



Rural development opportunities through contextual interventions: a systematic review

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Abstract

Classic technical assistance to local resource users in tropical agrarian frontiers has shown important successes but also has been criticized for being expensive, dependency creating, and destructive to traditional social-ecological systems. Alternatively, supporting rural families by improving their contexts might have the potential to more effectively unlock the individual and collective capacities of local resource users. This literature review systematically explores the state of knowledge on contextual interventions and their effects on small-scale farmers. It outlines five contextual categories and 17 contextual elements, and document for each element the quality of data, as well as the reported social, economic, and environmental effects. Literature on local development effects of contextual elements increased considerably in the last 40 years with an increasing focus on governance, but there are still important blind spots regarding the effect of education and logistics. Overall, the review indicates that contextual interventions should be more considered to support rural families in tropical agrarian frontiers.

Keywords Rural development · Small-scale farmers · Agrarian frontier · Latin America · Contextual elements · Systematic literature review

1 Introduction

The undergoing socio-ecological crisis poses serious challenges, especially to poor farmers living in the agrarian frontiers of the rural tropics (Borras, 2010; Rockström et al., 2009). Despite remarkable economic growth all around the globe, millions of rural families still live under precarious conditions and face massive challenges to secure their livelihoods (Berdegué & Fuentealba, 2013; FAO, 2020). Governmental and non-governmental organizations, often supported by the International Cooperation, are supporting these families typically through classic technical assistance approaches grounded in training and capacity

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building for linking and integrating the local producers into competitive markets. More recently, efforts have gained even more impetus due a stronger involvement of the private sector as pluralistic services providers (Blum et al., 2020).

Doubtlessly, the provision of technical assistance has lasted in some impressive successes (Fugile et al., 2019). However, this development approach is also suffering from drawbacks. First of all, the delivery of services to individual households is quite expensive, which, in contexts of notoriously empty public coffers in many tropical countries implies large qualitative and quantitative gaps in the supply of the remote rural regions (Christoplos, 2010; Faure et al., 2012). Technical assistance, often linked to rural credit programs, impose certain production schemes widely ignoring eventually existing local potentials for alternative development options (Pokorny, 2013). The services provided also tend to favour the better-endowed farmers, which may aggravate the gap with poorer families that may become even more marginalized (Borras, 2010; Gatzweiler & Braun, 2016). Finally, the transfer of techno-financial packages may create dependency thereby increasing the risk for and vulnerability of the families (Medina et al., 2009; Pokorny, 2013).

A look at the wide range of structural constraints that limit local resource users to improve their livelihoods may indicate complementary options that are effective and may show fewer drawbacks compared to the classic technical assistance approach. Typical constraints in the rural tropics include improper infrastructure, difficult to access and ineffectively working public and private service providers, unsecure land tenure, power imbalances, excess of bureaucracy, logistical challenges to reaching for possibly unattractive markets, and a limited quality of continuously degrading environmental assets (Barbier, 2010; IFAD, 2013; Pokorny, 2013). To remove or at least mitigate these constraints has the potential to unlock the individual and collective capacities of local resource users for economic and sustainable development (Descheemaeker et al., 2016; Medina et al., 2015; Pokorny, 2013; Scoones, 2015).

With the initial aim to identify realistic possibilities for the promotion of sustainable local development through investments into improving the context for local action, we carried out a systematic literature review of rural development literature on this subject with a focus on Latin America. The review included three specific objectives: (1) to capture the diversity and scope of research on Contextual Elements relevant for sustainable local development; (2) to assess the methodological quality of the identified studies; and (3), to learn about the economic, social, and environmental effects related to the different Contextual Elements.

2 Methodology

To comply with our objectives, we did a systematic review of rural development literature with relevance to at least one of the five contextual categories (1) Infrastructure, (2) Services, (3) Governance, (4) Markets, and (5) Environmental Assets, each of them related to an array of specific contextual elements (Table 1).

Infrastructure includes the basic physical and organizational structures and facilities needed for the well-being and commercial acting of smallholders. It essentially embraces roads, electricity, water & sanitation, and telecommunication (Fort, 2019). Proper infrastructure is widely considered a key condition for economic development (Bourguignon & Pleskovic, 2012; Desai & Potter, 2014; Medina et al., 2015). Also, the *services* provided by governmental, non-governmental organisations and companies, are considered vital for

Table 1 Categories of contextual elements affecting smallholders' possibility for sustainable local development

