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Assessment of socio-economic configuration of value chains: a proposed analysis framework to facilitate integration of small rural producers with global agribusiness

RESEARCH ARTICLE

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Abstract

Value chain analysis is an important tool to assess and enhance the performance of agribusiness. This paper analyzes the empirical application of a conceptual framework known as the Rural Web to evaluate the socio-economic complexity of a specific agribusiness value chain. This can be used as a complementary approach to traditional value chain analysis. The proposed framework goes beyond linear descriptions of product flows and examines how supply chains are built, shaped and reproduced over time and space, while considering social, cultural, environmental and political aspects. The results demonstrate that the proposed framework is a suitable method for value chain analysis, principally for those whose early stages are based on small and medium-sized rural actors. The Rural Web analysis offers decision-makers a platform to identify key actors not traditionally considered in value chain analysis, as well as the social interrelationships that occur at different dimensions. It also enables the identification of corrective and preventive measures to enhance agribusiness value chains.

Keywords: socio-economic analysis, agribusiness, value chain, Rural Web, sustainability, rural development, Mexico

JEL code: Q01, Q13, R11, R23

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1. Introduction

Various authors have investigated the ways in which the relationship between small-scale producers in developing countries and agribusiness firms can act to enhance rural livelihoods (Blandon *et al.*, 2009). At the same time, contemporary development policy prescriptions often place emphasis on the potential for closer integration of poor people or areas with global markets. In accordance with this perspective much of the literature has concentrated on exploring how firms and farms in developing countries can be integrated into global markets through value chains (Bolwig *et al.*, 2010; Metzger *et al.*, 2010; Trienekens, 2011). In addition, international experience has demonstrated that value chain analysis can be an important tool to enhance the performance of agricultural, food and fiber systems. It can help chain stakeholders and policy-makers to identify corrective measures and to kick-start the development of areas and activities where the potential for growth has been identified (Da Silva and De Souza Filho, 2007). Many methods for value chain analysis have evolved in recent years, ranging from the more descriptive and qualitative to modelling and simulation studies (Fasse *et al.*, 2009). However, working with small scale producers and principally with those from developing countries, generally with a series of socio-economic disadvantages, represents for the chain stakeholders additional complications and challenges that goes beyond the economic approach assessed by the traditional value chain analysis tools. Along with cost-reduction and improvement strategies, members of global value chains (sourcing channels, producers, distributors and final consumers) should also consider non-traditional aspects from the small-scale producers such as the social, cultural, environmental and political. As Marsden *et al.* (2010) noted, in order to fully understand the role and potential of chains, there is a need to move beyond descriptions of product flows, to examine how supply chains are built, shaped and reproduced over time and space. Authors like Tallontire *et al.* (2011) and Tallontire (2007) recognize the importance of analyzing the ‘horizontal’ along with the ‘vertical’ dimensions of governance in a value chain analysis. One potentially interesting approach is to examine regional food or natural resource chains from within, to focus upon the social relationships of trust and cooperation between the actors within the network with a view to identifying obstacles and opportunities (Jarosz, 2000; Peterson, 2013). Along the same line Block *et al.* (2008) propose a ‘value web’ approach that considers the different dimensions in which a value chain develops and explores the interactive and iterative relationships between the actors involved.

This paper aims to go further in evaluating the socio-economic complexity of a value chain exploring the potential application of a methodology known as ‘Rural Web analysis’ (Van der Ploeg and Marsden, 2008) as a complementary approach to traditional-linear value chain analysis tools. We believe that by using the Rural Web the interconnections between six different dimensions (described below) of the value chain can be assessed, generating analytical insights that would remain hidden when applying a linear (producer to consumer) analysis of a value chain, as shown in Figure 1. Moreover, greater understanding can be achieved in relation to the strategic linkages – both between the actors involved in generating a product’s value and also with other actors who have an indirect effect on the agribusiness value chain.

In order to demonstrate the appropriateness of the methodology for the above described purpose, we applied the Rural Web empirically to the case of Candelilla wax producers in a number of rural communities in the Chihuahuan desert in northern Mexico. The broad range of contextual and other complex conditions that are covered in the Rural Web make a case study the most suitable way to test the applicability of the Rural Web for value chain analysis (Yin, 2012). Furthermore, this rural web analysis was part of a broader evaluation of the potential of the Candelilla wax supply chain to foster rural development in the region (Arato, 2016). In the current article the potential of the tool is shown and several interesting outcomes for the Candelilla case are generated: it will increase common understanding of the rural reality (as perceived by the different actors involved); it can serve as a starting point to negotiate and resolve the identified differences in opinions, needs and expectations; it can identify possible pathways to foster efficient improvement strategies; as well as enabling the proper identification and management of possible risks to ensure the sustainability of the value chain.

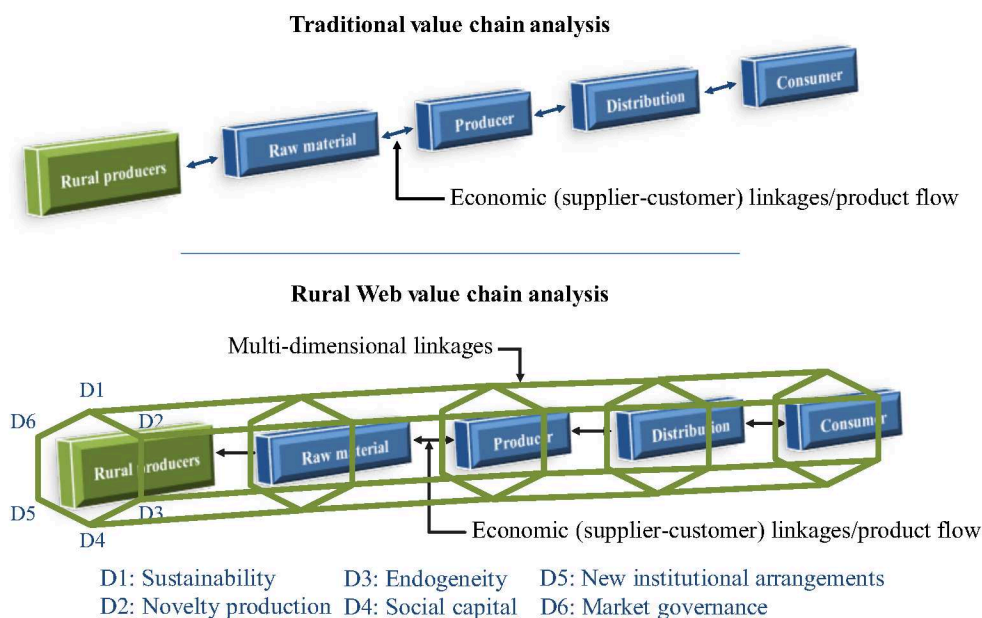


Figure 1. Conceptualization of traditional and rural web value chain analysis. Adapted from Kaplinsky and Morris (2002) and Fasse *et al.* (2009). The representation of rural web value chain analysis is adapted from Van der Ploeg *et al.* (2008) and Marsden (2010).

