Spatio-temporal dynamics of the dual-purpose cattle value chain in the Colombian Amazonas

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Abstract

The cattle sector plays an important role in the economy of the Caquetá department, located in the Colombian Amazon. However, the predominantly extensive production system is associated with low productivity and negative environmental impacts, such as land degradation, greenhouse gas emissions, and deforestation. Efforts to introduce improved practices (e.g., improved forages or silvopastoral systems) have been made over the last decades, but adoption rates remain low.

Though several studies have analyzed the cattle value chain (VC) to enhance the understanding of adoption barriers, the heterogeneity of farmers has been considered only marginally when trying to explain their adoption behavior. To narrow this knowledge gap, a VC analysis was carried out in March 2022, using semi-structured interviews with key informants.

Four types of cattle farmers were identified to operate along a gradient reaching from the Andean foothill in the department's northwest to the deforestation frontier in the southeast. While specialized and dual-purpose milk farms are located close to the foothill, dual-purpose cheese and cattle fattening farms operate closer to the deforestation frontier. The associated spatio-temporal dynamics seem to be associated with differences in infrastructure, access to inputs and services, and the presence of armed groups.

The observed enabling environment gradient is important for a more context-specific design of policies and interventions aimed at supporting the adoption of sustainably intensified cattle production systems, while needs and preferences of the heterogenous farmer groups should be further researched.

Introduction

With a pasture area that occupies 14 % of the total area of Colombia's Caquetá department (UPRA 2018), which is located in the Amazon natural region, the cattle sector plays an important role in the local economy. There, it constitutes the fifth largest cattle herd in the country, i.e., 2,175,065 out of 29,523,270 cattle at national level in 2022 (Torrijos 2022), and a daily milk production of approximately 1.87 ML. At the same time, the sector's predominantly extensive cattle husbandry system is characterized by low levels of productivity and negative environmental impacts, such as land degradation, biodiversity loss, and greenhouse gas emissions (Tapasco et al. 2019; Lerner et al. 2017). Moreover, Caquetá's extensive cattle husbandry is also linked to deforestation: with 30,317 ha deforested in 2019, which correspond to 19 % of the total deforested area at the national level, this department has the highest annual deforestation rates in the country. Next to illicit crop cultivation, illegal mining, unplanned transport infrastructure, and illegal logging, the establishment of pastures for extensive cattle husbandry systems, as well as poor cattle farming practices, have been identified as the main causes of deforestation (IDEAM 2020). The progressive forest loss is further exacerbated by land grabbing, which predominantly occurs along the deforestation frontier where the establishment of pastures is used as a means for obtaining land titles (Del Río Duque et al. 2022).

The current system's low productivity as well as its negative environmental impacts have placed the sustainable intensification of the cattle sector on the national policy agenda, as reflected in, e.g., the National Development Plan 2014-2018 (Santos Calderón, et al. 2015) and in Colombia's Nationally Determined Contributions (UNFCCC 2020). The potential for positive impacts from sustainable intensification, e.g., through improved forages or silvopastoral systems, has been extensively researched and the resulting evidence thoroughly documented. On the one hand, it has been demonstrated that sustainably upgraded production systems can improve environmental sustainability, e.g., by decreasing methane emissions, increasing biodiversity, improving soil fertility, and reducing soil erosion. On the other hand, upgraded production systems can improve incomes and livelihoods as a result of increased fodder quantity and quality, enhanced animal welfare and strengthened climate resilience, resulting in increased productivity levels (Aynekulu et al. 2020; Broom et al. 2013; Chará et al. 2019; Pezo 2019; Rao et al. 2015; Murgueitio et al. 2011; Peri et al. 2016). Despite these advantages, the adoption levels in Colombia, and in the Cauquetá department specifically, remain at a low level and desired impacts have therefore not yet been achieved (Tapasco et al. 2019).

According to Torrijos (2021), extensive production systems still predominate in Caquetá and there is not a single municipality with average stocking rates above 1 cattle/ha.

Low adoption rates of sustainably intensified cattle husbandry systems in the Caquetá Department, but also in Colombia and Latin America in general, have been the focus of an increasing number of scientific articles over the past years (e.g., Broom et al. 2013; Calle et al. 2009; Enciso et al. 2022; Tapasco et al. 2019; Chará et al. 2019; Rivas and Holmann 1999; Charry et al. 2018; Lee et al. 2020; Chará et al. 2017; Hurtado et al. 2020). A wide range of adoption barriers has been identified, reaching from financial and input barriers to knowledge and institutional barriers. However, in these studies the heterogeneity of cattle farmers has been considered only marginally and, in most cases, cattle farmers are treated as a single category of value chain actors.

Against this backdrop, this study has the aim of determining how the cattle farmers in Caquetá can be categorized into different groups and of enhancing the understanding of the specific needs and challenges the different groups are confronted with.