Contextual category	Contextual elements
Infrastructure	Roads, electrification, water and sanitation, and telecommunications
Services	Financial and credits, education, rural advisory services and extension
Governance	Policy, legal and institutional frameworks
Markets	Prices, logistics, certification
Environmental Assets	Property size, soil fertility, forests (availability and quality), water availability, biodiversity (level of degradation), climate change

facilitating rural development and alleviating poverty (Kay, 2010). Services include elements such as credits and loans (Clapp & Isakson, 2018; D'Antona et al., 2006; Hernández, 2016; Pokorný & Jong, 2015), education and schooling (Medina et al., 2015; Parry et al., 2010; Pokorný & Jong, 2015) and advisory services and extension (Christoplos, 2010; Davis, 2019; Hoffmann et al., 2009; Pretzsch et al., 2014; RIMISP, 2010). *Governance* refers to higher-level processes and institutions to manage rural socio-ecological systems (Agrawal & Lemos, 2007). This category includes governmental elements such as institutional and regulatory frameworks and public policies (Grisa & Sabourin, 2019), as well as the acting of civil society organizations and their influences (Edelman & Borrás, 2016). Also, *markets*, here defined as the array of mechanisms which sellers and buyers use to exchange goods and services for money, influence the economic, social and environmental dynamics of rural regions (Grisa & Sabourin, 2019; Prakash, 2011). Beyond prices, also logistics play an important role because largely shaping the practical possibility of smallholders to participate in value chains (Garrett et al., 2017). We also consider certification in our analysis due to its importance in the rural development debate (Kuit & Waarts, 2014). Additionally, *environmental assets* shape the context in which smallholders act. This category includes elements such as property size (D'Antona et al., 2006; Medina et al., 2015), soil fertility (Altieri et al., 2012; IFAD, 2013; Rosset & Altieri, 2017), access to water (IFAD, 2013), climate change (Shukla et al., 2019), and the availability and quality of forests (Barbieri & Pan, 2013; Duchelle & Almeyda Zambrano et al., 2014; Coomes et al., 2016), latter related to the level of environmental degradation (Diaz et al., 2015; Isbell et al., 2017; Teixeira et al., 2018).

To identify scientific papers with relevance to one of these categories, we scanned the titles, abstracts, author keywords and keywords plus of papers listed on the Web of Science (<https://apps.webofknowledge.com>) between January 1980 and December 2019 by applying combinations of search terms related to each Contextual Element listed in the Table 2. This search resulted in a total of 100.959 hits, which were quantitatively analysed without further validation, to obtain an overview of the thematic scope of relevant literature over the last 40 years.

From this bunch of papers, we then selected 116 papers for in-depth analysis by applying a top-down protocol (see Appendix) that progressively combined specific sets of search terms for each Contextual Element. The protocol foresaw three analytical steps. In a first step, we applied automatized filters to select publications that: (i) were published within the last 10 years (January 2010 to April 2020); (ii) mention economic, social or environmental effects; (iii) refer to local villages or households; and (iv) belong to tropical forest regions in South America. Thereby, we reduced the number of papers to 838. In the second step, we read the titles and abstracts of the publications to eliminate papers that did not

Table 2 Search terms used in web of Science for the range of contextual elements considered

Contextual elements	Search terms
Roads	TS = (rural) AND TS = (roads* OR accessibility*)
Electrification	TS = (rural) AND TS = (electrification OR electricity)
Water and sanitation	TS = (rural) AND TS = (water AND sanitation)
Telecommunications	TS = (rural) AND TS = (telecommunication* OR "digital connectivity" OR "digital divide" OR "ICT" OR "Information and communication technology*" OR radio OR TV OR television OR "cell phone*" OR "smart phone*" OR internet)
Financial and credits	TS = (rural) AND TS = (credit* OR "financial service*" OR "bank loan*")
Education	TS = (rural) AND TS = (schools* OR "education services*" OR "education facilities*")
Advisory services and extension	TS = (rural OR agricultural OR forest) AND TS = ("extension services" OR "advisory services*" OR "rural extension" OR "technology transfer")
Policies	TS = (rural) AND TS = (policy OR policies)
Legal framework	TS = (rural) AND TS = (legal OR law* OR regulation*)
Institutional framework	TS = (rural) AND TS = (institutional OR institutions*)
Prices	TS = (rural) AND TS = (price*)
Logistics	TS = (rural) AND TS = (logistics OR "supply chain")
Certification	TS = (rural) AND TS = (certification OR standards OR labelling)
Forests	TS = (rural) AND TS = (forest*)
Soil fertility	TS = (rural) AND TS = (soil*)
Biodiversity	TS = (biodiversity OR "biological diversity")
Property size	TS = (rural) AND TS = ("land* size*" OR "farm* size*" OR "holding* size*" OR "property* size" OR "land* area*" OR "farm* area*" OR "holding* area*")

address effects or smallholders, and those that were not in the geographical focus. This further reduced the number of articles to 204. Finally, we read the full text of these papers and dismissed those without empirical data on the effects of Contextual Elements.