2. Frameworks for value chain analysis

Traditional analysis of value chains

The field of value chain theory has received a lot of attention during the last decades (Bolwig, 2010; Fasse *et al.*, 2009; Kaplinsky and Morris, 2002; Porter, 2011; Tallontire, 2007; Tallontire *et al.*, 2011; Trienekens, 2011). According to Trienekens (2011) different disciplines have added to the development of value chain theory, including global value chain analysis; new institutional economics; supply chain management; and social network theory. Social network theory for example explains that value chains are shaped by concepts beyond economic considerations. Aspects like trust, reputation and power have a key impact on the structure and duration of value chains (Uzzi, 1997; Trienekens, 2011).

In terms of methodologies to assess the evolution and performance of value chains, a common element to identify the different actors, activities, flows, inputs and outputs is the ‘mapping of value chains’. The most common type of mapping is the vertical representation. This provides a linear description of product flows from input to output including the relationships among the involved actors, as well as the economic activities at each stage, as shown in Figure 1. Such type of mapping is often the basis for modeling, accounting and econometric exercises to evaluate the optimization and efficiency of value chains (Fasse *et al.*, 2009; Kaplinsky and Morris, 2002). Other types of mapping, principally related to the social network theory, constitute a combination of vertical and horizontal mapping. During the last decades the vertical-horizontal mapping has gained popularity because of the incorporation of the social context. Such mixed mapping provides a visual representation of the connection with other value chains, as well as a description of the social relationships of trust and cooperation between groups and organizations with a view to identifying obstacles and opportunities (Borgatti and Li, 2009; Jarosz, 2000; Peterson, 2013; Tallontine *et al.*, 2011; Trienekens, 2011). The current article relates to this literature and proposes the Rural Web analysis as a way to get a more holistic view on value chain performance.

The Rural Web

The Rural Web, as described by Van der Ploeg *et al.* (2008), is an analytical tool that allows for a thorough exploration of the characteristics of specific localities, wider regional settings and development initiatives. It consolidates the large body of theoretical and empirical work on rural matters. In accordance with Horlings and Marsden (2012) a 'Web' could be defined as the relational system through which the human and the ecological components of a territory interact and intersect. Six dimensions, each of which highlight particular features of the web, can be distinguished (Marsden 2010; Van der Ploeg *et al.*, 2008): 'sustainability', 'novelty production', 'endogeneity', 'social capital', 'new institutional arrangements' and the 'governance of markets'.

A series of potential applications of the Rural Web has already been identified (Messely *et al.*, 2013): as a tool for comparative analysis of different development paths, within and between regions; as an approach to sustainable rural development; and as a diagnostic tool for exploring the potential limits of rural development patterns. This paper, however, is the first attempt to use it to evaluate a supply chain. On the one hand, this application is based on the recognized importance of the value chain as the locus of economic growth and development for small and medium sized rural producers and their communities (Arnold and Ruiz Pérez, 1996; Belcher *et al.*, 2005; Belcher and Schreckenber, 2007; Fisher and Dechaineaux, 1998; Marshall *et al.*, 2006; Syampungani, 2009). On the other hand, it reflects the premise of Van der Ploeg *et al.* (2008) who stated that the performance of a regional economy, its comparative advantages, its competitiveness, innovativeness and sustainability could be explained by a functioning and comprehensive web.

Contrary to the linear-traditional value chain analysis which generally include only those actors who participate actively in the product lifecycle (from seeding, collection and processing of raw materials to industrial processing, distribution and trading of final value added goods), the use of the Rural Web would allow to identify all the actors involved at a regional level of a value chain. The Rural Web analysis framework aims to provide insights from the actors in the product lifecycle, but also from those who are not actively involved in the process, such as universities, research institutes, and government representatives. These external actors do not provide a tangible value to the product; however they could have a significant impact on the value chain performance (Bitzer and Arts, 2013; Gregoratti, 2011; Tallontire *et al.*, 2011). They could potentially limit its growth, and in some cases, hinder it completely by applying external impacts to the process.

3. Description of the study case

The case study area is composed of rural communities from the Chihuahuan Desert, a region which extends over 450,000 km² and includes part of the northern Mexican states of Chihuahua, Coahuila, Durango, Nuevo León, San Luis Potosí and Zacatecas (Schneider, 2009). The region is characterized by an arid and semi-arid ecosystem, with low levels of rain and extreme weather conditions which limit the potential for agricultural activity. As a consequence, the collection of Non Timber Forest Products is the main source of income for most families. One of these products is Candelilla. For about 3,000 families from this region the extraction and processing of this plant represents the main source of income.

The commercialization of Candelilla is regulated by the Mexican secretary of environment and natural resources 'SEMARNAT' through its Mexican Official Norm: NOM-018-SEMARNAT-1999. The plant is collected from its wild environment and processed to extract a wax product known as 'Cerote', which is transformed into Candelilla wax through a refining process. The activity is mainly undertaken by men with sporadic support from the women. Most Candelilleros, as they are called, collect the plant from communitarian land properties. These are extensions of common land provided to a group of tenants, based on the Political Constitution of the Mexican United States (Mexican United States, 2015) and the internal regulations of the communitarian assembly. The tenants are entitled to undertake agricultural activities and to utilize the natural resources (including Candelilla and other wild species available). This is stated within the utilization permits issued by the Mexican authorities who regulate the rational use and preservation of the resources (CONAFOR, 2008).

