

# Forms and Performances of Collective Agricultural Innovations: The Example of Warrantage System Management in Benin

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## Abstract

How to innovate collectively to face common challenges? This study seeks to investigate the performance of collective innovation within warrantage systems in Benin. Employing the "snowball" technique, primary data was gathered from six organizations involved in promoting warrantage systems via semi-structured interviews, which were subsequently analyzed through discourse analysis. The performance of collective innovations was evaluated by means of six focus groups with stakeholders and semi-structured interviews with management committees. Economic efficiency, member interaction, external relations, and sustainability of the system are the performance indicators. The findings revealed three distinct forms of collective innovation: collective innovation based on cognitive proximity, that based on social proximity and that based on organizational proximity. Collective innovation based on organizational proximity demonstrated the most favorable performance. The performance of collective innovation is determined by the actor's interaction capacity.

**Keywords:** post-harvest management, agricultural innovation, market, organizational proximity, food security

## 1. Introduction

Rural areas in developing countries, such as Benin, have undergone significant changes in recent decades, including the effects of climate change, accelerated population growth, and increased household food insecurity (Fofiri Nzossié et al., 2016). These changes pose new challenges for agriculture and exacerbate existing post-harvest management issues, including the selling of agricultural products, difficult access to credit, insufficient secure storage facilities, poor negotiation capacity, lack of control over market prices, and lack of knowledge of market information systems that should strengthen market transparency (Galtier et al., 2014).

To address these challenges, various projects and organizations have developed post-harvest management systems, including warrantage, which is a rural and collective credit system implemented by peasant organizations and microfinance institutions (Egah et al., 2014). Warrantage uses non-perishable agricultural products as collateral, which are likely to see their prices increase during the agricultural year and has been promoted in different forms to improve household food security in Benin (Garrido and Sanchez, 2003). In this system, several actors interact, such as producers, Farmer Organizations (FOs), Decentralized Financial Services (DFS), advisory services, and local authorities, and it is set up and developed according to the promoters, objectives, and stakeholders. However, this collective action mechanism faces governance problems (Iyébi-Mandjek, 2013), and strengthening collective action is essential for the sustainability of experiences (Labbaci et al., 2015). Collective innovation is also critical in this context, requiring an organizational effort that mobilizes various productive capacities and promotes the emergence of collective innovations (Uzunidis, 2018). Several studies have examined collective innovation along various dimensions, such as the innovation space, the local space of production, the knowledge capital, the accompaniment by adapted governance, networks and the coordination of actors in the territories, and the fundamental role of territory and proximity in collaborations between actors (Morel et al., 2018; Touzard and Temple, 2012; Laperche, 2018; Kasmi, 2018; Richez-Battesti and Vallade, 2012; Tanguy, 2018). However, while the literature has elucidated the failures and successes of collective action in common pool resource management, it has less specifically studied the factors that influence the performance of collective innovations.

Therefore, this study provides a typology of collective innovations using the proximity approach and explores the drivers of performance of these forms of collective innovation in the management of warrantage systems in Benin. Territorial factors play a crucial role in the performance of collective innovations, with the elaborated space, socially constructed, culturally marked, and institutionally regulated territory being an essential component (Muchnik et al., 2008). So, warrantage is an institutional innovation in Benin that has been developed to improve household food security and address post-harvest management issues. Collective innovation is critical for the sustainability of warrantage systems, and a typology

of collective innovations using the proximity approach provides insights into their performance drivers. Territorial factors, including an elaborated space, are essential components of collective innovations in warrantage systems in Benin.

