Diginomics. 2025; 4:240
doi: 10.56294/digi2025240

ORIGINAL

Virtual platform for the commercial coordination of agricultural producers' markets in the San Martín region

Plataforma virtual para la articulación comercial de mercados de los productores agrícolas de la región San Martín

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Cite as: Wong-Villacorta J, Rodríguez-Sánchez J, Cárdenas-García Á. Virtual platform for the commercial coordination of agricultural producers' markets in the San Martín región. Diginomics. 2025; 4:240. https://doi.org/10.56294/digi2025240

Submitted: 29-08-2024 **Revised:** 17-01-2025 **Accepted:** 23-07-2025 **Published:** 24-07-2025

Editor: PhD. Rubén González Vallejo

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ABSTRACT

The research aimed to design a prototype virtual platform with functionalities that contribute to direct commercial coordination between small agricultural producers and buyers in San Martín. This study was applied, descriptive in scope, quantitative in approach, and with a propositional, non-experimental cross-sectional design. The sample consisted of 30 key stakeholders, including 10 producers, 10 suppliers, and 10 customers. A survey and questionnaire were used. The results show that agricultural producers in San Martín have limited socioeconomic conditions, low associativity, and a strong dependence on intermediaries; buyers, in turn, have limited direct access to producers, although they express a willingness to use digital platforms; suppliers operate in a poorly digitalized environment, with limited connections with producers; and commercial coordination is generally low, with a predominance of informal relationships. In this context, it was concluded that the "AgroConecta San Martín" platform is emerging as a comprehensive solution to energize and formalize the regional agricultural market, strengthening ties between key players through digitalization, geolocation, training, and commercial formalization.

Keywords: Virtual Platform; Commercial Coordination; Agricultural Producers.

RESUMEN

La investigación tuvo como objetivo diseñar un prototipo de plataforma virtual con funcionalidades que contribuyan con la articulación comercial directa entre pequeños productores agrícolas y compradores en San Martín. Corresponde a un estudio de tipo aplicada, nivel descriptivo, enfoque cuantitativo, y diseño no experimental transversal propositivo. La muestra lo conformaron 30 actores clave, entre ellos 10 productores, 10 proveedores y 10 clientes. Se utilizó la encuesta y el cuestionario. Los resultados muestran que los productores agrícolas de San Martín presentan condiciones socioeconómicas limitadas, baja asociatividad y una fuerte dependencia de intermediarios; los compradores, a su vez, tienen escaso acceso directo a productores, aunque manifiestan disposición a usar plataformas digitales; los proveedores operan en un entorno poco digitalizado, con limitada conexión con los productores, y la articulación comercial en general es baja, con predominancia de relaciones informales. En este contexto, se concluyó que la plataforma "AgroConecta San Martín" se perfila como una solución integral para dinamizar y formalizar el mercado agrícola regional, fortaleciendo los vínculos entre actores clave mediante la digitalización, geolocalización, capacitación y formalización comercial.

Palabras clave: Plataforma Virtual; Articulación Comercial; Productores Agrícolas.

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INTRODUCTION

The marketing of agricultural products through virtual platforms has substantially transformed the agro-industrial landscape, allowing for a more direct, agile, and efficient connection between producers, buyers, and suppliers.[1,2] Through these digital tools, farmers can establish commercial links without intermediaries, facilitating access to wholesale and retail markets, as well as the final consumer, and generating new business opportunities. The incorporation of geolocation technologies, online payment systems, and digital certificates has improved traceability and confidence in product quality, creating an environment conducive to competitiveness and sustainability in the agricultural sector. However, the optimal use of these tools still faces significant barriers, such as limited digital literacy among farmers, deficiencies in technological infrastructure, and logistical challenges for product delivery in dispersed regions.[3,4,5]

In the Peruvian context, agriculture ranks second in economic importance after mining; however, its growth has been limited by various structural and cyclical factors. One of the most relevant is the lack of effective commercial coordination between producers, buyers, and agricultural service providers. This fragmentation weakens the value chain, restricts access to more profitable markets, increases dependence on intermediaries, and reduces producer profitability. Added to this is the volatility of key input prices, such as urea, whose cost increased by 263 % during 2021, affecting farmers' production capacity and economic margins.[1,6,7,8] This situation highlights an urgent need to modernize marketing channels with inclusive and sustainable technological solutions.[9,10,11,12]

Traditionally, business roundtables and in-person trade fairs have been the most common mechanisms for commercial coordination. However, these alternatives are often out of reach for small and medium-sized farmers due to economic, logistical, and geographical limitations. In this scenario, virtual platforms emerge as a strategic alternative to reduce gaps, optimize agricultural supply and demand, and democratize access to markets. These digital solutions not only make products visible but also enable dynamic and traceable commercial relationships between producers, buyers, and service providers.