The production of Candelilla wax is a very old practice, and there are records of production volumes for industrial purposes back in the 1950s. For a number of reasons, the practice declined in popularity, and was even abandoned altogether in many places. For some years, production only took place in the Coahuila State and at much lower volumes. Recently, in the states of Nuevo Leon, Zacatecas, Durango, Chihuahua and San Luis Potosí the activity revived, mainly due to promotion by private firms and government institutions, which are encouraging rural development by developing natural resource based productive chains (Arato *et al.*, 2014; CONAFOR, 2008). The value chain starts with the Candelilleros, who process the plant and trade it with local firms that then refine the product to produce the Candelilla wax. Due to its characteristics, Candelilla wax is a highly valued product for specialty applications in different industries, such as cosmetics, pharmaceuticals, the food industry, graphic arts and printing, among others. The main consumers of Candelilla wax are international markets in the USA, Europe and Asia, where 90% of the production volume is traded. The domestic market in Mexico accounts for less than 10% of the total volume produced. Mexican refinery companies are also participants in the Candelilla value chain, as they export the product to firms from the abovementioned markets (principally wholesale distributors and some large scale producers). Candelilla wax reaches final consumers in the form of a component for specialty consumption goods (Arato *et al.*, 2014).

The Candelilla wax value chain was the economic driver used in a rural development project encouraged by different actors (private firms, governmental representatives and civic organizations) to foster socio-economic development initiatives for Candelilleros (Arato *et al.*, 2016). Due to the social, environmental and economic variables affecting the value chain as well as the variety of actors involved, the project leaders stressed their need for a methodology or tool that could provide a broader analysis of the social linkages and the relevant variables affecting the development of the value chain. This initiated the exploration of the application of the Rural Web as an analysis tool for value chains.

4. Methodology

First the actors of the Candelilla wax supply chain were identified based on relevant literature (CONABIO, 2009; Schneider, 2009). They are presented in Table 1. Using this information, a plan for the interview process was established in order to obtain primary data about the perspectives of each type of actor. Primary data was obtained during a period of fieldwork in selected rural communities from three states in the Chihuahuan Desert (Nuevo León, Coahuila and Zacatecas), during July and August 2012 and during the same period in 2013. The communities were selected based on the importance of the production of Candelilla wax for their community and their experience of producing it. In order to select the rural producers, a general invitation was sent to all the Candelilleros from the selected communities. Those who accepted were interviewed. In total, interviews were conducted with 29 rural producers. In addition other types of actors were contacted and interviewed: 4 members from the private firm who initiated the rural development project, 2 members from a local university, 6 members from Forestry Governmental Agencies and Forestry Engineers and 1 member from a local governmental office. Overall 42 actors were interviewed.

During the data collection the different aspects of the Rural Web were evaluated, using a semi-structured questionnaire. The interviews revolved around the six dimensions of the Rural Web. The respondents were presented with a number of statements related to each dimension, and they were asked to give their perspective on each of these statements using a 4-point scale reflecting their level of agreement with the statement. Each statement was developed based on the theoretical definition of each dimension (below described) and on previous knowledge from the region. The previous knowledge from the selected case study was obtained from local representatives and by working experience prior to the above mentioned fieldwork period. The local knowledge resulted relevant to formulate the statements according to the socio-economic conditions from the evaluated actors. It allowed to translate the theoretical definitions into applicable concepts. An overview of statements included in the questionnaire is given in the following paragraphs.

The generally accepted definition of ‘Sustainability’ considers the existence of the social and ecological conditions necessary to support human life at a certain level of wellbeing for future generations (Earth

Table 1. Actors interviewed during the Rural Web analysis.

Actors	Characteristics
Candelilleros from Cuatrociénegas, Coahuila	This region represents the oldest producers of Candelilla wax. Contrary to the rest of the regions, these communities have shown continuous production over time. The Candelilleros from this region currently represent up to 40% of the total wax production in Mexico.
Candelilleros from Parras, Coahuila	This region is also a historic producer of Candelilla wax. These communities have shown continuous production over time.
Candelilleros from Nuevo León	A newly re-activated producing region that, in the past, has shown discontinuous performance. However since the mid-2000s, it has shown an increasing production volume.
Candelilleros from Zacatecas	This region, similar to Nuevo Leon, showed a negative and discontinuous performance during the 1980s and 1990s. However, since the mid-2000s the communities have been re-activating the production of Candelilla wax.
Forestry government agencies and forestry engineers	CONAFOR is the government forestry agency responsible for promoting and encouraging preservation and development of sustainable commerce for natural resources. It also provides socio-economic organization programs to create productive chains through the strengthening of social organizations and institutional capabilities, as well as by providing training in the adequate use of forestry resources, with the purpose of generating employment and income. Forestry engineers are responsible for evaluating and analyzing the natural resources present in the rural communities, working with rural communities and CONAFOR to develop the exploitation permits in order to ensure the proper utilization of biodiversity (CONAFOR, 2012).
Universities and research institutions	Representatives from different local universities and research institutions were invited to participate in the evaluation process. The selection criteria were based on their experience in previous or current projects focused on the Candelilla wax or its production process. The representatives evaluated belong to The National Commission for the Knowledge and Use of Biodiversity 'CONABIO'; Universidad Autónoma de San Luis Potosí; Universidad Autónoma de Coahuila and; the research and development department from a local private firm (Multiceras) which is currently running different projects focused on the improvement of the production process as well as for different applications of the wax. The interviewed actors are involved in different projects focusing on research about the properties of the plant, diversification of applications and research into methods to make the production process more efficient.
Municipal authorities	In this region there is significant integration between Candelilleros and municipal authorities. The representative of the municipal authority interviewed is a person with experience in the Candelilla collection process and he represents the interests of the rural collectors at local government level.
Private firm	This group includes collectors who are individuals located within the rural communities and generally work on a commission basis purchasing Cerote for different private firms. This group also includes members from different departments (Sales, Agribusiness and Social Responsibility) from a private firm that is recognized as the largest trader of Candelilla wax.