## **2. Theoretical Framework of the Study**

Organizations must continually acquire new knowledge to develop innovative products and services, apply advanced technologies, implement new production and marketing methods, or enter new markets (Uzunidis, 2018). However, managing warrantage systems as a collective innovation of multiple issues requires a thorough understanding of the actors and their roles (Fofiri Nzossié et al., 2016). This necessitates encouraging collective innovation among actors within organizations. According to Morel et al. (2018), promoting innovation has become a fundamental aspect of organizational strategy. Innovation is a cumulative and historical process that is collective in nature (Casadella & Uzinidis, 2018). The innovation system comprises a set of learning processes that begin with problems to be solved, engaging individuals, structures, methods, and knowledge in specific relationships. It highlights the notion of collective intelligence, which is multi-individual or multi-organizational intelligence, rather than individual or mono-organizational intelligence. Organizations are providing increasing opportunities to create collective intelligence for innovation. Collective intelligence is the capacity of individuals to co-construct experiences and work methods. It is also the ability of a collective or an organization to address common challenges and seek solutions together (Morel, 2018).

Proximity of actors is central to the characterization of collective innovations. In this context, appreciating the proximity of actors is essential to innovate collectively. According to the theory of proximity, there are various schools of thought. Coordination between actors requires the articulation of two forms of proximity: geographic proximity and organized proximity, according to the French school of proximity (Bouba-Olga et al., 2008). Geographical proximity pertains to the separation of agents in space, whereas organized proximity refers to an organization's "capacity to make its members interact." The concept of organized proximity is still being debated, as the authors of the French school of proximity belong to two primary currents: interactionists (Rallet and Torre, 2004) and institutionalists (Colletis-Wahl, 2008). For interactionist advocates, there is only one form of organized proximity, organizational proximity, which can be divided into two logics of belonging and similarity. The first logic implies that belonging to the same organization fosters collaboration among members since their behavior is based on the rules and routines established by the organization. The logic of similarity assumes that the members of an economic entity share the same system of representations and knowledge, which improves their ability to interact (Rallet and Torre, 2004; Torre and Rallet, 2005). Institutionalists, on the other hand, identify two non-spatial proximities, organizational and institutional proximities. Organizational proximity refers to the complementary resources held by actors within the same organization or set of organizations, whereas institutional proximity is based on the adherence of actors to common formal and informal rules of action and to a common system of representations and values (Gilly and Lung, 2005). The latter highlights the fact that these common rules and institutions that guarantee coordination are not immutable and result from compromises

established between actors with divergent and potentially conflicting interests. According to Carrincazeaux et al. (2008), it is possible to reconcile the two currents if the logic of belonging is linked to organizational proximity and the logic of similarity to institutional proximity, without disregarding the social and political dimension of the modes of coordination between actors.

However, the evolutionary economic geography current (Boschma and Martin, 2010) has extended these forms of proximity by identifying various types of proximity, including organizational, institutional, geographic, social, and cognitive proximity (Boschma, 2004). Cognitive proximity refers to the fact that people will share the same knowledge and skill base, learn from each other.

### **3. Study Methods**

The present study aimed to investigate the warrantage promoting institutions and organizations in Benin, in order to understand their rationale, approaches, implementation constraints, territorial scale of intervention and financing of their activities. Snowball sampling was used as the sampling technique to identify the key actors of these warrantage promoters in Benin. The snowball sampling technique allowed us to identify the next promoter from the first, by making regular contact until complete information was obtained. Out of the eleven warrantage promoters identified, six were studied.

The study focused on institutions promoting warrantage that are still active (or completed but still in the field), including the International Fertilizer Development Center (IFDC) with the ACMA2<sup>1</sup> project in central and southwestern Benin, Helvetas Swiss Intercooperation with the PPR<sup>2</sup> in the Atacora department in northern Benin, the Belgian NGO Île de Paix with the AMSANA<sup>3</sup> and the PARSA2<sup>4</sup> programs in the Atacora department, the PASDeR<sup>5</sup> through the regional union of producers (URP) Borgou-Alibori, and the UR-CUMA<sup>6</sup> with the Borgou Maize cooperative (CMB) in the North of Benin.

The study collected primary data on the types of actors involved in each warrantage model, the roles of actors in the warrantage system, forms of organization, management methods, intervention strategies, and support. General information about these institutions was also obtained from their websites, including the objectives, intervention areas, infrastructure and operations, technical and economic data, and the duration of interventions.