In macroeconomic terms, national agricultural production fell by 0,96 % in December 2022, as a result of declines in key crops such as tubers, cereals, and fruits.[2,13,14,15,16] Despite this slowdown, some regions such as San Martín are showing signs of growth, driven by crops destined for agroindustry. According to the BCRP[1] the San Martín region recorded year-on-year agricultural growth of 2,4 % through June of that year, with crops such as rice, coffee, cocoa, oil palm, and bananas standing out. However, the increase in production has not translated into a proportional improvement in marketing, as current mechanisms rely heavily on intermediaries, affecting producer income and making the final product more expensive.[17,18]

In this context, there is a clear need to strengthen commercial coordination through virtual platforms that digitally integrate the supply of agricultural products, buyer demand, and logistical, financial, and technical support services. This digital transformation would not only expand markets but also reduce dependence on intermediaries, optimize product traceability, and improve farmer profitability. An active presence on social media, mobile applications, and specialized portals can become a key catalyst for the commercial and technological inclusion of small producers, consolidating a more competitive, fair, and sustainable agricultural production ecosystem.[19,20,21]

METHOD

Scope and conditions of the research

Political location

The research was carried out in the San Martín region, located in the northern part of the country, with its capital in the city of Moyobamba. Its most populous city is Tarapoto. It has an area of 51 253,31 km^2, divided politically into 10 provinces, making a total of 77 districts. It is bordered to the north and east by Loreto, to the south by Ucayali and Huánuco, and the west by Amazonas and La Libertad.

Agriculture is the main economic activity in the region, with oil palm being the main crop. Other products are also produced, such as rice, coffee, cocoa, and, to a lesser extent, corn, tropical vegetables, tobacco for industrial use, cotton, tubers, cereals, and fruits (especially bananas and oranges). In recent years, the production of sacha inchi has increased.

Cattle and pigs are the primary livestock raised in the region, with several notable livestock areas such as Soritor-Calzada, the Ponaza, and the Biavo valleys. Poultry farming has experienced explosive growth in recent years. Natural resources include oil, coal, limestone, gypsum, gold, silver, and ornamental stone, especially in Alto Mayo and Saposoa, as well as salt. Notable industries include sawmills and cottonseed and oil palm oil factories, as well as distilleries famous for their wines and regional beverages. There is also a small aguardiente industry and the manufacture of toquilla straw hats in Rioja. The region has rice mills, soft drink factories, toiletries, and nectars. There are numerous brick and construction material factories, as well as a cement production plant. In Moyobamba, there are many producers of clothing, dairy products, packaged fruits, and cecina. At the same time, Tarapoto is mainly known for palm heart packaging and unique handicrafts in the production of cigarettes, sausages, and chocolates.

Geographical location

District: Rioja.
Province: Rioja.
Department: San Martín.

Implementation period

This study was carried out from January to December 2024.

Authorizations and permits

For this research, the respective permission of farmers in the San Martín region was taken into account regarding the information necessary for the development of this project. Likewise, the different Peruvian legal regulations in force for publications in virtual spaces and the establishment of online commercial activities were taken into consideration.

Environmental control and biosafety protocols

Not applicable.

Application of international ethical principles

The researcher declares that his intervention will respect the general ethical principles of research; in particular, the principles set out in the National Code of Scientific Integrity (CONCYTEC, 2019) will be applied, such as: intellectual honesty in research, respecting intellectual property and copyright, for which the APA 7th edition style rules will be applied; likewise, truthfulness and responsibility will be respected in the dissemination of the results of this research).

Variable systems

The following research variables are established:
Independent variable (x)

Virtual platform

Dependent variable (y)
Commercial articulation of markets.

Table 1. Description of variables by specific objective 1

Specific objective 1: Analyze the profile of agricultural producers in San Martín.			
Abstract variable	**Concrete variable**	**Means of recording**	**Unit of measurement**
Profile of agricultural producers	Characterization of agricultural producers	Questionnaire	Nominal

Table 2. Description of variables by specific objective 2

Specific objective 2: Analyze the profile of customers of agricultural products from San Martín			
Abstract variable	**Concrete variable**	**Means of recording**	**Unit of measurement**
Profile of customers of agricultural products	Characterization of customers	Questionnaire	Nominal

Table 3. Description of variables by specific objective 3

Specific objective 3: Analyze the profile of suppliers of agricultural products in San Martín			
Abstract variable	**Concrete variable**	**Means of recording**	**Unit of measurement**
Supplier profile	Characterization of agricultural product suppliers	Questionnaire	Ordinal

Table 4. Description of variables by specific objective 4

Specific objective 4: Evaluate the commercial coordination of markets for agricultural producers in the San Martín region			
Abstract variable	**Concrete variable**	**Means of recording**	**Unit of measurement**
Commercial coordination	Perception of articulation by suppliers, customers, and producers	Questionnaire	Nominal

Research procedures

Type and level of research

The research was applied and descriptive in nature, as the information obtained from the diagnosis allowed for the development of a proposal based on existing theories regarding market articulation, focusing on agricultural products, through a virtual platform whose characteristics respond to the needs identified in this type of product.

