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Mediation Effect of Adaptive Planning between Social Capital and Business Innovation: Application to a Community of Pisco Producers in Peru

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Received: 7 August 2020; Accepted: 11 September 2020; Published: date

Abstract: This study addresses the effects linking adaptive planning and social capital that drive business innovation. A case study has been selected that involves a community of pisco producers, grouped around a production innovation and technology transfer center (CITE agroindustrial) in the southern part of Lima, Peru. The study examines how their perceptions have changed over a six-year period (2012–2018). Results show the mediation effect that adaptive planning—promoted through CITE activities—has between social capital and innovation, which is also strengthened over time. In conjunction with this, a route is investigated for business innovation that goes further than the need–opportunity dichotomy, through associative and collaborative behaviors, and adaptive planning that stands out thanks to its actors (the community of producers). This represents a path for transforming needs into opportunities for innovation and development.

Keywords: business innovation; adaptive planning; social capital; structural equation modeling; Peru

1. Introduction

The definition of innovation provided by the Organisation for Economic Co-operation & Development (OECD) [1] has become widely accepted, and states that innovation means an implementation of a new or significantly improved product (good or service), or process (many times including new technology adoption), a new marketing method, or a new organizational method in business practices, workplace organization, or external relations. This study is based on the line of thought that considers that innovation can arise in contexts where basic forms of collective cohabitation prevail, based on trust, friendship, and collaboration [2], and focuses on the success story of an innovative industrial community in Peru linked to viticulture [3]. This community, in a fledgling state of production and with notable needs, was able to emerge and scale its innovation around the pisco—local type of brandy—industry, based on certain historical know-how resources and organization together with planning and prospective activities generated and promoted by the Viticulture Technological Innovation Centre (former CITEvid, now CITE agroindustrial).

The community of pisco producers linked to CITE have started businesses based on need as well as high aspirations for economic growth, transforming this need into an opportunity for development and progress [4–6], and not just as a means of survival. This is consistent with a local dynamic in

Perú, where 63% of entrepreneurs are motivated by opportunity, compared to 16.7% who are motivated by needs [7], in contrast with most entrepreneurs in Latin America that start their businesses based on need rather than opportunity [8].

Therefore, it is necessary to gain a deeper understanding of interaction among variables that are contributing to innovation, and especially in regions that have lower levels of development and limited access to Research & Development & innovation (R+D+i) resources and technologies. Social capital is a well-known concept that contributes to explaining some of these variables [9], and why there are innovative communities who are able to improve their economy, despite the limitations they face in terms of the aforementioned resources [10,11], even beyond physical borders of the original geographic area.

However, it is also important to consider the trend regarding co-creation and interactive innovation systems [12,13]. Innovation management is moving away from an individual vision to a collective and open system [14–16] that leads to support networks in search of common progress [17]. These structures are based on a collective interpretation of the contexts, challenges, and opportunities, and the identification of resources to be directed at innovation and collective development opportunities. However, a collective learning process is needed, and even more in production communities in developing countries. Adaptive planning [3] emerges here as the other concept that can contribute to fostering innovation, by providing a flexible way to support decision-making along the collective learning process.

Throughout these pages, a hypothesis is suggested that adaptive planning has a mediation effect in a path from social capital towards business innovation. The objective of this paper is to contribute to the validation of the hypothesis through the analysis of the selected case study, where adaptive planning activities are carried out thanks to CITE activity

In order to do that, firstly, in this Introduction section, the theoretical framework is reviewed: The relationship between social capital and innovation, the foundations of adaptive planning and references and characteristics of the mediating effect in other cases studies are studied. After that, the methodology section includes the case study description and the analysis tools that have been applied. Results obtained in two different periods of time and discussion are the following section, before some final considerations.

1.1. Social Capital and Innovation

The term ‘social capital’ appeared within sociology at the start of the 1960s to signal the operation of interpersonal networks between neighboring communities [18], and it has been interpreted as a ‘system of shared values and norms between members of a defined group’ [19]. This concept has evolved to consider different types of social characteristics, including virtual spaces and resources for knowledge creation, seeking financial capital, clients, and markets, as part of said capital and that defines the identify of a collective or virtual community [20–24].

Several authors point out its ability to facilitate activity in the market [25–28] In this sense, Grootaert [26] describes the mechanisms by which social capital contributes to better market efficiency. On one hand, greater levels of social capital lead to an increased exchange of valuable information, enabling a better use of shared resources amongst members of the network. On the other hand, social capital drives better coordination of activities by means of better interaction between individuals.

Therefore, a joint vision and improved trust amongst the community improve market efficiency and reduce associated costs. It also facilitates decision-making based on the needs of the whole group. This encourages a social and cultural vision amongst the community of producers, that goes further than just money [29,30], driving the trend in business motivation that is not just based on needs and survival, but rather a vision of opportunity, growth, and development, matching with the idea that entrepreneur’s motivation to grow their business is the most important factor with regards to business success [31]. In particular, it could be claimed that social capital strengthens social networks and promotes market opportunities, as it makes coordination and integration more viable and enables resources, capabilities, and efforts to be directed at innovation and development

opportunities [32,33]. Thus, social capital not only has a direct impact on market opportunities, but it can also be a source of innovation [34–36], arising from the exchange and summation of knowledge [37].

Three dimensions of social capital enable the link with innovation [32]. The structural dimension (1) represents the morphology of social network in terms of number and diversity of stakeholders and makes innovation viable as it enables a greater exchange of ideas. The cognitive dimension (2) covers everything related to the language and symbols of the individuals in the network: If they can communicate better, then there is a greater flow of new ideas and this facilitates innovation. However, relational dimension (3) consists of the characteristics that strengthen the social network with all of its connections and interactions—which can be translated into values such as trust, civic commitment, and friendship—as well as norms and sanctions [27,32,33]. The link between relational dimension and innovation arises as a higher level of trust leads to a greater willingness to nurture new ideas that also gain recognition and legitimacy amongst members of the community [37].