The study was conducted within an institutional analysis framework, with six focus groups

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<sup>1</sup> Communal Approach for the Agricultural Market phase 2

<sup>2</sup> post-harvest project

<sup>3</sup> multisector support for food and nutrition security in atacora

<sup>4</sup> income enhancement and food security program phase 2

<sup>5</sup> agricultural development sector support program

<sup>6</sup> regional union of cooperatives for use of agricultural equipment

and semi-structured interviews with the management committees to evaluate the performance of the collective innovations. The performances were analyzed through four dimensions: the "economic efficiency" dimension composed of volumes in grouped sales, crop year balances, and stock management; a "cooperation" dimension highlighting the interactions between cooperators and the mobilization of actors; a "relationship with external actors" dimension such as the SFDs and support services; and a "system sustainability" dimension. The strong, medium, and weak options were used to specify the assessments during the focus groups.

The data collected, which was essentially qualitative, was later processed and analyzed through unstructured interviews with the six promoters. A diagnosis was made of the promoters interviewed and a typology of collective innovation strategies in the management of warrantage stores was drawn up. The study provides insights into the warrantage promoting institutions and organizations in Benin, their approaches and implementation constraints, and the effectiveness of their interventions. The findings could inform policy and practice in promoting warrantage in Benin and other similar contexts.

Table 1 presents a summary of the different models studied. It presents some of the elements realized, the types of support, the management methods and the years of start-up.

Table 1. Some warrantage models studied

<b>promoters</b>	<b>Start-up year</b>	<b>Storage infrastructure</b>	<b>Type of support</b>	<b>Management mode</b>
<b>PPR/Helvetas</b>	2013	warehouse construction	facilitation	self-management
<b>ACMA 2/IFDC</b>	2015	warehouse construction	coaching	self-management
<b>AMSANA/ Île de Paix</b>	2015	warehouse construction	Advisory support	self-management
<b>PASDeR/URP B-A</b>	2013	warehouse construction	Advisory support	co-management
<b>UR-CUMA</b>	2014	warehouse construction	facilitation	self-management
<b>PARSA 2/ Île de Paix</b>	2017	utilisation des anciens magasins	Advisory support	self-management

Source: survey data, February 2020

## 4. Results

### 4.1 Characteristics of Warrantage Models in Benin

The present study has identified several variations that have allowed for the characterization of different forms of warrantage in Benin. These variations are based on several key factors, including the specific objectives of each warrantage promoter, the nature and type of support provided, and the different actors involved in the implementation of each model. To further explore these variations, Table 2 provides a detailed overview of some of the key characteristics of the warrantage models studied.

Table 2. Characteristics of the forms of warrantage in Benin

Promoters	Objectives	Actors involved
PPR/ Helvetas	Increase the food security of small producers through the reduction of post-harvest losses	OP <sup>7</sup> , SFD <sup>8</sup> , ATDA <sup>9</sup> /DDAEP <sup>10</sup> , local community
AMSANA/ Île de Paix	Reduce post-harvest losses and improve income through advantageous marketing channels and ensure food and nutritional security for the population	OP, SFD, ATDA/DDAEP, local community
ACMA2/ IFDC	To improve the income of direct actors through an increase in the volume of products marketed and the professionalization of commercial exchanges of agricultural products	Producers/processors, traders, SFD, ONG, ATDA/DDAEP
URP PASDeR B-A/	Fight against the sale of food products, improve household food security; Improve access to financial services for PSOs, Improve producers' income through the promotion of IGAs	Producers /OP/UCP <sup>11</sup> /URP <sup>12</sup> , SFD, ATDA/DDAEP, commune and intercommunality (APIDA)
CMB/UR-CUMA	facilitating access to inputs for its members, facilitating access to financing, facilitating access to the market, strengthening members' capacities	Producers /OP, SFD, CUMA, ONG
PARSA 2/ Île de Paix	strengthen the economic, environmental and social performance of sustainable family farming actors	OP, SFD, ATDA/DDAEP, local community