Population and sample

Population

There were three types of population: farmers, suppliers, and customers.

Sub-population 1: formal farmers in the San Martín region

Sub-population 2: suppliers of agricultural inputs and equipment in San Martín

Sub-population 3: Customers of agricultural products in San Martín, which in this case will be the general population at the local, regional, national, and international levels. It was not possible to establish a specific number.

Sample: the sampling was non-probabilistic for convenience at the discretion of the researcher:

Sample 1: 10 agricultural producers in San Martín, taking into account the following inclusion criteria:

Formal farmers in the department of San Martín.

Agricultural production of: coffee, cocoa, rice, corn, palm oil, XXX (products with the highest production indicators in San Martín)

Who voluntarily wish to participate in this research.

Sample 2: 10 suppliers of agricultural inputs and equipment in San Martín

Formal suppliers of agricultural products and services in the department of San Martín.

Who wish to voluntarily participate in this research.

Sample 3: 10 customers of formal farmers in San Martín.

Study design

The design was non-experimental because there was no direct manipulation of any of the variables.[3] The design of this research is as follows:

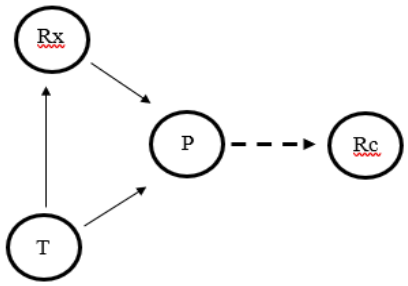

Figure 1. Study design

RX: Diagnosis of the current situation.

T: Theoretical studies.

P: Proposal.

RC: Changed reality.

Procedures

The reality was diagnosed based on the commercial coordination variable of agricultural producers in the San Martín region and how virtual platforms can improve this reality. Taking into account current theories regarding virtual platforms and how they intervene in market coordination, a proposal for a virtual platform

will be developed with characteristics that respond to the needs and expectations of farmers in San Martín with the aim of effectively coordinating agricultural markets, coordinating producers, suppliers, and customers.

Specific objective 1

Objective: to analyze the profile of agricultural producers in San Martín.

Activities

Development of a data collection tool.
Data collection.
Analysis and systematization of information.
Presentation of results.

Specific objective 2

Objective: to analyze the profile of customers of agricultural products in San Martín.

Activities

Development of data collection tools.
Data collection. Analysis and systematization of information.
Presentation of results.

Specific objective 3

Objective: to analyze the profile of agricultural product suppliers in San Martín.

Activities

Development of the data collection instrument.
Data collection.
Analysis and systematization of information.
Presentation of results.

Specific objective 4

Objective: to evaluate the commercial coordination of agricultural producers' markets in the San Martín region.

Activities

Development of a data collection tool.
Data collection.
Analysis and systematization of information.
Presentation of results.

RESULTS

Specific objective 1

Objective: to analyze the profile of agricultural producers in San Martín.

To achieve this objective, a survey was conducted among 10 agricultural producers in the San Martín region. The results are presented below:

Table 5. Characterization of the ages of agricultural producers in the San Martín region

	N	Minimum	Max	Mean	Standard
Age	10	43	60	50,20	5,007
Valid N (by list)	10				

In terms of age, the average is 50 years, with a minimum age of 43 and a maximum age of 60. The standard deviation was 5,007 years.

Table 6. Characterization of land ownership

Owns land	N	%
No	2	20,0
Yes	8	80

Of the 10 producers analyzed, 80 % (8) own their land, while 20 % (2) rent their land.

Table 7. Characterization of land area

Land area (ha)	N	%
2	1	10,0
2	2	20,0
3	1	10,0
3	2	20,0
4	1	10,0
4	1	10,0
5	1	10,0
5	1	10

It can be seen that producers differ in the amount of land they use for production, ranging from 2 hectares to 5 hectares.

Table 8. Descriptive characteristics of the land area

	N	Minimum	Max	Mean	Standard deviation
Land area (ha)	10	2	5	3,1	1,15
Valid N (by list)	10				

This table complements the previous one, showing that the minimum is 2 hectares and the maximum is 5. It also shows an average of 3,10 hectares among the 10, with a standard deviation of 1,15 hectares.

