voter' makes the quality decision in the cooperative level. If farmers who have a higher incentive to invest in high-quality product are in the majority, then the cooperative produces at a quality level which is even superior to the first

best option. Another theoretical approach is based on quality decisions in a mixed duopoly case (cooperative versus investor-owned firm) (Giannakas and Fulton, 2005; Hoffmann, 2005; Drivas and Giannakas, 2010). The difference between the two types of organization is often shown in the form of different objective functions. In these models, the cooperative may provide a higher-quality level in the case of high innovation costs, depending on cost structure. Moreover, when the quality of products supplied by members to the cooperative is not observable, the free riding problem may emerge. Several factors can explain heterogeneity in quality at the farm level. For instance, external shocks (such as bad weather conditions) affecting agricultural production may limit some farmers' capacity to produce high-quality product (Saitone and Sexton, 2009). Moreover, farm exogenous characteristics (such as soil fertility) may create productivity disparities among farmers. Hence, farmers may have different propensities to free ride. Bonroy et al. (2019) analyse the free riding behaviour of cooperative members on product quality in an experimental setup. In this model, farmers' individual quality decisions affect the collective rent from the final product. Taking into account that the production cost increases as product quality increases at the farm level, free riding is characterized as a dominant strategy. However, as the authors explain, punishment may limit free riding. In their model, punishment is in the form of exclusion. In this case, the farmer has a trade-off between, on the one hand, free riding and having a non-zero probability of being excluded from the cooperative and, on the other hand, revealing the true quality information. The authors conclude that in games with few players, farmers tend to cooperate, but an increasing number of farmers increases the cases where free-riding behaviour dominates the game. As the authors suggest, one solution to this problem is to create sub-divisions within the cooperative. Indeed, reducing group size increases the incentives to cooperate. In addition, creating groups with similar characteristics (implicitly similar economic objectives) may enhance the cooperation.

As shown in this second section, the theoretical literature of fersavariety of frameworks for agricultural cooperatives. The main aim of this section was to shed light on the cooperatives' distinct characteristics and their economic performance. Agricultural cooperatives, by eliminating double marginalization (that is to say, eliminating supply chain intermediaries and thus pricing over marginal cost at each stage in the supply chain) and by aiming to improve member welfare, may be beneficial for farmers. Nevertheless, the cooperatives' specific organizational features, combined with the issue of members' heterogeneity, can create some deficiencies linked to investment decisions (the horizon problem), to asymmetric information (free riding on quality) and to overproduction.

### **EMPIRICAL STUDIES: CAN COOPERATIVES INFLUENCE FARM SUSTAINABILITY?**

Our objective is to assess whether cooperatives influence farm sustainability. For this, we provide a comprehensive review of the existing empirical literature linking cooperative membership and farm sustainability, in terms of economic, environmental or social dimensions. We explain the literature findings in light of the theoretical aspects of cooperatives explained in the previous section. More precisely, we examine the empirical studies that draw conclusions on at least one of the three pillars of sustainability; namely, economic, environmental or social. The results of those empirical studies are summarized in Table A2. Most empirical studies show a positive effect of agricultural cooperatives on farm sustainability. However, in this section, we also highlight some negative effects underlined in the empirical literature.

In terms of methodology, we performed a search in the EconLit and Google Scholar databases using the keywords 'agricultural cooperatives', 'cooperative membership', 'farm practices', 'innovation', 'environmentally friendly' and 'farm sustainability' over the period 2010–2020. This search allowed us to identify potentially relevant studies. We also screened the most recent literature applied in developing countries, but only selected studies which were published in the agricultural economics literature and which deal with environmental or social issues. We also include in our review some articles that were quoted in the literature selected from the databases, as well as empirical studies that specifically examine quality issues in cooperatives, for two reasons. First, this literature illustrates well the cooperative governance issues when member heterogeneity is wide. Second, consumers may value differently some environmentally friendly or fair trade practices and are thus willing to pay for a product with an environmental or a social attribute. Thus we can get some insights from the literature into how cooperatives may enhance quality. Finally, we included studies that were recommended by the reviewers of the present paper.