A total of 616 effects of Contextual Elements were mentioned in the 116 publications analysed in-depth (Fig. 1), most frequently belonging to the governance category, followed by those linked to environmental assets and infrastructure. Contextual Elements related

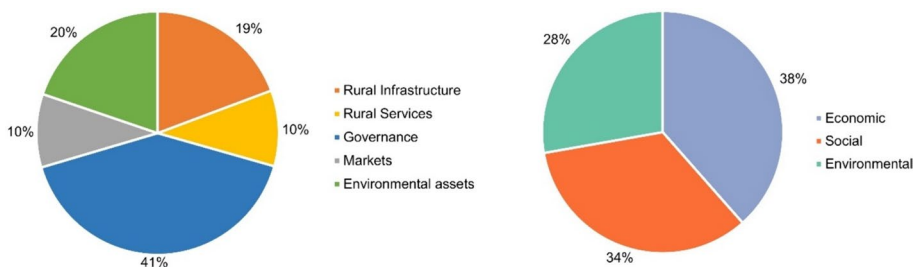
**Fig. 1** Proportions of the effects mentioned in the selected publications

Table 3 The minimum sample size for different methods (adapted from Sivakumar et al. (2017))

Data collection method	Minimum sample size for a reasonable scientific analysis
Case studies	4 to 10
Key informant interviews	5
In-depth interviews	25 to 30
Semi-structured interviews	30 to 60
Focus group discussions	2 to 3
Survey (households)	80 (considering a population of 100 at 5% margin error and 95% confidence level)

Table 4 Sub-categories of economic, social, and environmental effects were mentioned in the CE literature

Effect dimension	Sub-Categories
Economic	Income, livelihoods, productive assets, productivity, employment, credits, market access, sales, prices, costs
Social	Education, health, food security, equity, poverty, empowerment, social capital, knowledge, access to public services, social conflict, migration, local culture, wellbeing, tenure rights
Environmental	Deforestation, forest or landscape degradation, land, soil, biodiversity, emissions, ecosystem services, land use

to markets and services were mentioned less often. Regarding reported effects, the papers were balanced, however, with the economic dimension considered most often, and environmental effects least.

The selected 116 publications were also analysed for the quality of the provided information. To assess the quality of data, we distinguished studies that gathered their own data, met quality thresholds (Table 3), and applied statistical tests that went beyond simple descriptive statistics.

Regarding the effects attributed to the Contextual Elements studied by the papers, we first registered all mentioned effects. For each registered effect, we then interpreted the level of impact attributed by the authors based on a “Likert Scale” (very positive, positive, neutral, negative, and very negative). The effects were also attributed to one of the three dimensions: economic, social, and environmental, and related sub-categories (Table 4).

Finally, for each effect dimension, we qualitatively describe the most important effects described in the article. We aggregated the reported effects based on similarity to generate a list of 50 effects, which we then ranked according to their frequency of mention. In the finding section, we focus on the most frequently mentioned effects.

3 Findings

3.1 Scope and evolution of literature on contextual elements

Since 1980, publication intensity on the influence of contextual elements has grown tremendously. Overall, the total number of relevant publications found on Web of Science has increased by almost 600 times over the last 40 years (Fig. 2).

We found a significant number of publications for all contextual categories outlined. Of all publications, those on Environmental Assets were the most frequent (25%). Also, publications referring to Markets and Infrastructure were frequent (15% and 14%). Least often, were publications on the Services category. Particularly, governance literature experienced an almost exponential growth, especially since 2005. Publications attributed to the other categories also increased but less accentuated.

Within the **Governance** category, policy issues were the most relevant topic, with nearly two-thirds of the hits. In comparison, publications discussing Institutional and Legal aspects were much less frequent. Also, publications dealing with **Environmental Assets** showed a certain focus on Forests (44%) and Soils (32%). Biodiversity started to play a more accentuated role only during the last years. There were comparatively few hits referring to Land Property issues (15%). The rural development literature on the influence of **Infrastructure** was thematically balanced covering primarily the effects of Roads and Telecommunication, as well as, to a lesser degree, Electrification. Much fewer publications were found about Water and Sanitation. Rural development publications dealing with **Markets** had a strong focus on the influence of Certifications. In comparison, classic market topics such as Prices played only a minor role, and literature on the role of Logistics was nearly completely absent. The much sparser literature on the role of **Services** in rural development strongly focussed on one single topic, Education. Financial services and Advisory services and Extension were much less considered.