Thus, focusing on relational dimension it is possible to define two sub-variables: The first one (relational) is the interest in sharing information and resources as well as interest in improving relationships within the community. The second one (support), is seeks for evidence of trust among stakeholders and also some support mechanisms.

Although social capital facilitates using, creating, and obtaining basic resources, information, and capabilities, it is also possible that in certain situations, it has a limited impact on development. Therefore, Grootaert [26] states that there could be a moment in which some individuals discover that they could benefit at the expense of other members of the network. This deteriorates social capital and weakens the network, whilst the ability to exchange knowledge, and thus create innovation, is lost. Following the collection of data from various production companies, Pérez-Luño et al. [38] maintain that social capital, in its relational dimension, does not guarantee innovation of a radical nature. Similarly, Capaldo [39] suggests that compact networks could make it difficult to incorporate new knowledge, despite their wealth of social capital.

In order to achieve innovation, different authors [26,38,40] remember that social capital requires three situations. The first is that members of the network share common objectives when it comes to decision-making, whilst the second is that decision-making is applied in a way that reinforces the sense of unity and belonging to the network in the long term. The third situation is that social networks need to maintain a constant flow of learning and contextualization of opportunities to maintain its competitiveness and achieve its objectives. This contextualization is brought together with the planning activity as a route to innovation.

1.2. Adaptive Planning

Conceptually, planning is the determination of proposals, programs, and routes that are designed to achieve certain objectives, and at the same time building bridges between present and future for the community. Several decades ago, a tendency arises to question the effectiveness of planning, especially deliberate planning [41–43]. Early in 1985, Mintzberg [44] stated that the content of planning can change whilst the plan is being executed, but then added that organizations with rigid models or strong authority figures, operating in stable and predictable environments, are not motivated by plans based on contingencies [44,45]. The concept adaptive planning appears in 1988 [46] but it was implicit one year earlier in Friedman's work about planning as Social Learning [47]. It represents an emerging vision of planning itself, and it has been also adopted as learning-by-doing in planning practice [48,49] or learning-by-doing, by-using, and by-interacting (DUI)[50,51]. The concept of adaptive planning evokes a type of emerging planning that production communities turn to [40]. These communities are less hierarchical and, in general, are in hostile environments with limited access to conventional resources such as infrastructure, public and private investment, and highly specialized knowledge. Therefore, these communities establish their general collective goals with a certain inclination towards change, given that they do not resort to exhaustive deliberations or rigid schedules, but rather tend to coordinate their actions by consensus. This would lead us to a

view of the community contextualization of planning, which reinforces adaptive planning as a co-learning method based on association.

An effective adaptive planning is based on three conditions or dimensions [3]. The first one is associativity, reflecting the sense of belonging that each person shares with the community, by identifying the benefits and synergies that working together have in terms of sharing available resources [52]. It is worth adding that, although associativity can strengthen the unity between members of the community in the long term, it is necessary for them to be aware that the benefits of working together exceed the benefits of working independently [53].

The second dimension is participation. This defines the support and collaboration in planning efforts, based on eventualities [44,50], towards a common goal. Participation requires the involvement in joint decision-making, providing the network with a clear direction [53]. However, in order to move from participation to innovation, it is necessary for the members' decisions to be motivated by their desire to innovate outside of the hostility that could be present in the environment [54,55], displaying behavior that is also defined as pioneering [56]. Therefore, in addition to sharing of knowledge, there must also be an attitude that leads into innovation [57].

The participation leads to the third dimension, co-learning and co-creation, which indicates that members of the community bring together their knowledge during interactions [50]. Therefore, co-learning reflects the ability to identify, absorb, and utilize knowledge, whether it is shared from within the network or obtained externally [58]. Part of this knowledge is only gathered when information is shared (for example, market trends), whilst in other cases knowledge is referred to as local knowledge [41] or has a tacit characteristic as a potential innovation resource [57]. As co-learning is responsible for acquiring knowledge, it helps to transform shared resources into innovation [57,59,60].

In summary, the associativity, participation, and co-learning sub-variables converge in an ecosystem that promotes the acquisition and exchange of ideas from which innovation can be generated [37] through flexible planning, and the effect of social capital can be articulated and strengthened.

1.3. Planning's Mediation Effect between Social Capital and Business Innovation

The definition of adaptive planning maintains a certain filiation to that of social capital. If the first concept (based on participation, association, and co-learning) provides the community with planning ability to match opportunities and through common objectives and joint decisions; the second is based on the network's own characteristics and social relationships, which also enable the community to obtain resources, information, and access to capabilities. As a result, it appears to have a logical feedback sequence: Firstly, there is a source of resources in social networks that are rich in social capital, and then appropriate decisions are made in order to improve the use of resources [61]. The mediation role of adaptive planning revitalizes the sense of opportunity and authority for decision-making, with planning activities and procedures that would reinforce the direction of the communal objectives on a path to transforming the resources into collective values reflected in innovation.

There are some studies in the most diverse scenarios supporting that social capital and innovation are connected by adaptive planning. For example, Drazkiewicz, Challies, and Newig [62] describe the case of three German towns whose residents were actively committed to the decision-making process to the benefit of the community and the environment. They conclude that these communities made better decisions and enabled themselves to opt for innovative solutions, in a way that led to greater participation amongst the members of the community and shared common objectives. Li, Chen, Liu, and Peng [63] identified that Chinese entrepreneurs (within their respective social capital networks) were able to make the most of market opportunities, including the ability to create innovation using a learning process known as exploration and exploitation. If co-learning is understood as the creation of knowledge through collective ties, both cases seem to reflect considerable levels of co-learning and innovation.

In terms of participation and association as elements for adaptive planning, in a study on the Mexican fishing industry, Nenadovic and Epstein [64] state that participation in collective decision making tends to be influenced by social capital. Furthermore, Gou, Liang, Wang, and Peng [65] also indicate that members of digital communities tend to participate more and exchange more information and ideas when there are strong social ties between them and inherent shared purpose. As a result, a vision of shared goals as part of adaptive planning could mediate between social capital and innovation.