### The Cooperatives' Economic Role

Cooperatives may influence the economic performance of their members. This has mostly been discussed for developing countries. A large number of empirical studies in such countries have been devoted to the impact of farmers' membership of a cooperative on the farms' productivity (Wossen et al., 2017; Ma et al., 2018a; Ortega et al., 2019; Manda et al., 2020; Zhang et al., 2020) or on farmers' incomes (Verhofstadt and Maertens, 2014; Ma and Abdulai, 2016; Mojo et al., 2017; Hoken and Su, 2018; Kumar et al., 2018; 2019; Ofori et al., 2019). These studies emphasize the positive role of joining a cooperative on members' economic sustainability. The impact of cooperative membership may vary depending on farm size. Hoken and Su (2018) and Kumar et al. (2018) show that the relative impact of cooperative membership on farm income is larger for small-scale farms. Wollni and Fischer (2015) find that small-scale farmers benefit from being a member of a cooperative either because of their lack of bargaining power or because the opportunity cost is too low. They also show that large-scale farms gain from being a cooperative member since they can enjoy scale economies in processing and marketing activities. This effect is demonstrated by Liu et al. (2019) who find a larger positive impact of cooperatives on farm income for larger farms. In developed countries, the literature gives evidence of a wider economic impact of cooperatives: impacts for non-members (yardstick effects), and a mixed effect on quality since quality requirements are higher worldwide.

From the theoretical hypothesis of cooperative pricing rules, cooperatives can provide higher prices (Milford, 2012; Hanisch et al., 2013; Jardine et al., 2014). Hanisch et al. (2013) investigate empirically the competitive yardstick effect of agricultural cooperatives on prices paid to farmers. They find that, in the European dairy sector, agricultural cooperatives offer higher farm-gate prices to farmers. Moreover, their empirical results prove that a higher market share of cooperatives increases this effect even further. The authors underline that the competitive yardstick effect is beneficial for farmers who are not cooperative members. This result is in accordance with a positive spill-over effect of agricultural cooperatives (Jardine et al., 2014). One can expect that agricultural cooperatives pay farmers more than the marginal value of product. Milford (2012) also finds a pro-competitive price effect of cooperatives in Mexico, although her hypothesis of a stronger effect when considering the cheating behaviour of intermediaries was not confirmed by her qualitative analysis.



The orientation of cooperatives towards quality differentiation may decrease the marginal cost of innovation, thus encouraging the adoption of these practices by other firms in the market. [Jardine et al. \(2014\)](#) analyse the impacts of the creation of an agricultural cooperative in Alaska's salmon fish industry. They conclude that the creation of the cooperative increased the prices received by local fishermen. Moreover, the investor-owned firms competing with the cooperative then adopted the new fishing production system. The existence of cooperatives may facilitate quality improvements in the whole supply chain by also decreasing innovation costs for other farmers who are not members of the cooperative. In the poultry sector, [Cechin et al. \(2013\)](#) also find that producers who deliver to the cooperative have, on average, higher quality performance. Cooperatives may also help farmers to cope with market imperfections. This is especially true in developing countries, where membership of cooperatives increases the probability of farmers benefitting from global markets. This opportunity to export can encourage farmers to engage in quality improvement via product differentiation. Cooperatives, by providing farmers with access to larger national and international high-quality markets, may offer higher prices and more reliable contracts ([Wollni and Zeller, 2007](#); [Milford, 2012](#); [Cechin et al., 2013](#)). Cooperatives can choose different ways to signal the product quality to consumers ([Grashuis and Magnier, 2018](#)). They can create their own brands. By doing so, cooperatives may create a product differentiation for consumers who have positive perceptions towards the cooperative product. Alternatively, they can choose to use a collective quality label, such as a geographical indication, which provides certain restrictions on the farming system and/or the processing. [Fares et al. \(2018\)](#) analyse the relationship between these two different strategies in small French cooperatives. They show that cooperatives with stronger ties to other cooperatives tend to engage in collective labels, whereas others choose to create independent brands. They also show that there is a substitution effect between the two strategies.