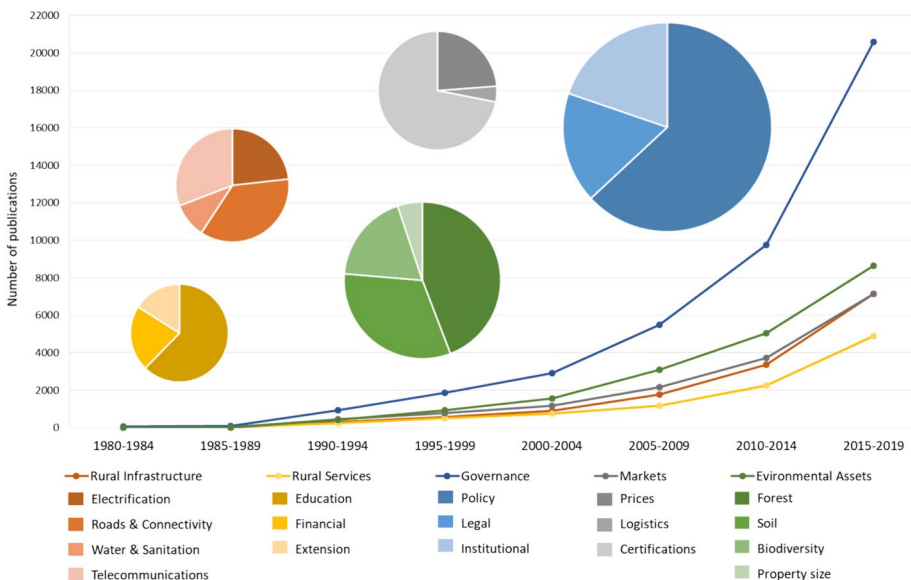


Fig. 2 Scope and temporal distribution of the CE literature between 1980 and 2019 (N= 100.959)

Resuming, our analysis demonstrates that scientific interest in the influence of Contextual Elements on rural development dynamics has grown significantly over the years, particularly on the topic of governance. Policy issues have been and still are at the centre of academic concern. Also, environmental issues are well covered by academia, whereas the issues of infrastructure, markets (except for the aspect of certification), and service provision attract significantly less attention within the scientific community.

3.2 The quality of the methodological basis

Regarding the methodological quality of the studies explored, our in-depth analysis of papers dealing with rural Latin America revealed a rather ambivalent picture (Fig. 3).

More than three quarters (78%) of all analysed papers used primary data sources, and 71% met the minimum sample size considered for a reasonable scientific analysis. Accordingly, only 15% of the papers did not meet the set quality thresholds, and another 14% of the papers failed to provide accurate information on the sampling methods applied. More than half of the papers (57%) invested in some kind of statistical test to detect possible effects of the Contextual Element under analysis. However, combining the three quality criteria together –primary data, sampling size, and application of proper statistics–only 39% of the publications rely on a scientifically sound methodological basis. More than 60% of the studies suffer from deficiencies concerning data source, sample size and statistics, or, failed to properly inform about at least one of these aspects. Publications on Infrastructure (51%) and Environmental Assets (52%) reached the highest methodological quality as they used primary data sources and applied statistical tests with proper sample sizes. On the other extreme, many governance papers showed poor sampling and methodological description. Nevertheless, all in all, our analysis indicates that much of the generated knowledge on development effects of Contextual Elements bases on a transparent and satisfactory methodological basis.

3.3 Effects of contextual elements on smallholders

The 116 publications reviewed in-depth reported on a total of 616 effects of Contextual Elements on smallholders (Fig. 4), effects of different dimensions and ranging from very negative to very positive. The publications analysed economic, social and environmental

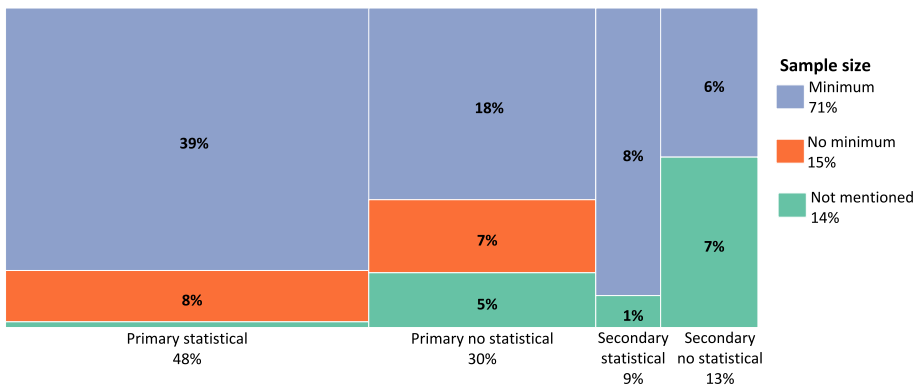


Fig. 3 Quality of the methodological basis of CE publications dealing with rural Latin America (N = 116)