An additional case for the adaptive vision of planning is Villa El Salvador human settlement in the south of Peru's capital. It was created in a sandy area during a precarious invasion of immigrants in the 1970s and nowadays has become a district urban area with an industrial community vision. Neighbors share the same social fabric based on their indigenous legacy [66]. They established different kind of associations and maintained democratic and organized participation in decision-making, which essentially responds to the criteria of adaptive planning. That is why Villa El Salvador stands out as being an entrepreneurial and industrial community, and even a cluster of manufacturing activities.

Gálaso-Reca [66] show the situation in Silicon Valley, which demonstrates how strong friendship and trust between the company's personnel created a favorable environment for innovation, and also that greater levels of participation, association, and co-learning. Dessie, Schubert, and Hauser [67] describe the case of the innovative traditional farming community in the Awra Amba region of Ethiopia: Although for many decades it enjoyed strong social capital ties, this community did not achieve increased development until recently, when institutions were founded that provided them with a better sense of progress and opportunities. Since then, Awra Amba has become internationally renowned for its social and economic achievements.

In these six examples, mediation effect of adaptive planning has a greater impact on social resources, allowing the community to identify new opportunities. In addition, the emerging sense of collective development reveals that adaptive planning enhances the components of social capital in favor of innovation. In summary, adaptive planning could stimulate the binding effects between social capital and business innovation, and in conjunction, these variables could define a path for the communities with notable needs and in emerging contexts so they can turn their resources into innovation opportunities.

2. Methodology

This study used a descriptive correlational design based on primary information from a sample of Peruvian pisco producers in the Ica region to the south of Lima. All of them belong to the same agrosystem whose origin goes back 400 years ago to colonial times.

2.1. Case Study

Three hundred kilometers south of Lima, the capital of Peru, is the Ica region (see Figure 1), characterized by its warm climate, grape crops, and the Pisco wineries—a beverage obtained exclusively by distilling fresh musts of "Pisco grapes"—and wines. In the Ica region is the CITE, around which the grape and pisco producers are located. In this region, there are areas with a considerable degree of heterogeneity, by ecological conditions, by economic aspects in the production structure, the availability of production factors, and in market specialization capacities, in addition to access to services and infrastructure for production. In general, a production unit with a growing space, usually called a farm, can have four types of production processes: 1) Agricultural production; 2) livestock production (includes all kinds of animals); 3) product processing; and 4) transactions between the farm and the environment that surrounds it (including all types of buying, selling, marketing, and investment) [68].

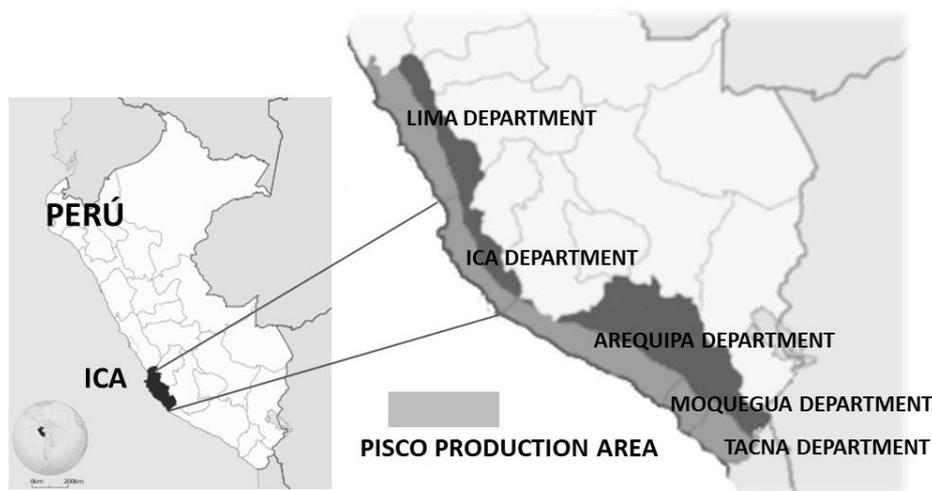


Figure 1. Case study location and main pisco production areas in Perú.

There is a lack of historical series of information on the sector except for national production and export figures. However, it is possible to get an idea of the weight of the study area from the partial available data. The pisco sector has grown significantly from 1.8 million liters in 2001 to exceed 9 million liters as of 2015 [69], with exports from 1 million liters to 7.4 million liters in the same period. Ica has always been the reference region, and pisco production represents 60–65% of the national pisco production until 2014, and 50–55% until 2019, a change due to important investments in Lima region. In 2008, there were a total of 12,308 pisco grape producers in Ica, cultivating above 3000 ha, figures that represented 56% and 41.3%, respectively, of the total [70]. Grape production reached 121,000 tons in 2010 and almost 150,000 tons in 2012, representing 62.3% and 61.7% of the national total [71]. Regarding the number of pisco producing companies, a total of 180 wineries were identified in 2001 [72], 164 in 2013 (39.6% of the total), and 174 in 2015 (38.4% of the total) [69,73].

In 2000, CITEvid was officially created with seed capital from the Spanish Agency for Development and Cooperation (AECID). It was designed as a technology center whose mission was to “transfer new technologies and knowledge to achieve adequate solutions for each producer in the wine chain, mainly Small and medium-sized enterprises (SMEs), allowing them to innovate and improve their competitiveness and living conditions” [74]. Four years were needed for the installation of vineyards and demonstrative winery, and a laboratory for analysis, as well as the selection of the human team. In this sense, from the three technicians in 2000, a stable staff of 13–14 people was reached in 2005, including researchers, viticulture and oenology lab technicians, quality control technicians, secretariat, field manager, driver and administrator. In 2005, it came into full operation with a set of participative and associative activities, which consisted of workshops for pisco producers on productive practices, marketing processes, product exchange fairs, events of experiences of new technologies in the industry of wine and spirits, and in addition, technological missions to various regions of America and Europe where participants were encouraged to absorb experiences of the industry and the designations of origin in the wine sector. That training, technical assistance, micro-business incubation, and project development program made CITEvid a major player in strategies for the development of the pisco industry [75,76]. In particular, very important results were achieved that transformed the productive landscape of the region [77]: Registered brands move from 16 to more than 400 and 5 collective brands were also created; Denomination of Origin certificates moved from 48 to more than 700; and, finally, the productivity of the grape increased remarkably, going from 3 to 5 tons per hectare, to registering up to 35 tons per hectare.