Source: survey data, February 2020

<sup>7</sup> professional organization

<sup>8</sup> Decentralized Financial Service

<sup>9</sup> Territorial Agricultural Development Agency

<sup>10</sup> Departmental Directorate of Agriculture, Livestock and Fisheries

<sup>11</sup> Communal producers' union

<sup>12</sup> Regional producers' union

The objectives of the warrantage promoters vary depending on the specific model implemented. For instance, some promoters, such as Helvetas Swiss Intercoopération with the post-harvest project, international NGO Île de Paix with the AMSANA program, PASDeR through the URP Borgou-Alibori, aim to improve household food security. Meanwhile, IFDC through the ACMA 2 project aims to improve household incomes, and PARSA 2 aims to strengthen performance. On the other hand, other promoters aim to facilitate farmers' access to agricultural inputs, such as UR-CUMA's Borgou Maize Cooperative.

The study found that promoters are mainly concerned with limiting the sale of agricultural products and improving access to financial services. In terms of support mechanisms, all promoters have built storage warehouses in the intervention communes and provide technical and institutional support to actors. Some promoters also provide coaching and advisory support to build the capacity of actors to implement the warrantage system, such as UR-CUMA, PASDeR, and IFDC. Other PTFs, including PSDCC, LISA 2, Pavicot, CTB, Giz (Fi-agri), have built warehouses that are also used for implementing the warrantage system in some communes, such as in the case of the Île de Paix/AMSANA model.

Two main groups of actors are involved in the implementation of the warrantage models: direct actors (producer/trader members, POs, and SFDs) and indirect actors (NGOs, decentralized state structures) who facilitate and support the first group of actors. However, traders are also involved in the warrantage model promoted by IFDC. The presence of communes and intercommunality (APIDA) in the PASDeR model has facilitated the search for opportunities and the management of local resources. The ATDA/DDAEP are present for quality control, inspections, and technical monitoring in all models.

#### *4.2 Some Parameters and Management Modes of the Warrantage Models*

The different models studied have some specific characteristics. There are several forms of warrantage with speculations varying from one model to another. For most models, maize remains the dominant crop. Several types of credit with different Decentralized Financial Services (DFS) and different interest rates. Table 3 presents the situation of the different models studied.



Table 3. Some characteristics of the warrantage models studied

Promoters	PPR/Helvetas	AMSANA/ Île de Paix	ACMA2/ IFDC	URP B-A/ PASDeR	CMB/UR-CUMA	PARSA 2/ Île de Paix
<b>Form of warrantage</b>	AGR Warrantage <sup>13</sup>	Plural Warrantage	Warrantage marketing	Plural Warrantage	Plural Warrantage	AGR Warrantage
<b>Speculations</b>	Maize, Cowpea	Maize	Maize, Soya, Palm oil	Maize, Soya, Peanut, Rice, Sorghum	Maize, Soya	Maize, sorghum, rice, cowpea
<b>Type de crédit</b>	AGR Credit	AGR credit + social obligation	AGR credit + social obligation	AGR Credit + Input	AGR Credit + Input	AGR Crédit
<b>SFD</b>	CCIF	CCIF, PEBCo, SIA N'SON	ALIDE	CLCAM, SIA N'SON	CLCAM, N'SON	SIA CLCAM, CCIF, PEBCo
<b>Interest rates</b>	1 à 1,7%	1 à 1,7%	1,25%	2%	2%	1 à 1,7%
<b>Geographical coverage</b>	National	Regional	National	Regional	Regional	Regional

Source: survey data, February 2020

The warrantage models that were examined are implemented either at the regional level, such as the Île de paix, PASDeR, and UR-CUMA models, or at the national level, such as the IFDC and Helvetas models. All the credits are first oriented towards IGAs and then accompanied by social obligations (Ile of Peace and IFDC) for some and inputs for others (PASDeR and UR-CUMA). The duration of the experience is at least five (5) years for all the promoters. Interest rates vary according to the models: from 1 to 1.7% for the models promoted by Île de paix and Helvetas, 1.25% for the IFDC model and 2% for the models promoted by PASDeR and UR-CUMA. The credit amounts are set per 100 kg bag of product deposited. Most of the models have one to two speculations (mainly maize and/or soybean and mainly palm oil in the ACMA 2/IFDC model in the central and southern zone of Benin). Only in the PASDeR model are there several speculations such as maize, soybean, groundnut, paddy rice and sorghum. The "faire-faire" approach is used by most promoters to facilitate a better appropriation of intervention strategies by the direct actors themselves.