Council, 1994; Van der Ploeg *et al.*, 2008). In accordance to this we developed a series of statements that would provide us with the insights and perspectives from the different actors interviewed, in relation to the following: (1) the continuity of the activity; (2) the extent to which the income generated by the activity is sufficient; (3) their opinion about the current economic revenue from the activity; (4) their opinion about the involvement of future generations in the activity; (5) their perception about future improvement in the activity; (6) whether they believe there is sufficient stock of the plant to continue processing; (7) their awareness and knowledge about recommendations for plant preservation; (8) their opinion about how involved the rural producers are in resource preservation measures; (9) their perception about the reforestation campaigns and their effectiveness. The respondents provided their perceptions on all of these aspects using a four point scale

(for example for question 8, where the respondents were asked to indicate the degree of involvement of rural producers in resource preservation measures the scale ranged from ‘little involved’ to ‘highly involved’).

The second dimension ‘Novelty Production’ refers to new insights, practices and artifacts developed to improve the process or the product. At the same time, it refers to deviation from the rule, distinguishing its results from the accumulated or expected knowledge (Marsden, 2010; Van der Ploeg *et al.*, 2006). Therefore, under this dimension we evaluated to what extent changes or improvements are made by the Candelilleros: (1) in the plant collection process; (2) in terms of simplifying the wax production process; (3) to increase the production volume; and (4) for the preservation and reforestation of the plant. Other aspects included in the evaluation of this dimension were the level of diversification and multi-functionality currently taking place (Durand and Van Huylbroeck, 2003; Ellis, 2000; Ellis and Biggs, 2001; Nemes, 2005). This involved asking about (5) the development of other initiatives for complementary activities (tourism, cultural events, traditions, other activities). For all these aspects, the respondents were asked to rate the extent to which these actions took place.

In line with the premise stated by Van der Ploeg *et al.* (2008) about endogenous development which occurs when there is sufficient consensus about the goals of development and, consequently, about what can be considered as local resources and the value of local entities as resources, we included the following aspects in the evaluation of ‘Endogeneity’: (1) to what extent the Candelilleros depend on other entities (private firms, buyers, government) to collect and process Candelilla; (2) the level of dependency on others to obtain the processing equipment and supplies; (3) the dependency on others to learn the process and obtain training; (4) how the Candelilleros organized the development of community improvements (building of schools, roads, hospitals, etc.); and (5) how the Candelilleros attempt to increase the added value of the wax.

The fourth dimension ‘Social Capital’, as defined by Fukuyama (1999) is an instantiated set of informal values or norms shared by the members of a group. It generally refers to trust and willingness to live by the norms of one’s own community and to punish those who do not (Bowles and Gintis, 2002; Durlauf, 2002). Therefore, within this dimension, we measured the ‘collective efficacy’ (Sampson *et al.*, 1999) of the Candelilleros by analyzing their ability to engage in networks, cooperate and make use of social relationships for common benefit. We did this by formulating statements about: (1) how much cooperation exists between the Candelilleros from the same community (sharing knowledge, resources, support); (2) how organized the Candelilleros are to achieve common benefits; and (3) how good the relationship between Candelilleros from different communities is.

The ability to achieve synergistic ‘win-win’ outcomes, as addressed by Barret *et al.* (2005), depends largely on the ‘New institutional arrangements’ that shape the incentives and constraints faced by human agents. In order to analyze this fifth dimension, we asked respondents to evaluate the institutional constellations that solve coordination problems and support cooperation among Candelilleros and different actors, such as: (1) local government institutions, (2) universities and research institutes; as well as (3) private firms.

The final dimension considered is ‘Market Governance’. The capacity to control and strengthen markets, as well as to construct new ones, is related to the way in which a certain supply chain is organized, the distribution of the value created, and how the potential benefits of collective action are delivered. Candelilleros act as self-employed producers, working within their own territory and having the opportunity to decide whether to produce Candelilla wax or undertake any other complementary activity. To analyze ‘Market Governance’, we differentiated between two different market governance capacities: (A) the capacity of Candelilleros to control the market (sale price and offer), by evaluating: (1) their influence on the selling price of Candelilla wax; (2) the feasibility for Candelilleros to produce an additional quantity of Candelilla wax per month (10 kg, 30 kg, 60 kg extra). (B) The capacity of the other actors along the value chain to control the market (demand) by questioning: (3) the influence of private firms on the purchase price of Candelilla wax; (4) the influence of final users on the purchase price of Candelilla wax; and to analyze the demand volume of Candelilla wax

in the market, by (5) the feasibility for a private firm to purchase an extra quantity of 10, 30 and 60 kg of Candelilla wax per month, (considering that the average monthly production is 120 kg of wax per person).

To analyze the results generated by the data collection process described above, we applied a mixed qualitative-quantitative method. The ratings (from 1 to 4) obtained for each aspect were processed (calculating average scores per dimension) in order to map the results. This was undertaken to provide a picture of the general perception regarding each dimension, which was translated in the Rural Web chart (Figure 2), as explained in the results section. This analysis was complemented and interpreted using the additional information obtained from the interviews and the informal conversations.

5. Results

Sustainability

Sustainability was considered to be a critical dimension by all the actors interviewed. As described above the dimension considered, for example, the continuity of the activity and the preservation of the resource over time. The group of Candelilleros from the region of Cuatrociénegas and Nuevo León were more concerned about this dimension compared to the Candelilleros from the other regions. Other groups concerned with performance in terms of this dimension were the representatives of the national and local forestry authorities. Their concern related to the knowledge and application of the officially recommended preservation measures and about the effectiveness of the reforestation campaigns. Nevertheless, respondents were generally optimistic about the survival of the practice over the next five to ten years, and had positive expectations for improvements to the activity and its value chain in the future, as well as a positive perception regarding the adequacy of bio-stocks of the plant in the region. For most actors interviewed, the main concern identified related to continuity for the current collectors over a period longer than 15 years. This is logical considering that the average age of the Candelilleros ranges between 40 and 45 years. Moreover, another factor affecting continuity is the low number of young Candelilleros available to maintain the practice in the future.