During the first 12 years, the attention of the activities described in the previous paragraph was dedicated to viticulture and pisco, which as a whole was awakening and at the same time reaffirming elements of its social capital as a productive community, and building a vision of participation and exchange of experiences between pisco producers. This vision encouraged the expansion of the range of action, from the community of pisco producers, to become in 2013 a Technology Center that

supports various agro-industrial chains. Within the framework of its new stage, the new agro-industrial CITE set out to focus its intervention on technological extension oriented to differentiated products and processes, which are related both to the country's food and nutritional security, and to agro-industrial exports with higher added value. In 2013, an effort was made to formulate an Institutional Strategic Plan 2014–2018 [77] aimed at four work guidelines: (1) Promoting productive diversification and agro-industrial technological empowerment with a future perspective, (2) through the active articulation of territorial actors and sector allies, (3) the development of technological extension programs, and (4) training and the implementation of R+D+i projects for the transformation of a dynamic agribusiness of the Peruvian economy. In addition, it defined a set of tools for articulation, such as the so-called Agroindustrial Forums—whose objective was to sensitize the actors, share vision, and analysis on the challenges—and Technical Tables—to establish work programs and shared goals. The political changes aborted the final approval, and despite the fact that the work guidelines have been adopted, the agro-industrial CITE needs a new reinforcement of the spaces to identify and/or update the knowledge on the needs of companies and producers to create strong ties of trust around a joint strategy [74]. Anyway, it is worth highlighting that before the year 2000, the community was unable to increase its production levels beyond more than 600,000 L per year. Following the foundation of the CITE, higher levels of participation, association, and co-learning strengthened innovation [3], and the production of pisco was increased to 6.5 million liters per year and expanded the range of products as well as export levels. Also, throughout the existence of the CITE, the degree of influence on the producers of Ica increased: In the first five years, 2000–2005, approximately 25 to 30% of local producers were associated. This percentage increased gradually up to 45–50% in 2019.

2.2. Structured Questionnaire

A structured questionnaire was applied to 41 managers of pisco producer companies in 2012, at the end of the first of seven-year period of full activity as CITEvid, and then to 47 managers in 2018, after another six years of activity as CITE agroindustrial during the conference on the future of agribusiness. Age groups show that most of them have wide experience: 8.9% are between 20 and 30, 37.8% are between 30 and 40, and 53.3% are between 40 and 60 years of age. Additionally, in terms of educational level, 84.4% of the managers have a university degree, and another 6.7% have technical training, so they were fully aware of the implications of the study.

In 2012, the 41-manager sample represented the universe of pisco producers actively involved into CITE-vid activities. Those producers represented approximately 40% of pisco production in Ica. In 2018, the 47 managers were a sample of the 110 pisco producers involved in CITE agroindustrial and accounted for approximately 43% of the pisco production in Ica.

The questionnaire was designed with three mediation scales, which are detailed below. Each one of them highlights the different dimensions and key aspects discussed in the introduction section.

- Social Capital

A multidimensional scale was created with two specific dimensions (Relational Interest and Support). These help to measure the managers' perceptions on the exchange of information amongst members of the CITE agroindustrial community and the support amongst producers to improve their production processes. Additionally, a questionnaire was created with 8 items (see Table 1), and the responses were gathered using a 5-point Likert scale with values between 1 = completely disagree and 5 = completely agree.

Table 1. Dimensions and items in the social capital (SC) scale.

Dimensions		Items
Relational Interest	Sharing info and resources	SC1. The small, medium, and large producers exchange information on production practices and process improvements.
		SC2. They believe that people in their company are interested in sharing information within their production community.

Support	Promoting relation ships	SC3. They believe that companies are interested in having better relationships within their production community. SC4. They have observed that in the last 10 years, there is a growing interest in having better relationships for exchanging information or for production support within their community.
	Trust	SC5. They believe that they are part of a community that brings together companies and organizations that reliably contribute to improvements in their production activities. SC6. They observe an environment of trust within their community that encourages information sharing for production process improvements.
	Support mechanisms	SC7. There are support activities, as well information sharing between companies and organizations in their community. SC8. They believe that in the last 10 years, the support ties for production activities within their communities have been strengthened.

- Adaptive Planning

A unidimensional scale was designed to measure the managers' perceptions on the production system planning and participative co-learning between members of the CITE agroindustrial community. In order to specifically measure the adaptive planning promoted through CITE activities, a questionnaire with 5 items was designed (see Table 2) with a 5-point Likert scale, with values between 1 = completely disagree and 5 = completely agree.

Table 2. Items in the adaptive planning (AP) scale.

Items
AP1. They believe that trust within the community has facilitated planning and improved the development of production activity in the community.
AP2. Thanks to the support of the community, good planning practices have been developed for general planning activities.
AP3. The dependency between companies in the community and institutions such as CITE, has promoted better planning in the production system and amongst the community in general.
AP4. They believe that shared tasks are carried out amongst companies in the community, where some depend on others, which enables them to plan increased and better production.
AP5. They are clear that the existence of a network of associated companies provides strengths that help to plan and improve production, benefiting the community's companies.

- Business Innovation

A unidimensional scale was used to measure the managers' perceptions on development and the change and use of technology in their production processes. To calculate innovation, a questionnaire was designed with 5 items (see Table 3), using a 5-point Likert scale with values between 1 = completely disagree and 5 = completely agree.