Table 9. Characterization of the main products

Main products	N	%
Rice	1	10
Cocoa	5	5
Coffee	1	10
Corn	1	10
Plantain	2	20

The main products are cocoa (50 %), followed by plantains with 20 %, rice, coffee, and corn, all with 10 %.

Table 10. Characterization of average harvest

Average production per harvest	N	%
1 t cocoa	1	10
1,2 t cocoa	1	10,0
1,5 t cocoa	1	10,0
1,5 t coffee	1	10,0
2 t cocoa	1	10
2 t corn	1	10
2 t banana	1	10
2,5 t banana	1	10,0
4 t rice	1	10,0
800 kg cocoa	1	10,0

It can be seen that all producers differ in average production. The table shows that one producer has an

average of 4 tons of rice. However, products such as cocoa range from 800 kg to 2 tons on average per harvest.

Table 11. Characterization of monthly earnings

Monthly earnings	N	%
< 1000 soles	5	50
1000 - 5000 soles	5	5

It can be seen that 50 % of producers have monthly incomes of less than 1 000 soles, and the other 50 % have incomes ranging from 1 000 to 5 000 soles per month.

Table 12. Characterization of earnings range

Earnings range	N	%
Not enough to subsist	3	30
Enough to survive	7	7

For 70 % of producers, profits are only enough to subsist, while for the remaining 30 %, they are not enough to subsist.

Table 13. Characterization of the form of purchase and sale of products, inputs, and services

Sale of products	N	%
In person	10	10
Purchase of supplies	N	%
In person	10	10
Purchase of services	N	%
In person	10	100

All producers sell their products in person, sell their products in person, and purchase their inputs in person.

Table 14. Characterization of sales levels

Level of sales	N	%
Local	8	8
Provincial	2	20

20 % of producers sell in the provincial market and 80 % in the local market.

Table 15. Characterization of strategic allies

Strategic partners	N	%
No	7	70,0
Yes	3	30,0

Only 30 % of producers have strategic allies, while 70 % do not.

Table 16. Characterization of sales methods

Form of sale	N	%
Intermediaries	4	40,0
Wholesalers	6	6

Sixty percent of producers sell their products to wholesalers, while the remaining 40 %

Table 17. Characterization of promotional events

Promotional events	N	%
No	7	70,0
Yes	3	30

Only 30 % of producers attend marketing promotion events such as local and national fairs, etc. Meanwhile, 70 % of producers do not attend such events.

Table 18. Characterization of main customers

Main customers	N	%
Private company	10	10

Absolutely all producers (10 out of 10, or 100 %) sell their products to private companies.

Specific objective 2

Objective: Analyze the profile of agricultural customers in San Martín.

To respond to this objective, a survey was conducted among 30 customers. The responses were provided by small traders, collectors, retail companies, and end consumers in local markets.

Table 19. Characterization of the main customers

N	Where do you buy?	Main criterion	Do you know any associations?	Would you buy through a platform?	Do you have alternatives?
1	Intermediaries	Price	No	Yes	No
2	Wholesalers	Ease of access	No	Yes	No
3	Intermediaries	Price	No	Yes	No
4	Supermarket	Quality	No	Yes	No
5	Intermediaries	Price	No	Yes	No
6	Intermediaries	Ease of access	No	Yes	No
7	Wholesalers	Price	Yes	Yes	No
8	Intermediaries	Price	No	No	No
9	Intermediaries	Price	No	Yes	No
10	Intermediaries	Price	No	Yes	No
11	Wholesalers	Ease of access	Yes	Yes	No
12	Intermediaries	Price	No	Yes	No
13	Supermarket	Quality	No	No	No
14	Intermediaries	Established relationship	Yes	Yes	No
15	Intermediaries	Price	No	Yes	No
16	Intermediaries	Price	No	Yes	No
17	Intermediaries	Price	No	Yes	No
18	Intermediaries	Price	Yes	Yes	No
19	Wholesalers	Ease of access	Yes	Yes	No
20	Intermediaries	Price	No	Yes	No
21	Intermediaries	Price	No	Yes	No
22	Wholesalers	Quality	No	Yes	No
23	Intermediaries	Ease of access	Yes	Yes	No
24	Intermediaries	Price	No	Yes	No
25	Intermediaries	Price	No	Yes	No
26	Intermediaries	Ease of access	Yes	Yes	No
27	Intermediaries	Price	No	Yes	No
28	Intermediaries	Established relationship	No	Yes	No
29	Intermediaries	Price	No	Yes	No
30	Wholesalers	Ease of access	Yes	Yes	No

The table shows that there is a high dependence on intermediaries. Seventy-three percent buy from intermediaries, and only 10 % buy from wholesalers. Direct access to producers is almost non-existent. In addition, there is little information about associations. Seventy percent are not aware of any producer associations or cooperatives. There is also interest in virtual platforms. Ninety percent would be willing to buy directly if a platform existed. Likewise, there is a clear lack of current alternatives for producers: 29 out of 30 customers consider that they do not have sufficient alternatives to buy directly from producers.