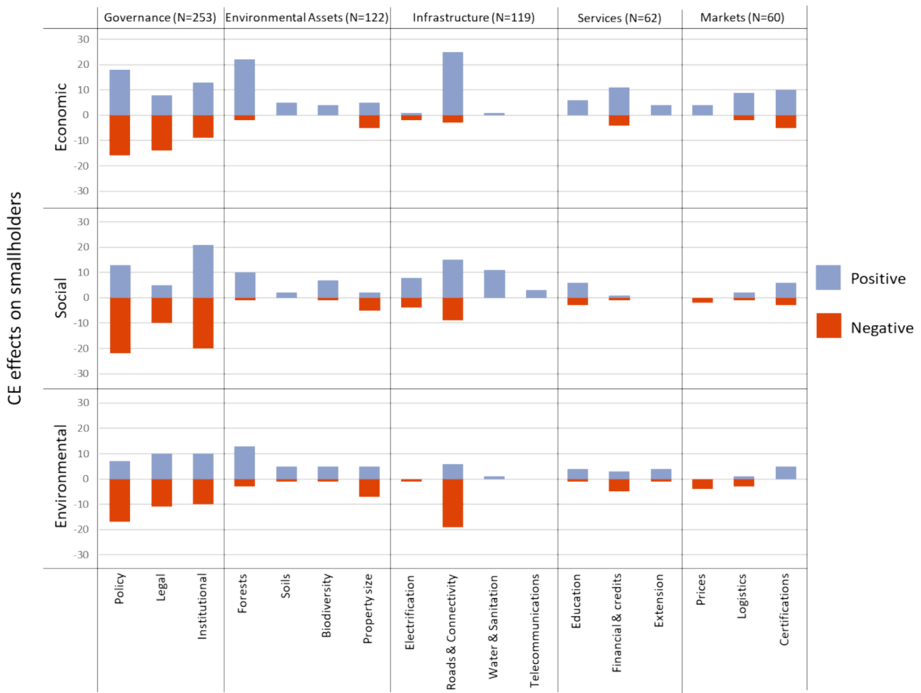


Fig. 4 Overview of the effects reported by studies on contextual elements in Latin America

effects in same intensity with a slight focus on the economic dimension. In total, slightly more than half of the reported effects were positive (55%) and less than 40% negative. For the rest, no clear interpretation was possible based on the information provided. We found publications for all Contextual Categories that reported very positive and very negative effects. However, the scope of effects clearly differed between the papers of the five categories. Economic effects dominated in the publications exploring markets. Social considerations were prevailing in papers which belong to the infrastructural category. Environmental effects were stronger highlighted in papers about Contextual Elements on the environmental category. For most Contextual Elements, there is a clear preponderance of positive effects. This is particularly the case for the environmental category (over 70%). Only governance literature reported mostly negative effects (more than 50%) distantly followed by papers which belong to markets (more than 30%).

Within the best studied category of *Governance*, the studies on *policies* observe largely ambivalent economic effects, and, in their majority, negative social and environmental effects. Here, papers analysing the effects of cash transfer programs report an increase in household incomes, but also high transaction costs for smallholders often travelling to far-distant urban centres to obtain the subsidy (Dou et al. 2017; Parry et al., 2010; Piperata et al., 2011a) It is also reported that cash transfer programs trigger the displacement of local food systems by the purchase of processed foods, carrying out food insecurity and malnutrition within beneficiary households (Piperata et al., 2011b; Piperata et al., 2016). Papers analysing national extractive policies and industrial agriculture frequently report on increased deforestation and GHG emissions, and the displacement of local cultures and

indigenous communities (Bebbington et al., 2018; Pacheco & Pocard-Chapuis, 2012; Pokorny et al., 2012), in addition to a concentration of land that triggers cycles of rural violence and food insecurity (Bennett et al., 2018a, 2018b; Bennett et al., 2018a, 2018b).

Studies on the effects of *institutional and legal frameworks* also report positive and negative effects regarding all three sustainability dimensions. On the one hand, these studies argue that support for social movements and peasant education institutions promote the establishment of sustainable, diverse production systems, soil fertility, equity, justice and self-sufficiency (Altieri et al., 2012; D'Amico, 2016; Simmons et al., 2010). On the other hand, they observe that strengthening local producer organisations are often related to cash-crop farming, which tend to marginalise local production schemes and creating dependencies (Chase, 2010; Porro et al., 2015). The studies belonging to this category also highlight the significant negative economic impacts of protected areas and environmental restrictions as they limit the smallholder's options to use the resources thereby reducing the income potential from forests (Mejia et al., 2015; Pokorny et al., 2012). In parallel, some studies emphasize the positive effect of agrarian land reforms in increasing peasants' access to land rights and credits (Coomes et al., 2016; Fitz, 2018), but they also mention that they promote unsustainable land-use practices and land fragmentation (Albers & Robinson, 2013; Peres & Schneider, 2012) and associated social conflicts (Simmons et al., 2010) thereby also increasing deforestation (Pacheco & Pocard-Chapuis, 2012). Finally, land tenure studies argue that enabling access to land rights may trigger rural in-migration and agricultural-based deforestation (Coomes et al., 2016; Jusys, 2016). Overall, the revised papers point out that small land sizes contribute less to total deforestation than larger properties (Godar et al., 2012; Richards & VanWey, 2016).