Table 3. Items in the business innovation (INN) scale.

Items
INN1. They incorporate the proven changes within their general production processes .
INN2. They achieve greater benefits from their finished products, improved quality, increased sales, etc., after changing their production processes.
INN3. New technology has been introduced in their company's production processes.
INN4. They observe that new production processes have been developed within their company, which have led to improvements in production, quality, sales , and exports.
INN5. With the new technology, new products or production processes have been developed in their company.

2.3. Measurement Model, Validity and Reliability

The scales in this study were subjected to an internal consistency analysis using the Cronbach's alpha coefficient, a convergent validity, using the average variance extracted (AVE) average (see Table 4) and a discriminant validity using the Fornell–Lacker criteria (see Table 5) and heterotrait–monotrait Ratio (HTMT) (see Table 6). The reliability and validity of the scales were evaluated using the Smart PLS 3.2.3 program (SmartPLS GmbH, Boenningstedt, Germany) [78].

In terms of the validity, the analysis has been carried out using convergent and discriminant validity. For the first of these, the factorial charges should be higher than 0.708 (the authors suggest not being too rigid in the initial stages of the analysis) and the average variance extracted (AVE) is estimated with an acceptable value equal to or higher than 0.5, which is the equivalent of saying that the latent construct has an explained variation of 50%. For the second case, discriminant validity is established using the Fornell–Lacker criterion and monotrait–heterotrait matrix, which confirms the independence of the latent variables when the values are lower than the unit [79].

As shown in Table 4, the measurement model is reliable and valid for the grouped sample (total), with Cronbach's alpha values that are higher than the minimum that was hoped for (Alpha < 0.706) [80] and with an average variance extracted higher than 50%. In terms of the sub-samples, the AVE and Cronbach's alpha values decreased slightly for the social capital dimensions (2012) and for adaptive planning (2018). These variations, however, are not significant [81].

Table 4. Reliability (Cronbach's alpha) and convergent validity (average variance extracted, AVE).

	2012		2018		Total	
	Cronbach's alpha	AVE	Cronbach's alpha	AVE	Cronbach's alpha	AVE
Social Capital (SC)	0.749	0.758	0.821	0.753	0.817	0.782
SC (Trust)	0.622	0.470	0.771	0.595	0.738	0.560
SC (Relational Interest)	0.608	0.464	0.784	0.616	0.742	0.567
Innovation	0.818	0.580	0.774	0.526	0.821	0.582
Adaptive planning	0.822	0.593	0.695	0.465	0.770	0.529

Note. The social capital variable is of second order with two internal dimensions (trust and relational interest), whilst the other two variables have been measured as unidimensional.

Table 5 shows the validity of the constructs using the Fornell–Lacker criterion, in which the square roots of the AVE from the scales are greater than the correlations with the other scales. Therefore, it can be said that they are mutually exclusive.

Table 5. Discriminant validity of the scales: Social capital, innovation, and adaptive planning.

	2012		
	Social Capital	Innovation	Adaptive Planning
Social capital	0.663	-	-
Innovation	0.540	0.763	-
Adaptive planning	0.544	0.666	0.727
2018			
Social capital	0.611	-	-
Innovation (Execution)	0.588	0.762	-
Adaptive planning	0.518	0.593	0.770
Total			
Social capital	0.671	-	-
Innovation	0.407	0.725	-
Adaptive planning	0.549	0.714	0.682

Similarly, using the heterotrait–monotrait ratio (HTMT), the discriminant validity of the variables is evaluated, as social capital is a multidimensional variable with 2 dimensions. Table 6 shows that the variables have a discriminant validity, as the HTMT coefficients are less than the units between them (this demonstrates the independence of the constructs), and higher than the units when

the two dimensions of SC Trust and SC Relational Interest are connected with Social Capital (in this case, both are part of the construct).

Table 6. Discriminant value using the heterotrait–monotrait ratio (HTMT).

	2012	2018	Total
CS Relational Interest -> SC Trust	0.932[0.728; 1.327]	0.620 [0.324; 0.962]	0.756 [0.512; 0.981]
Social capital -> SC Trust	1.299 [1.144; 1.544]	1.080 [0.997; 1.266]	1.137 [1.060; 1.286]
Social capital -> CS Relational Interest	1.310 [1.140; 1.535]	1.075 [0.998; 1.218]	1.135 [1.061; 1.262]
Innovation -> Social capital	0.724 [0.589; 0.953]	0.507 [0.386; 0.866]	0.641 [0.472; 0.831]
Adaptive planning -> Social capital	0.660 [0.527; 0.959]	0.708 [0.553; 0.951]	0.675 [0.506; 0.868]
Adaptive planning -> Innovation	0.716 [0.582; 0.918]	0.934 [0.761; 1.104]	0.821 [0.694; 0.954]

Note. Simulation using Bootstrapping. Resampling (5000 times). Confidence interval between cohorts.

- Structural Equation Modeling

The data were tabulated using IBM SPSS v24 software (IBM Corp. Armonk, NY, USA) and analyzed using the SmartPLS (v3.2) statistics program [78]. Structural variance equations were used with partial least squares (SEM-PLS), as these are suitable techniques for calculating the mediator effect between one variable and other dependent or independent variables when the sample size is small and when not all the multivariate normal distribution tests are met [79]. Therefore, as the PLS technique is predictive and exploratory, this enables theories to be developed [80]. SEM-PLS was used to simultaneously evaluate the measurement model (reliability and validity of the variables) and the structural model (explanatory relationships between variables).

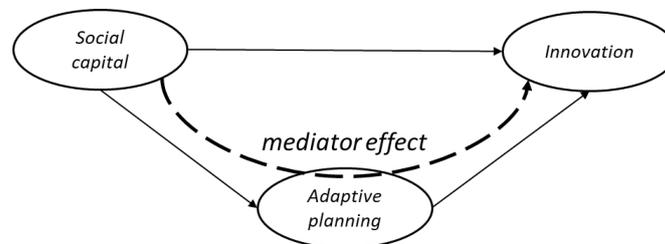


Figure 2. Direct and mediator effect of social capital and adaptive planning on innovation.