Methods

The study was carried out in the Caquetá department, which is located in the Colombian Amazon natural region in the country's southwest. The department has an area of 88,965 km² (Secretaria de Educación Departamental 2016), making it Colombia's third largest department; yet its 420,337 inhabitants correspond to only 1 % of the national population (UPRA 2018). It is estimated that approximately 14 % of the departmental area is currently used for cattle husbandry (UPRA 2019), with extensive, dual-purpose cattle farming being the predominant production system (Torrijos 2022).

Semi-structured interviews were conducted with sector experts and cattle farmers in March 2022 in the departmental capital, Florencia, as well as in four municipalities in the northern part of Caquetá: La Montañita, El Paujil, Puerto Rico, and San Vicente del Caguán. A qualitative assessment of the resulting data helped understanding the functioning, structure and key challenges of the dual-purpose cattle value chain in Caquetá. In total, 11 interviews were carried out that captured the expert knowledge and perspectives of six cattle farmers, a dairy processor, a local research institute, two NGOs, and that of a representative of the regional cattle farmer association. In addition, one focus group discussion was held with six cattle farmers. Each interview session lasted approximately one hour and was guided by a question list that was developed to obtain information about the different stages of the dual-purpose cattle value chain and its enabling environment. The questions covered primary production; dairy processing; marketing channels and producer-buyer relationships; input and services provision; access to information; natural environment; value chain governance (horizontal and vertical linkages); societal enabling environment (infrastructure, institutions, and past and ongoing projects) and overall challenges and opportunities. Depending on the background and knowledge of the interviewees, these questionnaire topics were discussed with differing levels of detail during the interviews.

For data analysis, the collected information was first transcribed before it was categorized according to the different value chain stages and the natural and societal enabling environment. Next, a value chain map was developed, the information was interpreted, and research gaps were identified.

Results and Discussion

Based on the collected information, four main types of cattle farmers have been identified in the Caquetá department, which are briefly described in Table 1.

Farmer category	Milk production per category/day	Key farm level characteristics	Main marketing channels
Specialized milk farmers	70,000 l (4 % of departmental milk production) (Torrijos 2022)	• Weaning after a few days • Average milk production/day/cow: 8.6 l (Torrijos 2022) • Medium use of inputs (e.g., concentrate and nutritional supplements) • Partially mechanized milking process	Industrial cold milk processor or semi-industrial (formal) milk processors
Dual-purpose milk farmers	950,000 l (51 % of departmental milk production) (Torrijos 2022)	• Weaning after 7-12 months • Average milk production/day/cow: 4.5 l (Torrijos 2022) • Low overall input and technology use but large differences within this group	Industrial cold milk processors, semi-industrial (formal) milk processors, artisanal (informal) milk processors
Dual-purpose cheese farmers	837,000 l (44 % of departmental milk production) (Torrijos 2022)	• Weaning after 7-12 months, • Average milk production/day/cow: 4.5 l (Torrijos 2022) • Low input and technology use • On-farm processing of milk into salty cheese	Mostly informal cheese traders
Cattle fattening farmers	Not applicable	• Calves purchased from specialized milk and double-purpose farmers • Fattening period: 18-24 months or longer • Low input and technology use	Live animal traders, who sell cattle to regional and extra-regional slaughterhouses