Specific objective 3

Objective: analyze the profile of agricultural product suppliers in San Martín.

Table 20. Characterization of agricultural product suppliers

N	Type of products/ services	Main customers	Marketing channel	Current access of producers	Willingness to use platform
1	Agricultural inputs	Individual producers	In person	Partially	Yes
2	Agricultural inputs	Individual producers	In person	No	Yes
3	Technical services	Associations	In person	Yes	Yes
4	Agricultural inputs	Individual producers	Virtual	No	Yes
5	Other (Tools)	Individual producers	In person	Partially	Yes
6	Technical services	Agricultural companies	In-person and online	Yes	Maybe
7	Agricultural inputs	Individual producers	In person	No	Yes
8	Agro-industrial	Individual producers	In person	No	Yes
9	Agricultural inputs	Associations	In person and online	Yes	Yes
10	Technical services	Individual producers	In person	Partially	Yes
11	Agricultural inputs	Individual producers	In person	No	Yes
12	Agricultural inputs	Individual producers	Virtual	No	Yes
13	Others (Certified seeds)	Individual producers	In person	Partially	Yes
14	Agricultural inputs	Associations	In-person and online	Yes	Maybe
15	Technical services	Individual producers	In person	No	Yes
16	Agricultural inputs	Individual producers	In person	No	Yes
17	Agricultural inputs	Individual producers	In person	Partially	Yes
18	Technical services	Associations	In person and online	Yes	Yes
19	Other (Agricultural packaging)	Individual producers	Virtual	No	Yes
20	Agricultural inputs	Individual producers	In person	Partially	Yes

It can be seen that most suppliers sell agricultural inputs and work with individual producers, reflecting a fragmented and poorly coordinated market. The face-to-face channel dominates, with little adoption of digital tools. More than 70 % believe that producers do not have full access to their services, indicating an access gap. A high percentage would be willing to use virtual platforms.

Specific objective 4

Objective: to evaluate the commercial coordination of agricultural producer markets in the San Martín region.

For this objective, the participation of 30 key actors (10 suppliers, 10 customers, and 10 producers) was taken into account. The results are presented below:

The table shows that there is low overall coordination. Only 9 out of 30 actors reported being coordinated with their buyers or suppliers. This represents just 30 %, confirming the hypothesis of a low level of commercial coordination. The face-to-face channel predominates. The face-to-face channel is widely used in all three groups, especially among producers (80 %). This reveals a low level of digitization and modernization in commercial practices. In addition, formal contracts are almost non-existent. Only 6 out of 30 actors claim to have formal contracts or agreements.

Table 21. Commercial coordination of agricultural producer markets

Stakeholder	Linked to buyers/ suppliers/customers?	Means of transaction	Does it have formal contracts?	Participates in spaces?	Are there enough channels?
Producer	No (7), Yes (3)	In person (8), Virtual (2)	No (9), Yes (1)	No (6), Yes (4)	No (8), Yes (2)
Client	No (8), Yes (2)	In person (7), Virtual (3)	No (8), Yes (2)	No (8), Yes (2)	No (7), Yes (3)
Supplier	No (6), Yes (4)	In person (6), Virtual (4)	No (7), Yes (3)	No (5), Yes (5)	No (7), Yes (3)

This indicates informality and a lack of structure in commercial relations. Finally, there is little participation in coordination spaces. Producers and customers have low participation in fairs, business roundtables, or technical workshops. Suppliers participate the most (50 %), indicating that they play a more active role. There is a negative perception of coordination channels, with most actors (22 out of 30) believing that there are not enough channels to coordinate the agricultural market. This data reinforces the need to implement a digital platform for commercial coordination.

In general, the level of market coordination is summarized and presented below:

Table 22. Level of commercial coordination

Commercial coordination	Absolute frequency	Relative frequency
No	2	0,70 (70 %)
Yes	9	0,30 (30 %)

Seventy percent of actors are not commercially linked to their suppliers or buyers, confirming a low level of market linkage in the San Martín region. Only 30 % have some type of structured or formal connection.