The above Figure 2 contrasts the direct impact that social capital has on innovation, as well as the role that adaptive planning has as a mediator variable between social capital and innovation. Social capital and Adaptive planning are independent variables while Innovation is a dependent variable. All of them are defined by a set of indicators (questions)

Before evaluating the structural model, the constructs should be subjected to a collinearity test, where the VIF values (variance inflation factor) should be lower than 5. In effect, there was no collinearity with the constructs that were analyzed, as the VIF values were between 1.219 and 2.429. Subsequently, the indicators that are used to estimate the structural model are: a) The Coefficient of Determination (R^2), which is the percentage of the explained variance of the exogenous construct over the endogenous construct, which should be higher than 0.1 to be considered significant. On this point, Hair et al. [79] recommend R^2 values of 0.75, 0.50, and 0.25 (substantial, moderate, and weak, respectively). b) The Path coefficient (standardized β), which represents the hypothetical relationships between the latent constructs, where the values should be higher than 0.1 to be considered significant, because if the β is closer to zero, the relationship is weaker and is not significant [79,82].

As SEM-PLS is a nonparametric technique, it assumes that data are distributed normally. In order to examine the accuracy of the path coefficients (beta) estimates and to carry out the statistical hypothesis testing, the Bootstrapping resampling technique was used (sample = 5000 times, using the option of unchanged signs), which estimates the standard errors and enables the calculation of the Student's t-test and p-value of the path coefficients. The figures are considered to be significant when <0.05 and the T obtained should be higher than the critical value (1.96, significance level of 5%; 2.57, significance level of 1%) [79,82]. The size of the effect, measured by f squared, indicates the importance of explaining the other variable, with values that are operationally defined as small, medium, and large (0.1;0.3;0.5) [83].

3. Results and Discussion

Figure 3; Figure 4 show the direct and indirect effects that social capital and adaptive planning have on innovation. To confirm these relationships, firstly the validity of the model for measuring the variables was analyzed. Subsequently, the structural model is evaluated using the Bootstrapping statistical significance test. As shown in Table 7, the indirect effects that social capital has on innovation, mediated by adaptive planning, are statistically significant, both in the 2012 sample ($B = 0.204$; $t = 1.902$; $p = 0.057$) as well as the 2018 sample ($B = 0.386$; $t = 3.233$; $p = 0.001$).

Table 7. Path coefficient significance (standardized regression coefficients Beta) direct and indirect effects between social capital, adaptive planning, and innovation.

	Path coefficients (Beta)	Confidence interval		T	Sig.
		2.5%	97.5%		
2012 (n = 41)					
<i>Direct effects</i>					
Social capital -> Innovation	0.384	0.138	0.667	2.852	0.004
Social capital -> Adaptive planning	0.518	0.198	0.785	3.099	0.002
Adaptive planning -> Innovation	0.394	0.111	0.674	2.642	0.001
<i>Indirect effects</i>					
Social capital -> Adaptive planning -> Innovation	0.204	0.034	0.408	1.902	0.057
2018 (n = 47)					
<i>Direct effects</i>					
Social capital -> Innovation	0.021	-0.305	0.287	0.139	0.890
Social capital -> Adaptive planning	0.549	0.229	0.754	3.970	0.001
Adaptive planning -> Innovation	0.703	0.552	0.898	7.468	0.001
<i>Indirect effects</i>					
Social capital -> Adaptive planning -> Innovation	0.386	0.152	0.620	3.233	0.001

Note. Simulation using Bootstrapping. Resampling (5000 times). Significance, $p < 0.05$.

When the two periods are compared it is noted that the path coefficient regarding Adaptive Planning increases from 0.394 to 0.703, while the direct route from Social Capital practically disappears, from 0.384 to 0.021. Consistently, the mediating effect of adaptive planning increases significantly after another six years of CITE's activity, moving from a coefficient path of 0.204 to 0.386. Similarly, the mediator effect of adaptive planning is supported on an explained variance of innovation growing from 46.0 in 2012 to 51.1% in 2018, thus exceeding the significant threshold of 50%.

To explain these results, we must consider that during the first period of existence of the CITE, the years of full operation were only seven, from 2005 to 2012—when the first survey was carried out. CITE encouraged entrepreneurs and business owners to get involved in the context, benefiting from resources and spaces promoted by the CITE itself, as well as others. Before the existence of the CITE, the production activities did not have a sufficiently communal vision and were not directed towards collaborative development. It is since the creation of the CITE in the year 2000, that collective practices started, through fairs at which producers could meet up and various events that enabled the

community of producers to be made aware of the importance of associative work with a market opportunity vision. This has led to exponential growth in the production of pisco, as well as quality improvements and greater competitiveness, as indicated when describing the case study. This activity identified with adaptive planning through the CITE began to generate an alternative path to promote innovation, which can be seen in the results, and that was already approaching the threshold of significance at that time.

However, it is important to have in mind that many of the results obtained, linked to the improvement in the competitiveness of companies due to improvements in training, brands, and quality, generate inertia for the following period. The activity of the CITE in training producers, providing technical support and service, and also as a place for dialogue, has enhanced the role as facilitator of actions aligned with adaptive planning. Consequently, the mediator effect is reinforced in the second period, compared to the “path” that came from Social Capital as a traditional community. This is consistent with works [74,77] that value CITE as a benchmark for the Pisco value chain, even more than the body that regulates the Denomination of Origin. This aspect has been especially relevant when planning efforts have been carried out in the community being studied, which for centuries has been on the margin of public policies and development plans. As a result, the adaptive planning vision that was adapted to needs and provided concrete improvements in pisco production represented the first milestone in its association development.