#### 4.3 Typology of Collective Innovations in Warrantage Systems

The technical and organizational parameters, cooperation and catalysts of collective innovations are criteria for the typology of these collective innovations. For each model, actors are organized and mobilized to bring about collective technical, social and organizational innovations. The typology of collective innovations is based on the dimensions of proximities. Table 4 presents the typology of collective innovations.

<sup>13</sup> income generating activity



Table 4. Typology and functioning of forms of collective innovation

Promoters	Parameters				
	Technical	Organizational	Cooperation between members	Catalyst for collective innovation	Forms of collective innovation
<b>PPR/ Helvetas</b>	-Use of improved granaries, -Drying on waxed cloths or black tarpaulins, -Use of credit for income-generating activities to diversify income sources	-make-do approach, -self-management, -coordination by the management committee	trust based on social relationship, friendship, family ties	Social proximity	<b>Collective innovation through social proximity</b>
<b>AMSANA/ Île de Paix</b>	-Setting up buffer stocks to ensure food security, Classifying stocks (stock for self-consumption, warrantage and group sales) with priority given to self-consumption, -Family storage through improved traditional granaries and collective storage, -Facilitation and capacity building of POs	-make-do approach, self-management, -Availability of management tools, -Existence of a warehouse management committee and a warrantage committee, -Literacy of management committee members	trust based on social relationship	Social proximity	<b>Collective innovation through social proximity</b>
<b>PASDeR/ URP B-A</b>	-Valuation of endogenous techniques, -adherence to the same traditions and beliefs -Involvement of all actors in the search for a market.	-participatory approach, co-management, -collective learning process, -Establishment of committees at the village, communal and regional levels,	sharing the same common knowledge base learning from each other	Cognitive proximity	<b>Collective innovation through cognitive proximity</b>

		-networking of direct actors			
<b>UR-CUMA</b>	-Use of inventory sheets, -Use of certain tools such as the moisture meter to check the warrantability of products, the probe for the cleanliness of stores-inspection périodique des stocks constitués -Strengthening the technical capacity of POs	-make-do approach, self-management -Conflict management through the development of social relations -management tools, analysis and decision making	trust based relationship	Social proximity	<b>Collective innovation through social proximity</b>
<b>ACMA2 /IFDC</b>	-cooperations and the capacity of interaction between members, -Valuation of the technical experiences of the actors, -Quality control of the products to be warranted, Quality control of the products to be warranted, -Strengthening of the technical capacity of the actors, -Development of campaign plans, -certification of deposits -Availability of a procedure manual (accounting	Make-do approach, Self-management and experience capitalized by routine -Multi-actor committee operation, -Control on the basis of established principles and rules, -Rigorous application of the management manual -Networking for business partnerships, Networking for business partnerships, -Structuring of	integration of control systems	Organizational proximity	<b>Collective innovation through organizational proximity</b>

	guide) and organizations management tools (from the base to the umbrella)			
<b>PARSA2/ Île de Paix</b>	-storage and classification by type of products and actors, -Capacity building of POs, -Use of technical sheets, training manuals -The availability of management tools, -Self-evaluation of technical performance	-make-do approach, Self-management, -Existence of a warehouse management committee and a warrantage committee -Networking of management committees for the search for information on the prices of agricultural products -Development of mutual aid, savings and tontine systems to become autonomous	trust based Social on social proximity relationship	<b>Collective innovation through social proximity</b>

Source: survey data, February 2020

#### *4.4 Performance of Collective Innovations in the Management of Warrantage Systems*

The performance of actors in the management of warrantage systems is related to their capacity to introduce and apply the different innovations. The first performance criterion is related to the economic efficiency of the warrantage systems. It concerns the volume of grouped sales, crop year balances, stock management and credit management. The second dimension relates to cooperation between actors. It highlights the interactions between cooperators, the mobilization of actors, collective intelligence, and innovation capacity. The third dimension relates to the management of relations with external actors. This concerns relations with key partners in the warrantage system such as the SFDs and support services and a final dimension relating to the sustainability of the system. The innovations introduced are the new practices and/or new processes brought to technical and organizational management. The following table exhibits the effectiveness of diverse forms of collaborative innovation based on measures of economic efficacy, cooperation, external relations, and sustainability of the system.