However, possible organizational problems in cooperatives can affect overall product quality negatively. [Pennerstorfer and Weiss \(2013\)](#) show that cooperatives provide lower product quality compared to investor-owned firms through the empirical part of their study on the quality choice in the Austrian wine industry. By using data about the Austrian wine market during 2004–2007, they find that the wine quality is significantly lower in cooperatives compared to investor-owned firms. One explanation provided by the authors is that the free riding problem in product quality, where members who benefit from quality rents in the cooperative may cheat on product quality, might reduce the incentives of farmers to increase product quality. Another explanation provided is that in the Austrian wine market, the size of cooperatives is significantly higher than that of investor-owned firms. Furthermore, asymmetric information is one of the main limitations faced by farmers when considering adoption ([Chavas and Nauges, 2020](#)). In many cases, farmers struggle with foreseeing the economic benefits of new practices. Despite this, cooperatives play an important role in encouraging the adoption of environmentally friendly practices by members.

### **The Cooperatives' Role in Encouraging Environmentally Friendly Practices**

Overall, agricultural cooperatives may influence farmers to adopt environmentally friendly practices and agricultural innovation, thus increasing farm environmental sustainability ([Gonzalez, 2018](#)). [Bareille et al. \(2017\)](#) explore how the alignment of objectives between a multipurpose cooperative and its members influences member commitment.

The authors show that the adoption of new agricultural practices has a small but significant effect. In other words, innovative activities may help farmers to have converging economic objectives and greater incentives to be involved in the cooperative. Furthermore, several studies show empirically the role of cooperative membership in technology adoption and in the adoption of environmentally friendly practices (Abebaw and Haile, 2013; Zhou et al., 2018; Ma et al., 2018b; Ma and Abdulai, 2019; Yu et al., 2021). Ma et al. (2018b) show that being a cooperative member increases the probability of investing in organic amendment. Yu et al. (2021) find that cooperative membership has a significant and positive impact on the adoption of green control techniques that include ecological regulation, biological and physical control and the scientific use of chemical pesticides. Ma and Abdulai (2019) also show the role of cooperative membership in sustainable practices by focusing on integrated pest management technology. Zhou et al. (2019) illustrate that farmers have some difficulties in satisfying quality restrictions in terms of pesticide use in the Chinese fruit and vegetable sector. They show empirically that the involvement of cooperatives may help farmers to reduce pesticide use. Chinese cooperatives, by being involved in the production stage via quality standards and input purchase, improve environmental quality. Consequently, in developing countries, farmers engaged in cooperatives may have higher incentives to improve the product quality (Hao et al., 2018).

Other empirical studies examine the beneficial impact of technical assistance in favouring farmers' environmentally friendly behaviour (Naziri et al., 2014; Ji et al., 2019). Technical assistance services can substantially influence farmers' decisions about whether to adopt the practices with higher fixed costs. Naziri et al. (2014) find that the technical assistance offered by cooperatives increases the farmers' propensity to change their practices by reducing pesticide residues in the vegetable sector in Vietnam. Ji et al. (2019) examine the Chinese hog industry and conclude that farmers who are engaged in cooperatives have significantly higher incentives to adopt safe production practices. They identify safe practices as either when the input sourcing channel meets the safety and quality standards or when a pig farmer strictly follows the recommended production methods. They include feed use, breed use, vaccination, drug use and waste disposal. They also show that the effect is heterogeneous.

Finally, by providing technical assistance and reducing transaction costs, agricultural cooperatives can also help farmers to improve their productivity and their profits (Van Herck, 2014), reduce their cost of production (Bonroy et al., 2019) or adapt to specific quality requirements (Cechin et al., 2013). Most studies are applied to developing countries, as mentioned by Grashuis and Su (2019). They, by reviewing the literature, show that membership of a cooperative increases farm income through better access to inputs and technical expertise (Bernard and Spielman, 2009; Fischer and Qaim, 2012; Wollni and Fischer, 2015). Cooperatives, especially those in developing countries, may help farmers adopt innovations that decrease production costs or increase farm level productivity. However, this may have adverse consequences in terms of environmental impacts through the intensification of agriculture. This is for example underlined by Abebaw and Haile (2013) in the case of Ethiopian cooperatives helping farmers to adopt fertilizers, improved seeds and pesticides to improve their production, but that may lead to detrimental impacts on the environment. In this respect, one may even argue that cooperative membership can cause deterioration in the environmental quality of products when chemical fertilizers and pesticides are adopted.