The level of coordination among the three actors is shown below:

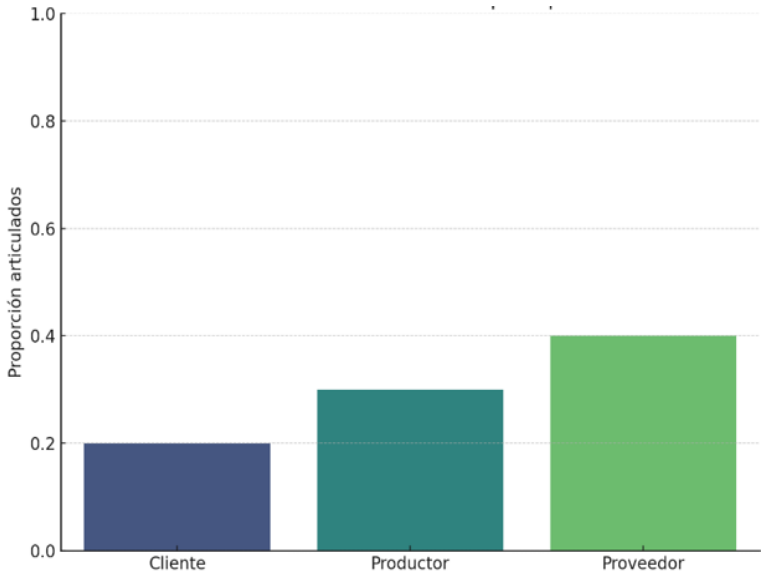

Figure 2. Level of commercial coordination by type of actor

This figure supports the findings in table 20, which shows that most suppliers have a higher level of coordination, followed by producers and finally customers.

These data reinforce the hypothesis that commercial coordination in San Martín is low, informal, and based mainly on face-to-face and individual relationships, without lasting structures or efficient use of technology. This highlights a great opportunity for the implementation of a virtual platform that connects producers, suppliers, and buyers in a more direct, efficient, and fair manner.

General objective

General objective: To design a prototype virtual platform with functionalities that contribute to direct commercial coordination between small agricultural producers and buyers in San Martín.

Design of a prototype virtual platform for the commercial coordination of agricultural producers in the San Martín region.

Objective

Design a prototype virtual platform with features that contribute to direct commercial coordination between small agricultural producers and buyers in the San Martín region.

Diagnosis of the current situation

Producer profile

Average age: 43 years old.
Type of agriculture: mostly family and subsistence farming.
Land tenure: Mostly small plots of land owned by the producers themselves.
Profitability: 80 % report monthly earnings of less than S/1,000.
Association: low, with a predominance of producers who are not formally associated.
Sales channels: Face-to-face sales and sales to intermediaries.

Buyer profile

Purchase origin: mainly through intermediaries.
Access to alternative markets: Limited.
Purchasing channel: mostly in person. Supplier profile
Main customers: individual producers.
Marketing channel: 65 % exclusively in person.
Producers' access to their services: 70 % consider access to be partial or insufficient.
Interest in digitization: 85 % would be willing to use a virtual platform.

Level of commercial coordination

Table 23. Summary of commercial coordination

Commercial coordination	N	%
No	21	70
Yes	9	30

Table 24. Percentage of coordination by type of actor

Actor	Total Actors	Coordinated (N)	Percentage articulated (%)
Producer	10	3	30,0
Client	10	2	20,0
Supplier	10	4	40,0

Proposed virtual platform prototype

Tentative name

AgroConecta San Martín.

Purpose of the Prototype

To facilitate direct connections between small agricultural producers and buyers, reducing dependence on intermediaries and improving access to inputs, technical services, and market opportunities.

Specific objectives

Digitize the supply and demand of local agricultural products.
Integrate suppliers of inputs and technical services into a network accessible to producers.
Promote formal marketing through digital contracts.
Encourage participation in virtual fairs, business roundtables, and online training.

Prototype characteristics

Table 25. Characteristics of the prototype

Module	Description
User registration	Producers, buyers, suppliers, public/private entities.
Product catalog	Publication of available products, with photos, prices, and quantities.
Negotiation module	System for offers, quotes, and counteroffers.
Digital contracts	Simple electronic signature for purchase agreements.
Geolocation	Display of producers and suppliers on a regional map.
Virtual business roundtables	Commercial events calendar with automatic registration.
Notifications and alerts	About prices, trade shows, business opportunities, and supplies.
Support and training	Tutorials, online assistance, and FAQ forums.

The prototype would have eight modules, which would enable the three actors to function appropriately and coordinate with each other when carrying out any commercial transaction. It would have a user registration module, which would be used to register all producers, buyers, suppliers, and public and private entities. The product catalog module will contain a list of available products with detailed descriptions, such as photos, prices, quantities, etc. The negotiation module will be important for managing offers, quotes, and counteroffers, which is very useful for coordinating the three key actors. It will also have a digital contract module, which will be key for electronic signatures for commercial transactions. It will also have a geolocation module, which will display all key players on a map. It will have a virtual business roundtable module, which will provide information on commercial events. The notifications and alerts module will allow you to manage all notifications and alerts about prices, trade shows, and negotiation opportunities. Finally, there is the support and training module. This module will include tutorials, online assistance, and a frequently asked questions forum, which will be very useful for keeping key players informed and trained.