Table 5. Performance of collective innovations

<b>Performance requirements</b>	<b>Forms of collective innovation</b>		
	Collective innovation based on social proximity	Collective innovation based on cognitive proximity	Collective innovation based on organizational proximity
<b>Economic efficiency</b>	Middle	Low	High
<b>member interaction</b>	High	Middle	High
<b>external relations</b>	Low	Low	High
<b>Sustainability of the system</b>	High	Middle	Middle

Source: Survey data, February 2020

The performance of collective innovations was observed in the technical and organizational management of the warrantage systems.

All warrantage models show varying levels of performance. These performances are linked to the introduction of innovations in the technical management of the warrantage systems. The collective innovation based on organizational proximity has the highest level of performance. The best results were obtained in terms of economic efficiency, cooperation and relations with actors outside the cooperatives. The various technical innovations induced have enabled a good performance in the collective management of the warrantage stores. These include: reduction in the sale of products at harvest time, improved profitability, buyer confidence, availability of outlets, sale of products at better prices, guaranteed insurance from SFDs to finance producers, product security, better quality products stored in comfortable conditions, transparency in stock management, reduction in the risk of detour and reduction in conflicts.

With regard to organizational management, in the different warrantage models, collective innovations in organizational management have been introduced and applied by the actors. These innovations are applied according to the warrantage models studied. Whatever the warrantage model, innovations have been introduced at the organizational level. In all models, information, sensitization and reporting meetings are organized, management committees are functional and the capacities of committee members and other actors are strengthened. However, none of the models practice the calculation and analysis of economic results. For the collective innovation based on organizational proximity with the IFDC model, there is the development of internal principles and rules for managing activities. The innovations induced in the organizational management have made it possible to obtain a significant level of performance. In the form of collective innovation by social proximity, the actors ensure good

coordination on the basis of social relations and thus guarantee the sustainability of the systems. At the organizational level, the models studied showed good management of the warrantage campaigns, a reduction in conflicts, a good level of communication about the system, a good command of the principles of warrantage, respect for the principles and rules of warrantage, good competence in managing the campaigns, a positive assessment of the campaigns, and a strong capacity to assess operations and make decisions.

## 5. Discussion

### 5.1 Typology of Collective Innovations in the Warrantage Models in Benin

The proximity approach has made it possible to characterize collective innovations. Three catalysts were used to characterize collective innovations: cognitive, organizational and social.

#### 5.1.1 The Cognitive as a Catalyst for Collective Innovation

Collective innovation is an approach that has gained increasing attention in recent years due to its potential to foster innovation and improve organizational performance. Collective innovation based on cognitive proximity, in particular, has emerged as a promising method for making better use of the knowledge of direct actors for the implementation and development of warrantage systems (e.g., PASDeR model). According to Boschma and Martin (2010b), cognitive proximity refers to the fact that people will share the same knowledge and skill base and learn from each other. Cognitive proximity encompasses different aspects of similarity, such as the same conception of innovation, paradigm, routines, traditions, beliefs, languages, and learning, decision-making, and governance procedures (Uzunidis, 2018). This proximity can be found within organizations, networks, and communities. To facilitate collective innovation, actors need to share the same knowledge base and a similar way of seeing things. This can lead to improved performance of management systems when actors respond by being strongly involved in management (Meinzen-Dick et al., 2002). However, it is crucial to select stakeholders based on cognitive distance to ensure that external knowledge can be absorbed and give rise to new internal developments. According to Nooteboom et al. (2006), an optimal cognitive distance exists to facilitate exchanges and mutual understanding. The quality and frequency of collaborations are also determining variables in the success of collaborative projects (Doloreux and Shearmur, 2012). However, Tanguy (2018) proposes a combination of locally embedded knowledge with external knowledge for innovations to emerge. This requires communities to make external connections with actors who may be sometimes distant from their own knowledge base (Ter Wal and Boschma, 2011). While organizations need face-to-face contacts and information and knowledge exchanged within the same organization and region or territory, they will also need the more distant knowledge transmission channels (Tanguy, 2018). Galliano et al. (2006) suggest that knowledge, networks, and intangible resources are important ingredients of innovation processes, but physical infrastructures and associated services are also required. Communities can compensate for weak external resources by developing their internal resources for innovation, particularly in research and development capacity, personnel qualification, or the use of Information and Communication Technologies (ICT).