## The Cooperatives' Social Role

A farmer's choice to be integrated in an agricultural cooperative can be related to non-monetary factors. Many studies examine the determinants of membership commitment and the role of trust (Hansen et al., 2002; Morrow et al., 2004; Roe et al., 2004; Nilsson et al., 2009; Österberg and Nilsson, 2009; Barraud - Didier et al., 2012; Bareille et al., 2017). However, empirical studies explicitly exploring the social role of cooperatives are scarce. The main conclusion of the few existing studies is that being a member of a cooperative has a positive impact (Hernández-Espallardo et al., 2013; Bareille et al., 2017). Hernández - Espallardo et al. (2013) show that 'non-price' factors provide higher incentives to stay in a cooperative than prices. Farmers may prefer to accept lower prices if the cooperative can cope with transaction cost problems such as securing market access, providing information about the cooperative management and helping farmers to meet market requirements and society expectations. Bareille et al. (2017) find a surprising result about the effect of the territorial presence of a cooperative, which is measured as market access facilitation to all outputs produced on each farm. Members seem to be more loyal to their cooperative in areas where the cooperative is not well established.

Different aspects of the social role of cooperatives can be found in the literature such as employment (Michalek et al., 2018), gender effect (Serra and Davidson, 2020) or knowledge (Hagedorn, 2014) for instance. Michalek et al. (2018) highlight the positive effect of cooperative membership on farm employment for the cooperative members. Serra and Davidson (2020) assess how cooperative membership can allow women smallholders to improve their economic outcomes. They show that cooperative membership significantly improves market price and quantity in the honey sector for these women. However, their membership does not allow them to increase their market power. This is in contrast to Ferguson and Kepe (2011) who show that in Uganda women extract non-monetary benefits from being part of cooperatives; namely, increased negotiating skills and ability to take decisions. Other studies deal with the provision of social capital. Zhou et al. (2018) show that cooperatives can help farmers to make better use of chemical inputs when associated with a high level of social capital (communication, trust and common goals). This allows the cooperative to help farmers to provide safe food. Hagedorn (2014) indicates that Lithuanian cooperatives create knowledge and capacity building for members. Yu and Huang (2020) show that societal impacts of cooperatives must be taken into account when assessing their efficiency. They define societal impacts as the services and assistance the Chinese cooperatives provide to non-members. The study of Figueiredo and Franco (2018) in Portugal also considers not only cooperative members but the rural sector in general. The authors show that agricultural cooperatives have multiple impacts on their members through training or technical support and are able to promote local development, for example by the use of local resources. In line with this, Hagedorn (2014) mentions, for the case of cooperatives in Slovakia, that they provide social services to members and contribute to the local development. However, in contrast to the communist period where these were social objectives per se, they are nowadays 'by-products' of economic objectives. This is in contrast to Bulgarian cooperatives where such non-profit activities are still very much present and take the role of safety nets in poor rural areas. Cooperatives contribute to public infrastructure such as roads and street lighting, and provide services such as kindergartens, sports facilities and inexpensive canteens and food shops.