The second most studied category is on *Environmental Assets*. The papers belonging to this category were dedicated to the four defined Contextual Elements with very different intensity. Particularly, the positive economic effects of *Forests* are well documented, especially by papers describing the relevance of forest products for the livelihood of forest communities (Guedes et al., 2014; Newton et al., 2012; Swierk & Madigosky, 2014; Wunder et al., 2018). Much less papers highlighted the attractiveness of forests, particularly if stocking on good soils, for small-scale settlers (Pokorny et al., 2013a; Zambonin et al., 2017) and the thread of overexploitation (Coomes et al., 2016; Swierk & Madigosky, 2014) both amplifying the pressure on the resource. Also, less frequently but consistently, the literature is positive about the effect of *Biodiversity* in all three sustainability dimensions. Studies emphasise both the value of natural ecosystems for smallholders (Ramirez-Gomez et al., 2015) and the important role that indigenous management systems and traditional knowledge play in preserving forests as a basis for health and food (Albers & Robinson, 2013; Gibson et al., 2011; Manno et al., 2018; Newton et al., 2012; Peneau et al., 2016). A number of studies highlight the positive effects of agroforestry systems, communal lands and traditional practices on biodiversity (Toda et al., 2016; Wilson & Coomes, 2019). Only few papers studied the relevance of *Soils*. They particularly highlight how good soil quality can promote livelihood diversification (Kawa et al., 2015) whereas poor soils contribute to rural in-out-migration dynamics (Godar et al., 2012; Zambonin et al., 2017).

Most of the studies belonging to the category of *Infrastructure* deal with *Roads & Connectivity* and comprehensively consider effects in all three sustainability dimensions. Typically, these studies report strong positive economic and social outcomes associated with the market integration of smallholders (Barbieri & Pan, 2013; Garrett et al., 2017; Parry et al., 2010), and improved access to rural services (Benevenuto & Caulfield, 2020; Parry et al., 2010; Perz et al., 2013; van Els et al., 2012). On the other hand, they state negative environmental consequences due to the in-migration of

small-scale settlers and extractive companies that push forward agrarian frontiers (Bebbington et al., 2018; Pacheco & Pocard-Chapuis, 2012).

Most studies dealing with the contextual category *Services* highlight positive economic effects, however, without necessarily providing empirical evidence. The studies on Contextual Element *Financial & Credits* describe strong negative environmental effects of improved access to credits for large-holders which encourage investments in unsustainable land uses and extensive deforestation (Jusys, 2016; Pacheco & Pocard-Chapuis, 2012; Pokorny et al., 2013b). Remarkably, only few studies suggest that finance for smallholders, when combined with effective extension services, can drive the expansion of sustainable production schemes generating positive economic and environmental effects (Clark & Martinez, 2016; Zenteno et al., 2013). Literature dealing with the effects of *Education* commonly mentions that higher education levels are associated with higher incomes (Porro et al., 2015; Torres et al., 2018) as well as other positive social effects including environmental sensitization. Positive health effects may also appear from investments in water and sanitation facilities (Voth-Gaeddert et al., 2015).

As mentioned above, the majority of reviewed *Market* literature focuses on the topic of *Certifications*, emphasizing mostly positive effects. Only some papers also mention negative economic effects and argue that certification improves farmers' access to niche markets offering attractive prices, but that it is costly and increases financial dependency on supporting organisations (Bitzer et al., 2013; Clark & Martinez, 2016; Duchelle et al., 2014a, 2014b; Pokorny et al., 2012). The few papers dealing with *Logistics* highlight that related investments tend to induce specialization in one cash crop, which increases risks and may reduce food security (Perz et al., 2013; Duchelle et al., 2014a, b). The effects of *Prices* on local development dynamics have hardly been considered in the studies that generally see a positive correlation with income and productivity (Bro et al., 2018; Mejia et al., 2015; Zenteno et al., 2013) but also an increase in deforestation (Jusys, 2016; Pacheco & Pocard-Chapuis, 2012).

For some Contextual Elements, we found significant knowledge gaps. This was particularly the case regarding the effects of *Telecommunications* on smallholders, including the hot topic of digitalization. In the case of the studies on *Advisory Services and Extension* the topic of environmental effects was nearly completely ignored.