### 5.1.2 The Organization as a Catalyst for Collective Innovation

collective innovation is an essential element in the process of developing and implementing innovative solutions that can meet the evolving needs of society. The success of collective innovation largely depends on the extent to which the actors involved can cooperate and interact effectively to achieve their common goals. In this context, organizational proximity plays a critical role in facilitating cooperation and interaction between the members of an organization based on established principles, rules, and routines. Organizational proximity refers to the degree of similarity or sharing of actors in organizational arrangements within an organization or between two organizations (Uzunidis, 2018). The ACMA 2/IFDC model provides an excellent example of how collective innovation based on organizational proximity can facilitate cooperation and interaction between actors from different organizations. The model involves a strong involvement of several types of actors, including farmers, traders, financial institutions, and NGOs, who work together to develop and implement innovative warrantage systems in West Africa (ACMA, 2019). The success of the model is largely attributed to the fact that the actors involved share a common organizational arrangement, which allows them to interact and cooperate effectively towards achieving their common goals. The importance of organizational proximity in facilitating collective innovation is also supported by previous research. For instance, Tanguy (2018) emphasizes the critical role of organizational proximity in facilitating coordination between actors within an organization. Tanguy argues that an organization's ability to have its members interact is essential for achieving collective innovation. This is because members of an organization who share the same organizational arrangements are more likely to have a similar understanding of the organization's goals, values, and objectives, which facilitates cooperation and interaction.

Moreover, communities or organizations that seek to foster collective innovation must combine different types of proximities to manage their partnerships effectively. These proximities may include cognitive, geographical, and organizational proximities. Tanguy et al. (2015) argue that communities or organizations should not limit their cooperation to geographically close partners but should also consider partners with similar organizational arrangements. The authors suggest that coordination between actors can be achieved through a combination of different types of proximities, which can enable communities or organizations to access new knowledge and resources. The choice of a partner to innovate is primarily driven by organizational and strategic considerations. Research indicates that belonging to a particular group is a crucial factor in accessing the group's resources and cooperation networks (Galliano et al., 2011). Moreover, the degree of similarity or sharing of actors in organizational arrangements within an organization or between two organizations is an essential element in ensuring collective innovation.

### 5.1.3 The Social as a Catalyst for Collective Innovation

Collective innovation based on social proximity is a strategy that aims to enhance social relations in order to facilitate the implementation and development of innovative solutions in various fields, including the management of warrantage systems. According to Boschma

(2005), social proximity refers to the relationship based on trust that is founded on factors such as friendship, family ties, and experience. Maintaining social capital is crucial for local actors, and it should be ensured at all stages of its construction (Fournier, 2008). Resource potential is another type of capital that can be accumulated and valued by individuals. In an uncertain economy, where the market does not provide all the necessary information for making entrepreneurial decisions, individuals build networks of social relations and develop strategies that promote gambling behavior. Bourdieu's concept of social capital is defined as a network of social relations supported by an individual's economic, cultural, and symbolic capital. In contrast, resource potential is presented as a system of resources that includes financial resources (economic capital) and knowledge resources (cultural and symbolic capital) (Bourdieu, 1986). Boutillier (2018) emphasizes the importance of human capital, which includes the scientific, technical, commercial, and administrative knowledge that individuals possess and are required to use. Resource potential is a product of conscious and unconscious social strategies of individuals, and it induces a systemic dimension between several types of resources that compose it (Boutillier, 2018). In the context of collective innovation, social proximity plays a significant role in facilitating cooperation and trust among individuals and organizations. The Helvetas, CUMA, and Peace Island models are examples of collective innovation based on social proximity, which prioritize social relations and trust between actors (Fournier, 2008). Social proximity enables local actors to work together towards a common goal, and it provides the foundation for the creation of new ideas and innovations. It is crucial for actors to be able to share their knowledge, expertise, and experience in order to improve the performance of management systems (Meinzen-Dick et al., 2002).