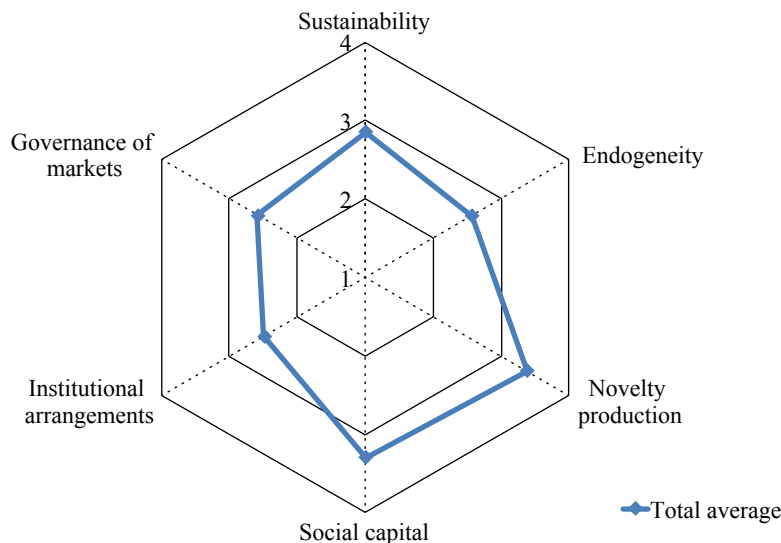


Figure 2. Rural Web results. This figure is for illustrative purposes only. It was included to provide a visual reference about the total average of rates per dimension, as reported by the interviewed actors. The figure aims to facilitate the analysis of the dimensions and its relevance in accordance to the evaluated concepts. It does not intend to provide a quantitative analysis of the results.

Novelty production

It was observed that novelties are mainly expected to take place in relation to the collection and production process. The types of novelty observed in the process vary according to the level of expertise and technological skills available. The concept of 'Peasant Innovativeness' (Oostindie and Broeckhuizen, 2008; Ventura and Milone, 2005) is reflected in this case in the small improvements developed by Candelilleros principally in relation to collection techniques and the production process. For example, using trucks or customized tools to collect and process the Candelilla plant can be considered as small improvements that save both time and effort. The actors interviewed from universities, research institutes and private firms are less optimistic concerning the level of improvements, basically because their expectations in terms of product and production efficiency relies on the application of advanced technology.

Nevertheless, in this case, some technological improvements, such as new designs for processing equipment and furnaces, have been developed in recent years, principally focusing on improvements in production efficiency and working conditions for the Candelilleros. These changes are currently in place and were developed based on local research supported principally by the Mexican government (CONAFOR, 2008). Other research efforts were undertaken by the private firm Multiceras, which is currently working on three main objectives: to improve production efficiency and the production process and to search for new and improved product characteristics and applications (Multiceras, 2013).

In order to increase the income of rural Candelilla collectors, two projects were developed by the Candelilleros from Cuatrociénegas, with support from the municipal authorities in cooperation with other national organizations. The projects involved the organization of workshops (in two different locations) to produce value added Candelilla wax. However, when the representatives from the private firms and research institutes were asked if they were familiar with these projects, they stated that there was limited information about the projects mentioned and, moreover, they lacked basic information on matters such as production capacity, the capabilities of the production equipment or even the specifications of their final product. Nevertheless, the representatives showed an interest in this project, because it would allow the Candelilleros to advance one further step in the value chain.

Other improvement projects were encouraged by different institutions such as Universidad de Coahuila, which along with the governmental agricultural agency 'SEMARNAT' and 'CONAFOR' developed a project to increase the production efficiency and to improve the safety in working areas. Finally, in relation to multi-functionality, we could observe different activities being undertaken alongside agricultural-related activities, such as tourism and other cultural activities, principally in communities from Coahuila and Nuevo León¹.

Endogeneity

The shared concerns with regard to this dimension relate to the general perception that Candelilleros are heavily dependent on external actors to obtain the technology and specialized skills to increase the added value of their product.

Nevertheless, most of the interviewees recognize the capacity of Candelilleros to transfer their knowledge and production skills from generation to generation, as well as their internal organizational skills to generate shared benefits. This is certainly the case in the communities from Coahuila. This is a location where stronger collaboration exists between the Candelilleros and where the activity is more mature and extensive. Compared to the rest of the regions, Cuatrociénegas showed a higher level of organization between the community members to generate their own benefits and to provide added value to the product. At the time of this research,

¹ The local governments from the regions of Cuatrociénegas, and Parras in Coahuila and García and Mina from Nuevo León encourage different historical and eco-tourism attractions (<http://tinyurl.com/zdg95xa>; <http://tinyurl.com/o87cequ>; <http://tinyurl.com/hwwpbqo>).

there were some ongoing rural development projects through productive chains, encouraged by municipal and national support agencies (CONAFOR, 2012).

Another peculiarity that distinguishes Cuatrociénegas is the larger presence of Candelilla wax buying private firms. This situation provides Candelilleros with greater negotiation power, which gives them more influence as a recognized group of producers. As already indicated, the local municipal authorities from Cuatrociénegas are closely involved in the interests and wellbeing of the Candelilleros as a group. Notwithstanding their organizational strength, the group of Candelilleros from Cuatrociénegas agreed that they are heavily dependent on third parties or government officials to provide them with production equipment and tools.

When they were asked about the possible reasons for that dependency, they argued that for them it is more beneficial to keep receiving the tools from the buyers and save costs, as well as to avoid possible conflicts of interest by using common equipment and utilities. In general, of all the groups interviewed, the research institutes and the private firms were least optimistic about this dimension. Their main concerns related to the high level of dependency on external actors to obtain production equipment, the motivation to undertake the activity and the limited value added.

Social capital

All types of actors interviewed agreed on the high level of cooperation and support that exists between members of the same community (as shown in Figure 2). Rural communities are organized through community assemblies known as 'Comisariado', which are formed by the members of the community.

The common activities developed in the community are first discussed between the members of the assembly and approved based on general acceptance. However, although there is a lot of cooperation between Candelilleros from the same community, limited cooperation was reported between members from different communities.

The 'Comisariado' is the local institution responsible for promoting the common benefit of all the members of a given rural community, including those who are not Candelilleros but who still have a voice and a vote concerning the activities developed within the premises and the communities. We could observe situations where differences arise between members of the community, principally in terms of land use and the balance between other economic activities and the interests of those members not producing Candelilla. In these cases, the Comisariado would take the role of mediator between the different interests, establishing measures to negotiate the best possible outcomes for all the actors.

On the other hand, some rural collectors mentioned cases where youngsters, who had left the community and moved to larger cities to work in factories or the construction industry, had returned after a couple of months and re-engaged in Candelilla collection. They argued that this occurs because in the city there are additional expenses such as rent and transport, and the cost of food tends to be much higher compared to the prices at the communitarian stores. These youngsters did not take such costs into consideration when making their decision to relocate.