The following chart shows the interrelationship between the three main actors:

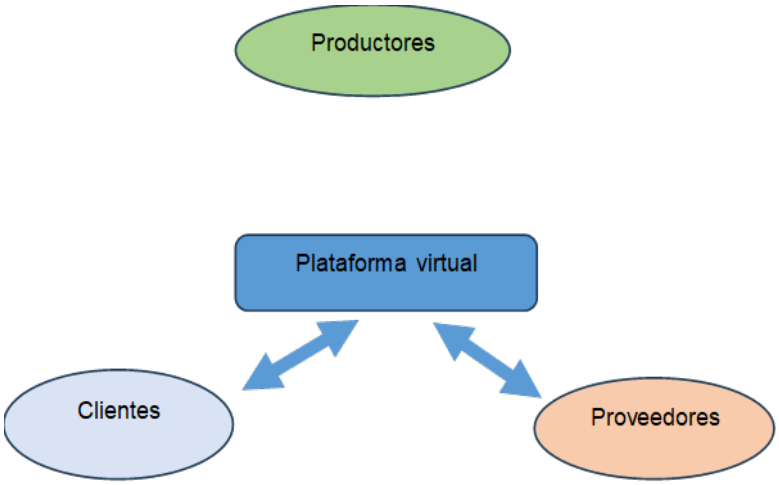

Figure 3. Interrelationship between the three main actors

From the graph, we can interpret that producers are linked both to suppliers (to purchase inputs and services) and to buyers (to sell their products). Suppliers interact mainly with producers, but they could also offer support to buyers on logistical or technical issues. Meanwhile, buyers have so far had a stronger relationship with intermediaries, but the platform will seek to establish a direct link with producers.

RECOMMENDATIONS

There is a structural weakness in the current commercial coordination.

Informality, face-to-face contact, and dependence on intermediaries predominate.

The "AgroConecta San Martín" platform represents a viable and necessary alternative for transforming regional agricultural marketing.

Validate the prototype with real users (producers, buyers, suppliers).

Coordinate with local institutions to facilitate technology adoption.

Include digital inclusion and agricultural training tools to ensure effective use.

Regarding the discussion of the results, on the profile of agricultural producers in San Martín. Farmers in San Martín have homogeneous conditions: advanced age, small plots of land, and low incomes. Agriculture is focused on subsistence, with little collective coordination and high dependence on third parties for marketing. This situation restricts their economic and productive growth. This profile reveals a weak productive structure. Low associativity prevents access to economies of scale, while dependence on intermediaries reduces final income. The fact that most people work on their land suggests that there are physical assets, but they are not being utilized efficiently due to a lack of knowledge, tools, or access to markets.[22,23]

Regarding the profile of agricultural customers in San Martín, the fact that 90 % are willing to use platforms is a clear sign of the potential for technology adoption and a solid basis for justifying digital interventions in the marketing system.

Buyers of agricultural products are heavily tied to intermediaries and have little access to or information about direct producers. However, most would be willing to use digital platforms to connect directly, representing an opportunity for commercial transformation. This indicates that the lack of connection is not due to disinterest, but instead to the absence of efficient channels. Customers are dissatisfied with the current way of purchasing products, but they have no alternatives. Here, the gap is more about market structure than willingness. The finding is important because it reveals that demand exists for solutions such as AgroConecta: it just needs to be channeled correctly.

On the profile of agricultural product suppliers in San Martín. Eighty-five percent of suppliers are willing to digitize, but 70 % believe that producers only have partial access. This shows an operational disconnect.[24,25]

Suppliers of agricultural inputs or services also operate in an informal, disconnected, and primarily face-to-face system. Although they would be willing to digitize their processes, producers' access to them remains limited, which hinders efficient management of the regional agroecosystem. This shows that the coordination problem affects not only producers and customers but also suppliers, which affects the chain from its inception. If farmers do not have easy access to fertilizers, technical assistance, or technology, their productivity and competitiveness are reduced. The willingness of suppliers to change is an opportunity that has been wasted until now.[26,27]

On the commercial coordination of agricultural producers' markets in the San Martín region. Only 30 % of actors are formally connected, and only 20 % use contracts. The study confirms that institutional coordination is almost non-existent, which limits systemic competitiveness.[28,29]

The regional agricultural system operates largely informally and improvisationally. Few relationships are formalized, contracts are almost non-existent, and participation in commercial events is low. This means that links between key actors are neither stable nor strategic, which affects the development of the agribusiness ecosystem. Low coordination creates high vulnerability for all actors: unstable prices, limited access to external markets, and a lack of planning, among others. It also prevents the building of trust, lasting relationships, or strategic alliances. This informal environment weakens incentives to invest or improve, as everything is based on short-term relationships rather than medium- or long-term commitments.[30,31]

When comparing these results with those of other studies, this study concludes that the "AgroConecta San Martín" platform offers a viable solution to improve commercial relations and reduce dependence on intermediaries in the region. This finding is very similar to the studies by Cubides et al.[4] and Wong[5]. Both highlight that the use of digital platforms during the pandemic was key to mitigating losses and improving direct marketing between producers and buyers.