4 Discussion

4.1 A lot of knowledge, but many blind spots

Our review shows that literature on the effects of Contextual Elements on local rural development has increased considerably during the last 40 years. Accordingly, academia has generated strong and reliable insights regarding their direct and indirect effects of contexts on local development dynamics. This is particularly true regarding the influence of governance issues, which may reflect the manifold attempts of several Latin America countries over the last 20 decades to respond to the historical struggles and demands of peasant movements (Grisa & Sabourin, 2019; Vergara-Camus & Kay, 2017). As a result, there is a sound basis to understand the complex array of actors, social structures and institutions directly and indirectly shaping territorial dynamics

(Berdegué et al., 2015). However, the poor sampling and methodological description of governance literature indicate an emphasis on theoretical-oriented desk studies with little empirical foundation possibly neglecting local realities (Pokorny, 2013).

While for some contextual parameters the information situation is very good, for other aspects we found a very weak consideration in the scientific literature. The yield of empirical studies on the effects of finance, education, and extension services was surprisingly meagre although they are generally assumed to be crucial for rural development. Also lacking are studies on the influence of education being widely recognized as a structural constraint for local development (Buckler & Creech, 2014; Saravia-Matus & Aguirre H., 2019) and the generation of economic, social and environmental benefits for smallholders (Porro et al., 2015). The COVID-19 pandemic has impressively confirmed the educational gaps affecting the most vulnerable rural households (ECLAC & UNESCO, 2020). Also, studies on the effects of logistics like transport services, input provision, processing and storage facilities, and market information were rare, although the great importance of these elements for market integration and farmer's welfare is obvious (Liverpool-Tasie et al., 2020).

In terms of the effects examined in the literature, our study showed a strong focus on income, versus environmental considerations and, most importantly, the social dimension. Accordingly, several studies highlighted the positive economic effects of contextual improvements particularly regarding markets (Donovan et al., 2020). The strong focus on economic development, however, may imply a somewhat insufficient consideration of environmental and social trade-offs (Mausch et al., 2020).

4.2 Three impact pathways of contextual change

The simplifying assumption that development interventions provoke linear effects (Leach et al., 2010; Scoones et al., 2007) is not supported by the study results. In contrast, the analysed studies in sum suggests that contextual change relates to a wide range of complex interconnected effects, sub-effects and feedbacks (Oldekop et al., 2021). Many studies suggest a triggering effect or “conjunctural causation” (Kneale et al., 2018) of contextual changes and effects as for example in the case of improved roads and better access to educational and extension services, (Atchoarena and Gasperini, 2003). Another example is the positive impact of secured land tenure rights (Lawry et al., 2014) that often goes hand in hand with the provision of public services like education and health, infrastructure, finance and logistics (Pokorny et al., 2021; Rapsomanikis, 2015). In contrast to such reinforcing “positive” effects, for many Contextual Elements simultaneously very positive and very negative outcomes were reported by the studies. For example, cash transfer programs in remotely located rural areas increase the household income, but, parallel, they imply significant costs for the beneficiary families to access the subsidy (Magalhaes et al., 2013). Specific research is needed to better understand these trade-offs in the various Contextual Elements.

Nevertheless, the myriads of causalities of contextual change and effects could be structured into three main *impact pathways* of contextual change: i) the *accessibility pathway*, where investments in roads trigger the arrival of services and infrastructure development, thereby increasing market integration and household incomes and improving the quality of life of local families, but also encouraging the arrival of new settlers who increase pressure on the forest frontier.; ii) the *governance pathway*, which is characterised both by agro-industrial expansion policies that trigger ecosystem degradation and social marginalisation, and by land tenure regulations that generate broad processes of colonisation and social

justice, but also deforestation and land fragmentation resulting in social conflict; and iii) the *environmental pathway* shaped by actions aiming at forest protection and recuperation of degraded areas allowing greater diversification of local livelihoods based on forest products and improved food security and nutrition for local communities. Better quality soils can also attract shifting cultivation practices, thus increasing pressure on primary forests. More empirical research is needed to better understand the spatial and temporal dimension within these three outlined pathways (Scoones et al., 2007).

4.3 Final considerations

Despite the limited number of intensively analysed papers from a broad disciplinary body of literature, and the observed bias on topics and analytical foci, it can be said that thousands of rural development studies have created a considerable body of knowledge. The above-described deficits regarding the effects of public service provision, education and logistics indicate and may orient possibilities for further research. Our review confirms the strong influence of contexts on local rural development, and the need to properly consider contextual aspects in the debate and decisions on sustainable rural development (Leach et al., 2010; Mausch et al., 2020). However, to effectively foster sustainable local development by manipulating relevant contextual elements is difficult to control in its effects due to the high complexity of causalities, that may also vary in dependence to local realities. There is also the concern that contextual interventions without targeted accompaniment of the marginalised tend to firstly benefit the well-endowed and richer segments of rural societies, thereby increasing existing social gaps (Leach et al., 2010; Pokorny et al., 2021). Against this backdrop, contextual interventions to create favourable conditions to unlock individual and collective capacities among local resource users inevitably requires differentiated accompanying direct support measures of these groups.