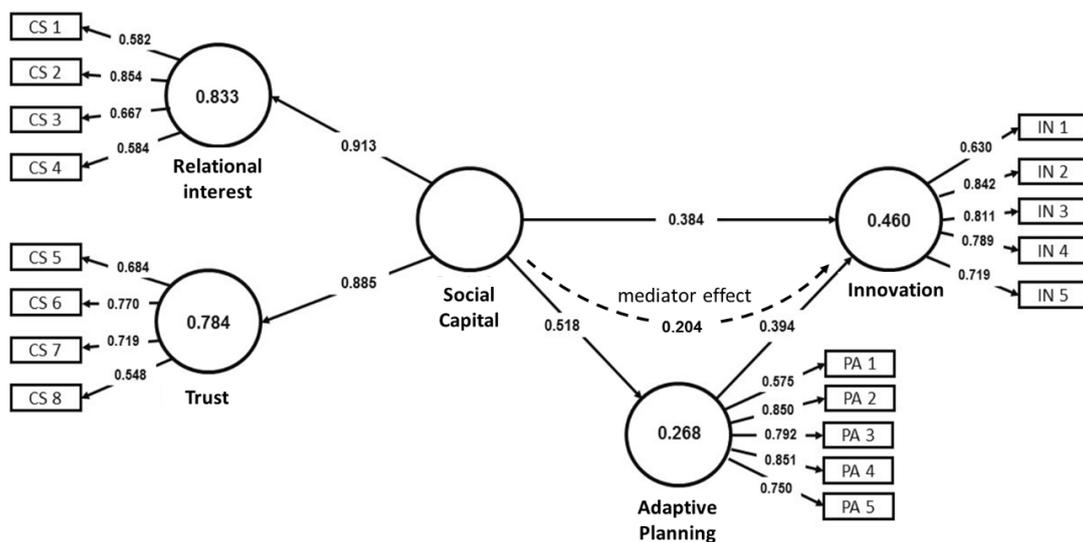


Figure 3. Direct and mediator effect of social capital and adaptive planning on innovation in the sample of producers in 2012. Note: Causal diagram using structural equations using partial least squares regression. It includes explained variance (circle); path coefficients (lines between circles); and factorial weights (lines linking circle and boxes). Social capital is a second-order variable.

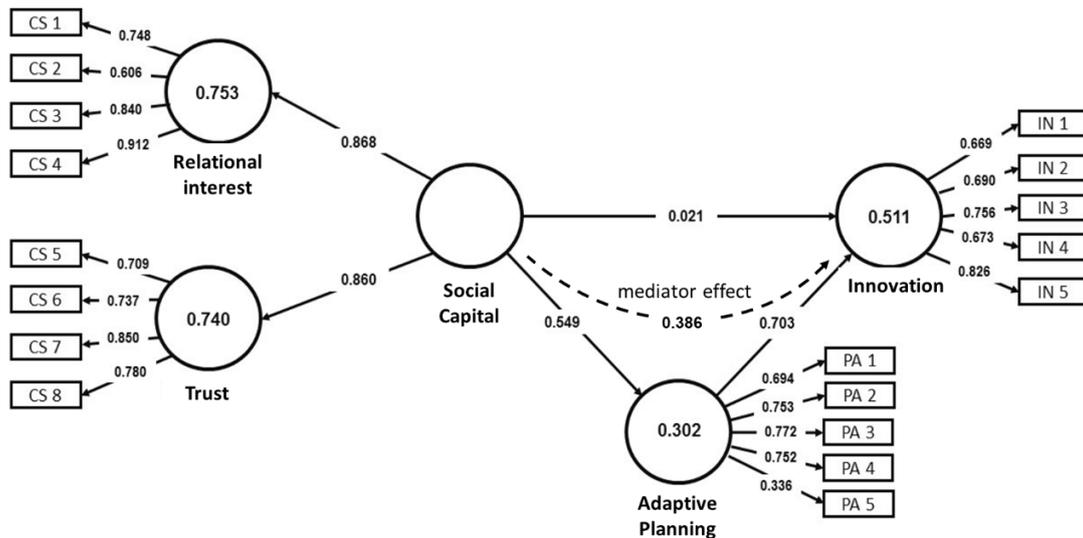


Figure 4. Direct and mediator effect of social capital and adaptive planning on innovation in the sample of producers in 2018. Note: Causal diagram using structural equations using partial least squares regression. It includes explained variance (circle); path coefficients (lines between circles); and factorial weights (lines linking circle and boxes). Social capital is a second-order variable.

Innovation in a local development community, faced with a shortage of resources—CITE started as an international cooperation project with limited funding—required for industrial transformation and market launches, is not just achieved by the availability and wealth of specific social capital, rather it requires planning that is designed to channel this capital towards specific objectives. It also requires the convergence of associativity, participation, and co-learning as factors that are connected and are mutually strengthened in order to generate innovation [84]. It proposes a route towards innovation opportunities and it approaches the idea of innovative ecosystems, which can be understood as complex sets of human relationships and technological assemblage which, in the most diverse way possible, feedback exchanges, openness, different skills, and creative institutions, according to Lundvall [50]. Therefore, despite the transformation of these needs into opportunities, spaces with successful innovation ecosystems support the exchange of resources and promote the spreading of ideas and projects. This group of resources and ideas creates capital, which when aimed at community goods or values (as is the case in our study based on production and commercial development of pisco in a region of Peru), can promote innovation.

Furthermore, as a reflection, a renewed social capital would appear to refer to human beings' dual nature: As an individual (as an entity in themselves), and as a person (social being). In the first case, this provides a collective with a sense of identity and belonging and makes a group of resources available that can be shared amongst the members of the community. In the second case, this goes further than just identity, by providing greater content opportunities and values to the group of resources. This double nature could be considered as the foundations of an organization. As a result, it gives greater meaning and content to human beings, as well as to their creations and the ecosystem. Furthermore, it encourages them to keep exploring factors that create social capital in organizations [85–87], and finally, improve research, entrepreneurship, and innovation [88–90].