## CONCLUSION

The objective of this paper was to assess the role of agricultural cooperatives in food supply chains in farm sustainability. Our literature review, both theoretical and empirical, shows that economists from different backgrounds study this issue. One part of the literature is mostly theoretical, and considers the behaviour of farmers in a cooperative. This approach provides analytical insights into the impacts of market power, farmers' heterogeneity, adoption costs and the availability of quality-related information when farmers are members of a cooperative. In contrast, the other part of the literature is purely empirical and generally investigates the role of agricultural cooperatives in an ad hoc way, by introducing in the econometric analyses one driver that represents the relationship of the farmers with their cooperative. While this can help derive stylized facts about the agricultural sector, it lacks systematic conclusions which could help build scenarios and design sound recommendations. To our knowledge, there has been no academic attempt to link these two strands of literature. The empirical literature about the determinants of farmers' adoption of sustainable practices aims at investigating a large array of determinants in order to identify the most important ones for a specific case study. In contrast, the literature on cooperatives based on industrial organization theory focuses on a specific type of organization and demonstrates theoretically whether it has an impact on welfare. In this case, empirical applications would necessitate some specific data that are generally lacking.

Regarding the different historical backgrounds of cooperatives and technical characteristics of agricultural sectors, one can argue that more contextual works, both at the sector and country level, are needed to fill the gap between theoretical and empirical studies. One reason is that there are more empirical studies relating to developing countries. Indeed, newly-founded and rural development-oriented cooperatives in these countries provide generally positive evidence about quality in cooperatives. Cooperatives often provide various economic advantages to farmers by decreasing the information gap and market uncertainties. The incentives for farmers to engage in cooperatives may be linked to access to markets at the international level. By acquiring different labels (e.g. organic, fair trade) and cooperative brands, farmers may benefit from export-oriented high-quality production. The major mechanism is linked to the cooperatives' impacts for coping with market imperfections in favour of farmers. In high-income countries by contrast, these effects are not so strong. Cooperatives may have cost-driven objectives to dominate markets. For example in the EU, cereal, sugar and pig meat cooperatives are oriented more towards market power via cost reduction than value creation (Höhler and Kühl, 2014). In addition, the theoretical literature investigates deeply the possible problems arising from farmers' heterogeneity and from the different economic objectives within the cooperative. Analytical results from these studies fit better with cooperatives in high-income countries where cooperatives historically have more market power. Several studies find that cooperatives can obtain efficiency gains through growing (Gezahegn et al., 2019; Pokharel and Featherstone, 2019; Musson and Rousselière, 2020). However, becoming a larger organization may imply a decrease in membership commitment (Fulton and Giannakas, 2001). Large cooperatives may thus be less efficient organizations than investor-owned firms (Hirsch et al., 2020). This is related to their governance characteristics: in the presence of heterogeneous membership, the voting system may lead to ineffective decisions because the cooperative's strategy is not accepted by all members (Hansmann, 1988; Hart and

Moore, 1996; Deng and Hendrikse, 2015). It is also worth noting that all cooperatives do not act as responsible firms or truly democratic firms. For instance, large cooperatives may, at one point, find that the democratic process is too binding to stay competitive. These cooperatives are democratic only formally and in fact behave as investor-owned firms (Nilsson et al., 2009). In that case, they are neither socially nor environmentally responsible either. Furthermore, legislations in many countries have allowed the cooperative firms to get external investors such as in France, Italy or China. Overall, there is a lack of studies on the role of supply chain organization, and in particular that of cooperatives, and on the adoption of farmers' sustainable practices, whether ad hoc or theoretical. However, we believe that this is a promising avenue for research and a topical issue, in the context of the growing scarcity of public subsidies. Several solutions or incentives, both from private or public sources, have been proposed in the literature to increase the adoption of ecological practices by farmers; for example, by improving their education, delivering better extension services to them, developing specific inputs or equipment, or providing public support. This paper shows that cooperatives play a non-negligible role in farm economic sustainability and in the adoption of environmentally friendly practices, suggesting that both public policies and private initiatives in cooperatives may be complementary. As regards social sustainability, there are only a few studies existing on the role of agricultural cooperatives. This is in line with the literature in general, where the social dimension of sustainability is still poorly investigated, due to the complexity of this dimension (encompassing both private aspects and public aspects) and to the difficulties of measuring it (Bond et al., 2012). Another issue that would need further investigation is the trade-off between economic and environmental sustainability in cooperatives, and whether these objectives are compatible, complementary, 'by-products' of each other, or in competition.

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