Moreover, social proximity can also lead to the development of strong partnerships and networks. For example, in the case of the ACMA 2/IFDC model, organizational proximity is an important factor that facilitates cooperation and interaction between members of the same organization, network, or innovation collective (Tanguy et al., 2015). The choice of a partner to innovate is often dictated by organizational or strategic considerations (Galliano et al., 2011). Thus, communities or organizations combine different types of proximities to manage their partnerships and collaborate with actors who may not be geographically close to them (Tanguy et al., 2015).

### *5.2 Performance of Collective Innovations Introduced in Warrantage Systems*

Collective innovation has been studied extensively in the context of the management of warrantage systems. The level of introduction and application of innovations in this area has been found to be higher for the collective innovation model based on organizational proximity, whereas collective innovation based on cognitive proximity has been associated with lower performance (Chaboud et al., 2017). The success of collective management of warrantage systems is due to a combination of factors, including the organizational environment, financial parameters, and technical requirements. These factors enable actors to make diagnoses, carry out prospective and evaluative analyses, and bring appropriate innovations. The performance of the collective management of warrantage systems is also linked to the roles played by warrantage promoters in the system, as well as the participation



of direct actors in the collective action (Lamarche et al., 2019). Technical management models that adopt a "faire-faire" approach, emphasizing self-management by actors themselves and capacity building through training, have been shown to perform better. This approach measures the degree to which actors share in the internal and external organization of cooperatives. The level of organization is linked to the degree of autonomy of the actors in their relationships. In contrast, organizational management is characterized by a hierarchical structure that defines the roles of each stakeholder in relation to the initial objectives. When stakeholders are involved upstream and downstream in the processes of implementing collective actions, from the diagnostic phase to evaluation, they are more motivated to participate in collective innovative design (Lamarche et al., 2019). It should be noted that the non-rigorous application of norms, the low organizational level of actors, and the experience and profile of actors can justify the low level of performance of models based on social and cognitive proximity. In addition, the quality of productive collectives plays a crucial role in the success of collective innovation, as the performance of actors depends on their ability to work effectively as part of a team to meet organizational challenges.

## 6. Conclusion

In Benin, warrantage systems are characterized by three different forms of collective innovation: cognitive proximity, organizational proximity, and social proximity. Proximity approaches were used to characterize these innovations, with each form of innovation having different implications for the warrantage system. In particular, the level of performance in the collective management of warrantage systems is strongly influenced by both the organizational and technical environments in which they operate. The performance of warrantage systems is evaluated in terms of their economic efficiency, member interaction, external relations and strategies for sustaining the gains. The findings of this study indicate that collective innovation based on organizational proximity is associated with the highest levels of performance in warrantage systems. This is due to the capacity of actors to make diagnoses, prospective and evaluative analyses in order to bring appropriate innovations. Moreover, the hierarchical structure that defines the roles of each stakeholder in relation to the initial objectives encourages stakeholders to participate in collective innovative design. In contrast, collective innovation based on social and cognitive proximity shows lower levels of performance due to non-rigorous application of norms, low organizational levels of actors, and the experience and profile of the actors. Nevertheless, it should be emphasized that the individual component in collective work should not be ignored, and the performance of actors depends on the quality of their productive collectives to bring collective innovations to face the organizational challenges. Overall, the different warrantage models are underpinned by the innovations they induce, and the level of performance is influenced by the organizational and technical environments in which they operate. Further research is needed to better understand the complex interplay between different forms of collective innovation and the performance of warrantage systems.

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