New institutional arrangements

Detected as a main improvement opportunity, this dimension, as shown in Figure 2, was perceived most critical by all the respondents. The general concern is based on the discontinuity and the limited relationship between the Candelilleros and the local governments, universities and research institutes. The strongest institutional relationships were observed between the Candelilleros and the private firms, principally because of their working relationship which represents, for the Candelilleros, their main source of income and supply of production equipment. However, with the exception of the above mentioned case of Multiceras, in most cases the relationship with private firms is limited to the selling-purchasing process. As observed during the

fieldwork period, Cuatrociénegas has a higher number of producers, compared to the rest of the regions, and attracts support from government and research institutes, both at local and national level, for improvement projects focused on infrastructure and social organization. This situation is not reflected in the rest of the Candelilla communities due to the lower number of producers.

Market governance

All the interviewees agreed that there is scope for improvement in terms of this dimension, principally for the market governance capacity of rural actors which is mainly determined by the influence of the members at later stages of the value chain. Regarding the two different market governance capacities we observed the following. Concerning the influence of the Candelilleros on the selling price of wax, which is the Candelilla wax in its simplest form, the rural producers from all the areas have a more positive perception, compared to the opinion of the rest of the actors interviewed. The general perception of the Candelilleros is that they can somehow influence the selling price by trading their product with the different private companies that purchase the Candelilla wax. However, the actors interviewed from research institutes, universities, government representatives and private firms believe that Candelilleros have limited influence on the selling price and state that the price is related to more external factors such as global demand and variability in the selling price of competing and substitute natural wax products. In terms of the supply of Candelilla wax, we evaluated the feasibility for a Candelillero to produce an additional quantity of Candelilla wax on top of what he is currently producing. In the short term, and considering the current working conditions, available tools and technology, an additional 10 kg of Candelilla wax per month was perceived as feasible. However, perceptions were less optimistic concerning the feasibility of producing larger additional quantities (e.g. 30 kg extra). Producing an extra 60 kg was regarded as impracticable, under the current conditions; and respondents suggested that some improvements in the process should be made to achieve this.

With respect to the demand, the average perception was that it was highly feasible for private firms to purchase an extra 10 kg or 30 kg. However, in terms of a scenario involving an increase in supply by 60 kg in the short term, the results varied considerably between the different actors interviewed. While the general perception among the Candelilleros was that the market can afford the purchase of this additional quantity, the rest of the actors – principally the private firms – regarded this scenario as less feasible, arguing that an extra 60 kg would represent a 50% rise in the total volume of Candelilla wax available in the global market, which would create the problem of overstocking. According to the comments from firm representatives, an increment in the available volume of wax should be accompanied by a marketing strategy in order to place the additional volume within new markets or increase the number of product applications, in order to create a balance between supply and demand.

6. Discussion

The Rural Web Analysis framework

As shown in the previous sections, the Rural Web analysis framework allowed us to gain insight into the social complexity and interaction between different members of a value chain. The framework enabled us to understand different perspectives on the potential of Candelilla production. The results obtained showed territory-specific peculiarities of the region and the economic activities that are based on the utilization of the local natural resource, as addressed by Van der Ploeg and Marsden (2008) and Marsden (2010).

Identification of all the actors involved at a regional level is important for the complete assessment of a value chain. Linear-traditional value chain analysis usually considers only those actors who participate actively in the product lifecycle (from seeding, collection and processing of raw materials to industrial processing, distribution and trading of final value added goods). All actors considered in linear analysis interact in the process and provide a specific value to the product. On the other hand, the Rural Web analysis framework provides insights from the aforementioned 'value adding' actors, but also from those who are not actively

involved in the process, such as universities, research institutes, and government representatives. These external actors do not provide a tangible value to the product; however they could have a significant impact on the value chain performance (Bitzer *et al.*, 2013; Gregoratti, 2011; Tallontire *et al.*, 2011). They could potentially limit its growth, and in some cases, hinder it completely by applying external impacts to the process

As shown in the results section, the concerns from the different groups in terms of the dimensions evaluated were quite different: while dimensions such as Social capital and Novelty production obtained more optimistic perceptions, dimensions such as New institutional arrangements, Endogeneity and Governance of markets received less optimistic answers. However, the purpose of using the Rural Web is not to take actions to improve these perceptions, because positive changes in one dimension might have a negative effect on other dimensions. On the contrary, it is more about understanding the peculiarities of the situation and acting according to its characteristics. It is important to bear in mind that this is a snapshot of the perceptions obtained from current actors. Situations are dynamic and could be modified based on the common dialog and understanding of the actors involved. The analysis framework presented could facilitate the generation of a diagnostic relating to the potential risks and improvement opportunities that must be addressed from the actors' perspective in order to develop a successful dialogue and the understanding to generate efficient development strategies.

Findings from the case study

Improvements in the socio-economic wellbeing of disadvantaged areas can best be brought about by recognizing and encouraging the collective resources of a territory itself (Ray, 2000). Therefore in this section, we analyze the main differences found in the perceptions of the actors interviewed. We link this with existing literature in order to provide specific recommendations and promote a common understanding of each one's point of view. Such common understanding would form a baseline to identify risks and maximize strengths for each dimension in order to address further development strategies.

In terms of Novelty production, given that there is a marked difference between the perception of Candelilleros compared to the rest of the actors interviewed, a common dialog must be encouraged between all parties in order to understand that novelties are largely a deviation from the rule and generally do not correspond with the knowledge accumulated to date (Van der Ploeg *et al.*, 2006: 200). Such a dialog would allow them to identify the 'Contextual knowledge' (Oostindie and Broekhuizen, 2008) generated by the accumulation of technological capabilities and skills from each region.

As observed, most improvements reported by the Candelilleros consist of small changes to production and collection techniques, generally on a territorial basis, which result in a steady but ongoing increase in benefits, while for the rest of the actors (principally private firms, research institutes and universities) the expected outcomes are linked more to improvements in efficiency and capacity building in relation to the production process. In this case, identifying the differences in concepts among all parties would enable the dissemination of knowledge throughout different territories (Oostindie and Broekhuizen, 2008). Another observation was that standardization and dissemination of new production and preservation techniques encouraged by private firms, governments and universities faced limitations due to the highly localized novelty production that exists within the rural communities. Shared understanding and communication would allow all parties to potentiate the possible outcomes from novelty production such as: improving resources, fine tuning, boundary shifts, and re-patterning resource use (Ventura and Millone, 2005).