Similarly, Singh et al.[6] identify self-organised and integrated platforms as the most effective, in line with your proposal for a multifunctional tool that incorporates training, geolocation, and formalisation. This similarity suggests that AgroConecta adopts a contemporary approach consistent with international best practices. However, Bustamante[7] warns that in the initial stages, platforms tend to prioritize economic values over social values, such as transparency or sustainability.[32,33]

The finding regarding the homogeneity of producers (average age of 50, land ownership, but low income and a focus on subsistence) is similar to the conditions found in studies such as Laurenzio[8] and Martínez et al.[9], which highlight structural limitations (access to services, limited technical knowledge, dependence on intermediaries) that condition access to high-value markets or biotrade. The difference lies in the profile of the producer. While in San Martín, the producer is traditional and poorly organized, the study by Tauzie et al.[10] shows a new elite of young farmers in Malawi who are digitally connected and have greater human capital. This explains why, despite the opportunities offered by digitization, barriers such as low association and lack of training persist in San Martín.

The conclusion regarding the high dependence of customers and suppliers on intermediaries and the weak coordination between actors is consistent with the findings of De Loayza et al.[11], who found that although trade coordination plans (PACs) improve export performance, their impact is still limited due to unstructured participation and a lack of sustainability. In addition, Tombe et al.[12] argue that agricultural social networks

allow the different links in the value chain to be connected. However, their effectiveness depends on the degree of technological integration. In this study, the San Martín market is still primarily face-to-face and fragmented, which explains why, despite interest in platforms, formal commercial coordination is very low (30 %).[34,35]

Both this study and those by Wang et al.[13] and Martínez[14] reveal a tension between technological modernization and traditional dynamics in rural environments. Although in San Martín, 85-90 % of actors express interest in virtual platforms, low digitization, informality, and the absence of formal contracts (only 20 % according to your findings) limit the possibility of structural transformation. In the case of India, for example, Martínez shows how large producers saw platformization as a threat to their autonomy and traditional models, which is related to the fact that platforms must not only facilitate market access but also respect local logic and avoid concentrations of power.[36,37]

In summary, the results of this research are solidly aligned with trends observed in both international and local research. The consensus revolves around the fact that digital platforms have a high potential to transform agriculture, especially in terms of reducing intermediation, access to markets, and value chain efficiency. However, it is also evident that for these tools to be effective and sustainable, strong institutional support and adapted public policies will be required the active inclusion of producers through training and technical support. Consider the social value of platforms, not just the economic value. And recognize and address local resistance to digital transformation.[38]

CONCLUSIONS

The "AgroConecta San Martín" platform represents a viable solution to address the structural weaknesses of the regional agricultural market. By integrating digitization, commercial formalization, geolocation, and technical training, this tool can transform commercial relationships between producers, buyers, and suppliers, reducing dependence on intermediaries and improving agricultural profitability.

Agricultural producers in San Martín are homogeneous in terms of age (average 50 years) and land size (average 3,10 hectares). Most own their land (80 %), but their incomes are low, with 50 % earning less than S/1 000 per month. In addition, their activities are mainly subsistence-oriented, with low levels of association and dependence on intermediaries for sales. This reflects a limited capacity to expand their operations and improve their profitability.

Agricultural customers show a high dependence on intermediaries (73 %) and limited access to direct producers. Most people (70 %) are unaware of associations or cooperatives and see few alternatives to buying directly from producers. However, there is interest in virtual platforms (90 % would be willing to use them), which shows an opportunity to connect these actors directly with producers.

Agricultural suppliers operate in a fragmented, primarily face-to-face market with low digitization. Although they are willing to adopt virtual platforms (85 %), there is a significant gap in producers' access to their services (70 % consider access to be partial). This limits the efficiency and reach of agricultural supply in the region.

Trade coordination in San Martín is low, with only 30 % of actors formally connected. Informal and face-to-face relationships predominate, while formal contracts are almost non-existent (only 20 %). In addition, there is little participation in trade events such as fairs or business roundtables, which limits opportunities to expand markets and establish lasting links between key actors.

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FINANCING

The authors did not receive funding for the development of this research.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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