Table 1: Description of cattle farmer categories in the Caquetá department

In addition to the farmer categorization summarized in Table 1, a map was developed to visualize differences in the geographic locations of the four farmer groups (see Figure 1). The specialized milk farms are mostly situated close to the Andean foothill (from south to north along Caqueta's western departmental border), where the departmental and most municipal capitals are located, and the infrastructure development is highest. The dual-purpose milk farmers are also commonly operating close to the Andean foothill but can also be found in more remote areas towards the southeast. This group supplies milk to formal and informal milk processors, who pick up the raw milk on a daily basis at the farm's gate or predetermined collection places. Consequently, the presence of the dual-purpose milk farmers ends at a remoteness threshold that prevents them from being reached by the processors' milk collection trucks. The farms of dual-purpose cheese producers are typically located further in the southeast (towards the deforestation frontier), where farmers no longer have the option of selling fresh milk to processing companies and, therefore, process milk into salty cheese on their farms. This group is usually followed in remoteness by the cattle fattening farms that, according to key informants, are mainly located along the deforestation frontier, to which they arguably contribute with their activities. The geographical locations of the four farmer categories are linked with differences in the social enabling and socioeconomic environment, as highlighted in Figure 1.
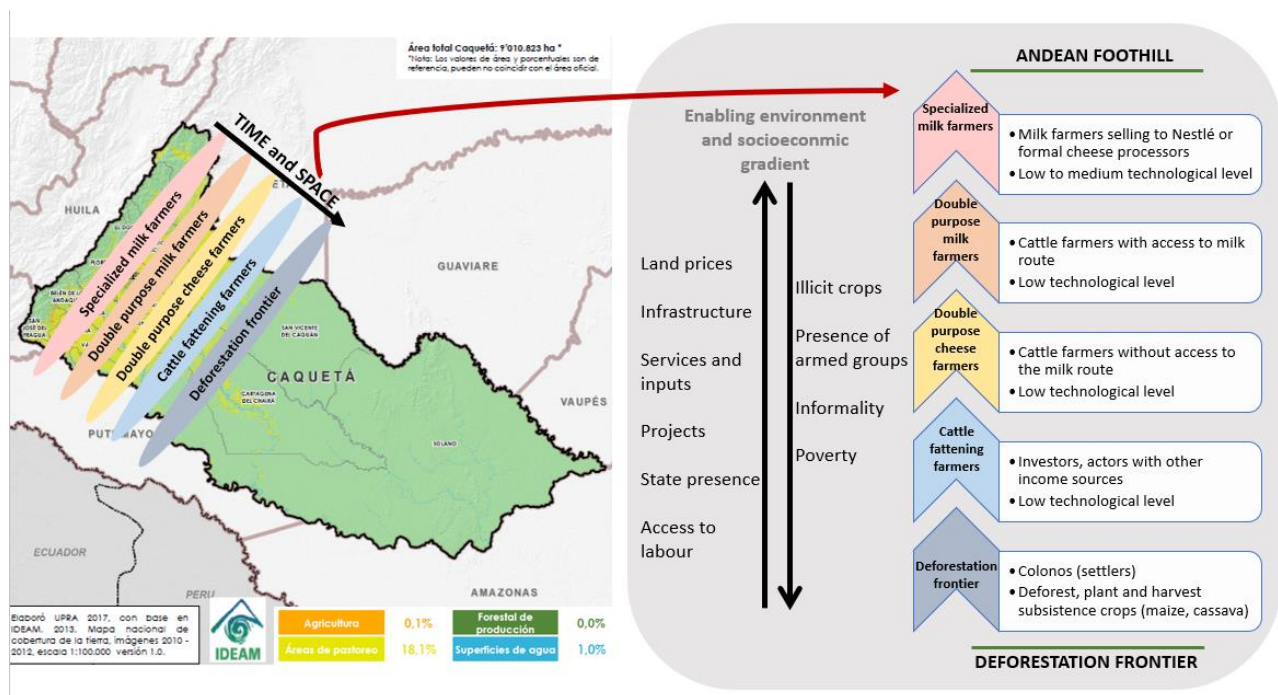
Figure 1: Production focus of cattle farms along an enabling environment and socioeconomic gradient. Source: map adjusted from Ministerio de Agricultura y Desarrollo Rural (2014) and own elaboration.

Based on the results, the hypothesis can be postulated that differences in production systems are closely linked to the level of remoteness of the cattle farms. With increasing remoteness (i.e., increasing distance from the more developed and populated foothill region) and correspondingly diminishing state presence, farmers' access to markets, services, inputs, and information decreases. Furthermore, we hypothesize that the dynamics that influence cattle farming activities in Caquetá are not only of a spatial but also temporal nature. If over time, the development of, e.g., roads, communication and electricity grids advances in currently remoter regions, it can be expected that farming and marketing activities will change as well. This spatio-temporal development could, for instance, entail that milk processors will eventually reach the group of dual-purpose cheese farmers who, no longer having to process milk into cheese on their farms, will also sell fresh milk instead. If at the same time the deforestation frontier should continue expanding, it is likely that a new region characteristically constrained by the disabling socioeconomic environment associated with high levels of remoteness, underdevelopment and weak institutions would form, in which on-farm milk processing would again be the most feasible business model.

Conclusions and/or Implications

Differences of cattle husbandry systems and their production focus in Colombia's Caquetá department seem to be closely linked to differing levels of remoteness as well as changes in the enabling environment over time. These spatio-temporal dynamics that shape the cattle sector in Caquetá should be taken into consideration for the design of tailored interventions and policy measures to promote context-specific technology adoption. It can be further argued that if the heterogeneity of cattle farmers and enabling environments, within which they operate, are not taken into consideration, it will be difficult to achieve the behavioral change in all identified farmer categories that is likely a precondition for the sustainable transformation of the cattle sector in Caquetá. It is therefore imperative to improve the understanding of the adoption behavior and preferences of the different farmer categories that operate along the gradient reaching from the Andean foothill to the deforestation frontier. Studying how parameters associated with remoteness influence technology-adoption behavior might, furthermore, bring valuable insights that may be extended to similarly structured regions beyond the boundaries of Caquetá and Colombia's Amazon natural region.

Acknowledgements

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