When applying development initiatives, it is important to consider the traditional territory-specific incentives that people deploy to regulate themselves, such as, for example: solidarity, reciprocity, reputation, personal pride, respect, retribution and vengeance (Bowles and Gintis, 2002; Gray *et al.*, 2014). In the case of Social Capital and Endogeneity, the stakeholders involved should encourage the development of a 'collective efficacy' (Anderson and Jack, 2002; Bellandi, 2001; Sampson *et al.*, 1999) in order to foster cooperation between communities within the same territory in a hands-on approach.

As described above, the limited communication and interaction between communities complicates the implementation of territorial and regional development projects. In general, Candelilleros perceive themselves as an organized community that follows a territorial-individualistic working philosophy. However, from the different regions, it is only in Cuatrociénegas that sufficient organizational skills have been developed to create an impact group sufficient to generate common benefits on a regional basis. For the rest, the working relationships have been on an individualistic basis, considering 'Community-specific' needs. As identified by co-actors, this individualistic culture generates a lack of efficiency in the distribution of resources (such as equipment, tools, technical skills, etc.). In this case, cooperation between the members from different communities should be encouraged through working relationships based on 'Trust' (Bitzer *et al.*, 2013; Bowles and Gintis, 2002; Durlauf, 2002). Trust could act like a lubricant that, in this case, would enable a more efficient distribution of knowledge and resources throughout different territories (Fukuyama, 1999).

In terms of Sustainability, the main concern from all those interviewed, is the low number of young Candelilleros who would undertake the activity in the future. For this reason, current improvement projects include the integration of youngsters in the production process. Awareness about the official recommendations for preservation is high, since most rural actors argued that they have received talks and training about it. However, when put into practice, in most cases the recommendations appeared inefficient, in view of the conditions where the activity is undertaken. Therefore, rural actors have come up with their own preservation techniques focusing on land distribution and collection patterns, alternating collection in order to let the plant re-grow. These collection schemes are respected by all rural members of the community and are regulated by the Comisariado for each rural community. In order to integrate the rest of the actors into the preservation measurements proposed by the Candelilleros, it is necessary to understand the constraints they experience in their daily activities, and from this, construct mechanisms to generate effective preservation of the natural resource. As suggested by Boettke *et al.* (2008), in order for formal institutions, to 'stick' with the regular working process, it must be mapped onto the informal rules.

With respect to New Institutional Arrangements, a stronger interaction between all actors in the value chain should be encouraged, in order to maximize rural development opportunities. Candelilleros from most regions agreed about the limited relationship that exists with research institutes and Municipal authorities. Actors should migrate from the traditional style of support into a more active role (Shucksmith, 2010). The first step in establishing effective institutional arrangements is to establish, monitor and enforce rules. Since every region currently works on a territorial-individualistic basis, it is understood that some differences could be encountered between regions (Barret *et al.*, 2001).

Finally, in terms of Market Governance, non-rural actors agreed that Candelilleros have a certain influence on the selling price. However, this influence is limited within certain price boundaries, because the purchase price relates more to external factors such as global demand and variability in the selling price of competing and substitute wax products, such as Carnauba wax. In order for the Candelilleros to advance in the value chain, it is necessary to foster the conditions needed to meet the requirements for technical skills and equipment; and to improve working conditions. This could be accomplished by integrating all the members of the value chain within multi-institutional networks to encourage the active participation of producers, consumers, local institutions, NGOs and related organizations (Block *et al.*, 2008; Marsden and Renting, 2003; Shucksmith, 2010; Tallontire, 2011; Ventura *et al.*, 2008).

Unfolding the Rural Web of the Candelilla wax value chain

As described by Messely *et al.* (2013), regionalized rural development is grounded in, and driven by, complex sets of internal and external interactions, which shape the relative attractiveness and competitiveness of rural spaces economically, socially, culturally and environmentally. In this section, we reviewed the interaction flow of the actors analyzed within the dimensions described in order to 'unfold' (Marsden, 2010; Van der Ploeg and Marsden, 2008) the Rural Web of the Candelilla wax value chain and thereby to understand the development trajectory of the case under analysis, as shown in Figure 2.

Based on the findings from the analyzed case study, the Rural Web flow begins with an interaction cell comprising the dimensions of Social capital, New institutional arrangements and Endogeneity. This first cell represents the main interaction block, where Social capital, as the key initiator, plays an important role in the development process because, as explained above, it represents the strongest dimension of the web due to the closed interaction and relationship between the rural producers from the same community (bonding social capital relations). Although the relationship with other communities (bridging capital relations) was rather weak, the relationship among the community members was strong enough to facilitate negotiations with the rest of the project members (linking social capital relations). In the analyzed case, the initial approach and negotiations were made between members from each community and the private firm. In line with the observed culture and traditions from the rural producers, the negotiations and agreements were performed according to the local interests. According to the comments from the interviewed, generally the agreements on price, volume, and other criteria from a given community might be different to those from a neighboring community, even when dealing with the same company and selling the same product.

In this same cell Endogeneity acts as a lubricant for Social capital, principally because of the consensus that exists among the actors interviewed about the value of local resources and traditional know-how concerning the production of natural goods (i.e. Candelilla wax), as well as the observed capabilities to bring about common benefits and endogenous development (i.e. the community of Cuatrociénegas which demonstrated a higher level of organization as well as development initiatives).

Influenced by the first interaction cell, Novelty production would be determined according to the relationship from the previous dimensions, which are defined by the members of the value chain and shaped according to their interests. As shown in this case, novelty varied according to the available resources and the objectives pursued by each group. Acting as a key lubricant and directly linked to Novelty production, is Market governance. This dimension serves as a base for the value chain, providing resources and income opportunities to the interacting actors. It must be said that, contrary to Social capital and Endogeneity which are somehow a constant element of this web, Market governance varies according to the economic activity encouraged. It also influences the New institutional arrangements, which will be configured according to the economic activity encouraged and the rest of the dimensions from the first interaction cell (i.e. the type of organizations interacting within the value chain varies according to the available resources, traditions, regulations, economic activity, and others). The relationship between the previously mentioned dimensions comprised a second interaction cell, represented in Figure 3 with a dotted line.