Based on all the above, we end up learning to create transformation and search for the best adaptation opportunities based on cooperation and collaboration structures. This is done whilst overcoming the complexities of our contexts, despite the lack of resources, and building paths that are adapted to the environment by sharing resources and strengths to give a sense of meaning to the process of continuous transformation. Based on this, Schmidt and Cohen state that, in a new era of shared power, nobody can progress and adapt to change by themselves, therefore making it essential to focus on relationships and collectives [91].

For this reason, efforts were initiated by CITE to carry out adaptive planning that took place in 2013 [77], which could not be completed by political changes. That plan proposed renewed spaces for dialogue both for diagnosis (Forums) and action (Technical Tables). Some demands are currently being detected at the local level for the CITE to articulate more inclusive spaces for dialogue with medium and small producers, and also to adequately adapt the technological services at the winery and laboratory so CITE was not seen as a competitor. However, a potential to expand its coverage to other regions has been also identified, and to adopt an information system and management indicators to expand the scope [74]. In short, the agro-industrial CITE faces a future that demands an expanded collaboration between the actors. Whether it continues to act as a mediating element for innovation, or whether it begins to lose inertia and the possibilities for growth, will depend on the ability to articulate that collaboration.

In the social and technological sphere, the expansion of the pisco industry in production, innovation, and commercialization has meant a development experience, especially in the five departments that comprise the Pisco Designation of Origin (south of Lima, Ica, Arequipa, Moquegua and Tacna), and greater political attention to these regions in related economic activities. An experience that has had consequences is the transformation of CITEvid to CITEagroindustrial in 2013, and also the approval of a public investment fund of 70 million soles (20 million dollars) for a CITE infrastructure project that promotes innovation business, a project that, if not for Covid-19, would already be completed and inaugurated as one of the most important agro-industrial technology centers in South America. Undoubtedly, this an important political decision influenced by the CITE, and an incentive to research and science as an R&D development center in Peru, and of an important social impact, which will feed back the current of social, collaborative, and of integrative planning with the own demands of the involved regions.

The effects of adaptive planning as a path to innovation in CITEvid, and the political decision of transformation in CITE Agroindustrial and investment in R&D, is convergent with what was stated by Gálaso-Reca [66]. In terms of the design of development policies, it is important to consider associationism, the interest of communities in problems, and joint development. The case of Villa El Salvador [66], on a district scale in the city of Lima, also coincides in its origin promoted by international cooperation. Based on the existing social cohesion and the orientation of decisions towards community development, it is now an example of the transformation of a community of immigrants from the highlands of Peru into an innovative community with diversity in industrial specialization. On the other hand, what is described by Li, Chen, Liu, and Peng [63] is also convergent, with respect to the influence of the participation of individuals in social networks and associativity on the entrepreneurial and innovative behavior of communities. The design and promotion of institutions of this type should consider their mediating role to facilitate that productive actors actively participate in adaptive planning. However, all these case studies and others referenced in the introduction section [62,64,65,67] do not provide a specific way to measure the influence of adaptive planning that can be used to compare perception of the stakeholders along periods of time.

Before ending this section, it should be noted that the absence of more complete and historically based official statistics is a weakness of the agrosystem studied, which makes it difficult to adopt measures and carry out more detailed analysis. On the other hand, it would be appropriate to contrast the results of this study with results in other CITEs whose target sector does not represent such a deeply historically rooted activity. However, the analysis of perceptions as presented in this study could face some problems. Depending on the level of maturity of the stakeholders—usually more fragmented and with lower profile—it may require significant pedagogical work before they are able to assess the questions. Finally, although interest is focus on pisco producers, it would have been interesting to discuss results with government representatives. Unfortunately, the volatile political situation in Peru last years has not allowed this exercise to be carried out.

4. Final Considerations

The results confirm that positive effects on the CITE production community in Ica-Peru have existed since 2012, when they were identified for the first time. It is still evident that the social capital

and adaptive planning variables form a path of direct and mediator connections, which turns business motivation into innovation opportunities. Furthermore, adaptive planning promoted through CITE's activities consisting of fairs, national and international conferences, training workshops, and producer meet-ups, has led to the awareness and exchange of new production knowledge and consumption trends, and has also helped the community of producers to adapt their efforts and direct their own as well as shared resources, in order to introduce new things to the market.

This work contributes to complete the panorama of experiences around the world that show the mediating effect of adaptive planning to promote innovation. In our case, it also shows how this effect varies over time due to the activities that have been carried out. For this reason, it will be interesting to observe in the next period whether this mediating effect has been consolidated or decreased, based on the actions. Hopefully, it could guide changes in the management approach not only of the CITE agro-industrial, but also for other CITEs in Perú. This challenge also implies taking into account the level of social capital that can be considered for a certain sector, adjusting the activities to reinforce it and connect it with adequate results in terms of business innovation.

For the purpose of the effectiveness of the route set out in this study, it is essential for the mediator role to adapt to the contexts or cultures where the social capital resources are found, and the appearance of other secondary components could be expected. Therefore, it would be important to analyze the role of other related variables that could be included in the path analysis, and which in some way mediate or have a certain level of responsibility so that social capital—mediation of adaptive planning—innovation can transform contexts into development opportunities. In this regard, we encourage the ongoing exploration of ways to integrate social capital with a sense of planning in developing countries, integrating the vision of this capital and aiming it at sources of abundance, development, and innovation, or towards what starts to emerge as a product of the cooperation between the aforementioned variables, in an expression that could be called Community Planning Capital or community planning capital.

Author Contributions: Conceptualization, J.A.A. and J.L.Y.; methodology, J.A.A. and A.V.; validation, A.V.; formal analysis, J.A.A.; investigation, J.A.A.; data curation, G.C.; writing—original draft preparation, J.A.A. and J.L.Y.; writing—review and editing, J.A.A. and J.L.Y.; supervision, J.L.Y. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding

Conflicts of Interest: The authors declare no conflict of interest.

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