Appendix

See Table 5.

Table 5 Top-down search protocol

Step	Filter	Search strategy for narrowing publications	Total		Rural infrastructure			Services		Governance		Markets		Environmental assets					
			Electri- fication	Road	Water and Sani- tation	Tel- ecom- muni- cations	Edu- cation	Credit	Exten- sion	Policy	Legal	Institu- tions	Price	Logis- tics	Certi- fications	Forest	Soils	Biodi- versity	Land size
1	Initial search	Articles and reviews focussing on Contextual Elements published between January 1980 and April 2020. Search strategy TS=(rural) AND TS=(combination of terms selected for each contextual element) (21.04.2020)	3421	5241	1450	4490	6281	2218	1751	27,035	7328	8475	3752	10,667	11,368	8924	6511	3755	1071
	Time	Last ten years between January 2010 to April 2020 (21.04.2020)	2798	3773	1141	3233	4597	1562	1326	20,037	5276	6168	2615	610	7962	6155	4373	2899	770

Table 5 (continued)

Step	Filter	Search strategy for narrowing publications	Total		Rural infrastructure		Services		Governance		Markets		Environmental assets						
			Electrification	Road	Water and Sanitation	Tel-ecom-muni-cations	Edu-cation	Credit extension	Policy	Legal	Institu-tions	Price	Logis-tics	Certi-fications	Forest	Soils	Biodi-versity	Land size	
Study subject		Rural poor dwellers or smallholders at household or village level. Search strategy AND TS = ihousehold* OR village* OR dweller* OR smallholder* OR poor* OR "small-scale farmer*")	1219	1087	731	729	853	907	482	6848	1187	2133	1189	168	2273	1812	1034	732	431

Table 5 (continued)

Step	Filter	Search strategy for narrowing publications	Total		Rural infrastructure		Services		Governance		Markets		Environmental assets						
			Electri- fication	Road	Water and Sani- tation	Tele- com- muni- cations	Edu- cation	Credit	Exten- sion	Policy	Legal	Institu- tions	Price	Logis- tics	Certi- fications	Forest	Soils	Biodi- versity	Land size
Outcome		Effects at economic, social and environmental dimensions. Search strategy: AND TS=(poverty OR income OR employment OR jobs* OR education OR school* OR health OR equity OR equality OR livelihood* OR "cultural identity" OR food OR nutrition* OR deforestation OR "forest degradation" OR "land degradation" OR "soil degradation" OR biodiversity OR welfare OR "well being" OR "well-being")	671	883	593	499	853	703	336	5568	802	1552	957	135	1775	1462	768	567	341

Table 5 (continued)

Step	Filter	Search strategy for narrowing publications	Total		Rural infrastructure			Services		Governance		Markets		Environmental assets					
			4626	223	Electri- fication	Road	Water and Sani- tation	Tele- com- muni- cations	Edu- cation	Credit	Exten- sion	Policy	Legal	Institu- tions	Price	Logis- tics	Certi- fications	Forest	Soils
Study region (1)		Countries or regions with large tropical forests. Search strategy: AN ID TS = (tropical OR tropics,* DK amazon OR amazonia OR Brazil OR Congo OR Indonesia OR Peru OR Colombia OR Bolivia OR Cameroon OR "Central African Republic" OR Ecuador OR Gabon OR Guyana OR India OR Laos OR Malaysia OR Mexico OR Myanmar OR "Papua New Guinea" DR Suriname OR Venezuela)	223	214	183	92	141	175	53	1265	187	392	238	35	378	603	187	195	65

Table 5 (continued)

Step	Filter	Search strategy for narrowing publications	Total			Rural infrastructure			Services			Governance			Markets			Environmental assets		
			Electri- fication	Road	Water and Sani- tation	Water and Sani- tation	Tele- com- muni- cations	Edu- cation	Credit	Exten- sion	Policy	Legal	Institu- tions	Price	Logis- tics	Certi- fications	Forest	Soils	Biodi- versity	Land size
Study region (2)		Countries in South America with large tropical forests	34	46	33	10	27	18	8	215	40	57	28	7	57	162	35	47	14	
		Search strategy: AND:TS- ("south america" OR amazon OR Amazonia OR Brazil OR Peru OR Colombia OR Bolivia OR Ecuador OR Guyana OR Venezuela)	9	17	8	5	6	9	7	36	14	16	7	5	6	28	8	15	8	
2	Screening	Publications mentioning a direct effect of CE at economic, social and environmental dimensions of smallholders in South America can tropical forest areas by screening titles and abstracts	204																	
3	Review	Review full article and eliminate duplicates	116																	

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Data availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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