The interactions between the dimensions analyzed, along with the trade and environmental regulations that frame the entire Rural Web, have a direct effect on Sustainability which, in turn, is determined according to the actors involved, the natural goods selected for utilization and their preservation, as well as the sector of the population available to process them. This interaction flow as a whole leads to rural development as an outcome.

Challenges and limitations of the Rural Web as value chain analysis framework

Based on our experienced using the Rural Web for the analysis of the Candelilla value chain, we agree with the observations from Messely *et al.* (2013) with regard to the need of a regional learning process as a prerequisite for its application in order to get familiar with its dimensions and functions. To minimize the limitations, and maximize the outcome from a Rural Web analysis, it is recommended that private firms receive support from social scientists, NGOs or local representatives with sufficient regional knowledge. Their support would facilitate a proper understanding of the communities, open dialog channels and would provide sufficient input to the stakeholders to guarantee the successful use of the Rural Web.

During the case study, additional to the previously mentioned support, a valuable contribution from regional actors was received during the development of the questionnaire: providing important recommendations about local language, expressions, wording, and current paradigms present within the evaluated communities.

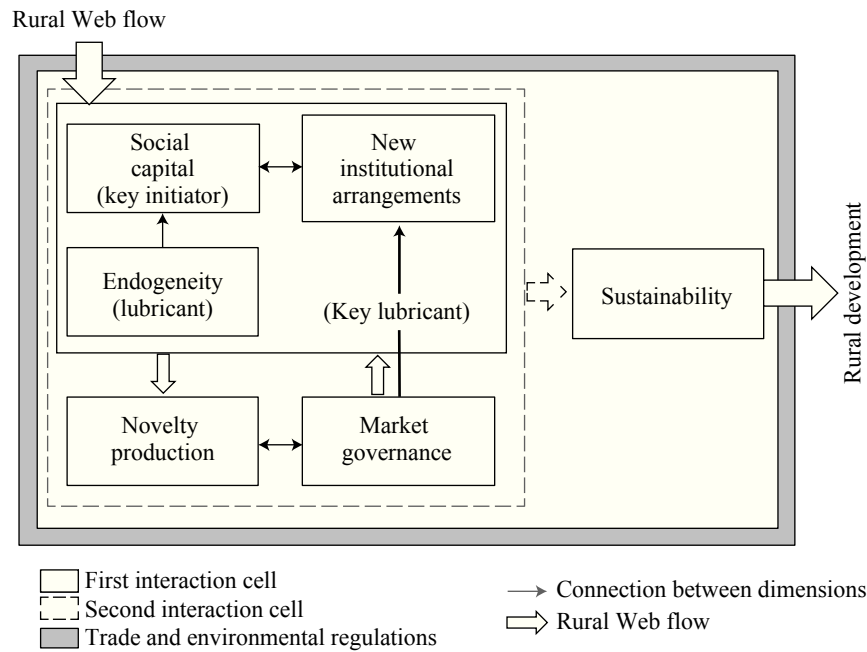


Figure 3. Unfolding the Rural Web.

In our experience, additional to the pre-requisite of regional knowledge, it is relevant for those interested to apply the Rural Web, to generate a preliminary evaluation about key concepts such as: (1) authority and hierarchy levels within the communities; (2) identification of local formal and informal leaders; (3) trust and perception from rural producers concerning the involved stakeholders and; (4) interest of rural producers to participate in the value chain, which for some might represent a change from another economic activity and learn new techniques and processes. The previous concepts were found relevant to secure the successful application of the Rural Web. However there might be more concepts that shall be considered, which opens an opportunity for further research work and analysis.

7. Conclusions

The information generated by the Rural Web analysis framework confirms the theory from Van der Ploeg *et al.* (2008) about the differences that exist between the different actors in terms of their web. It also helps to explain their particularities, as well as to foresee the possible development trajectory. Through this framework it was possible to identify the pattern of interrelationships, interactions, exchanges and mutual externalities within the different groups involved in the Candelilla wax value chain.

The Rural Web analysis provided relevant information about territory specific characteristics of the evaluated rural producers. The information provided includes insights of the local governance system, official and unofficial leadership structures and the type of incentives traditionally applied by the rural producers. This information is relevant for developing actors because it serves as baseline to delineate their strategies to encourage the participation of rural actors in specific economic activities and integrated development projects. Based on the information from the case study, for private firms to establish a solid relationship with rural producers, it is necessary to gain the trust from the leaders of the communities instead of simply limit their contact with regional rural leaders or authorities. Private firms should be open to negotiate the business conditions according to the needs and interests of the specific community. Also as observed in the case, the participation of development practitioners (governments, universities and NGOs) in some regions was relevant for the improvement of social cohesion and living conditions of the rural producers. However, in order to improve their relevance with the rural community members, they might need to strengthen

their bonds with community leaders in order to gain their trust and encourage their participation in future development projects.

The discussion about the dialog and opportunities to increase understanding, in the results section of this paper, was elaborated upon based on the observations and comments received from different actors during the interview process. These might serve as a baseline for the actors involved to define improvement strategies (Block *et al.*, 2008; Gregoratti, 2011; Messely *et al.*, 2013). However, the suggested recommendations might only be useful once the interests of each actor are fulfilled or when a common trade-off between all parties is agreed upon. As addressed by Van der Ploeg *et al.* (2000), synergy is a strategic element in many rural development experiences. It creates cohesion between activities, not only at farm level but also between different regions and other rural activities. The present research focused on the analysis of a value chain which is based on the commercialization of natural goods by independent small and medium rural producers that are obtaining improvement opportunities and benefits from integrating their operations along the value chain in a sustainable way. Based on the analysis we can argue that the Rural Web framework is suitable for analyzing the socio-economic configuration of value chains whose early stages are based on small and medium size rural actors. This because it identifies the social relations that occur at different dimensions, which in turn could foster or hinder its success. Given the characteristics and complexity of each value chain in relation to its product, production process, distribution channels and markets, this work opens possible pathways for further research the applicability of the Rural Web framework for other types of value chains in different contexts.

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