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Lessons Learned From the Business Model of Sustainable Vicuna Fiber Production Management in Chile

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Abstract---*The purpose of this article is to share with stakeholders and researchers in the Aymara livestock sector the results, experiences and lessons learned about the production and commercialization of vicuña fiber under sustainable management from different innovation initiatives financed by the Foundation for Agrarian Innovation, FIA. It is hoped that this information, systematized in the form of a "learned business model", will provide stakeholders with the information they need and provide elements that will allow them to make productive decisions and, potentially, develop initiatives related to this economic sector.*

Keywords---*Aymara, business model, lesson learned, sustainable management, vicuña.*

Introduction

The Vicuña Fiber Business Model has its origin in the results, experiences and lessons learned in the execution of different projects financed by the FIA "precursor projects", which in the execution of different projects financed by the FIA "precursor projects", whose objective was the productive, economic and social development of vicuña fiber in Aymara communities in the Chilean altiplano.

The experience involving the four projects was aimed at the production and marketing of vicuña fiber obtained from silvestría (extensive) and corral (captive) systems, with a subsequent consolidation of the organizational, technical and technical management of the vicuña fiber. consolidation of organizational, technical and commercial management. Simultaneously, the reproductive behavior of the vicuña and the improvement of the productive indexes of the species.

These projects were consecutive and complementary. As a final result, the Aymara producers organized around this effort obtained income close to US\$ 274,000 between 2002 and 2008, as a result of the total sale of 636 kilos of fiber, which directly benefited 45 families (Barra, 2009; Dubeuf et al., 2004; Klein et al., 2019). In addition to this achievement, in early January 2008, the first official Chilean export of alpaca fiber to Argentina took place. It should be noted that this work has required solid public-private coordination through a long-term program and permanent technical and financial support, with the active participation of the institutions of the Ministry of Agriculture: The National Forestry Corporation (CONAF), the Agriculture and Livestock Service (SAG), the Foundation for Agrarian Innovation (FIA) and the Regional Ministerial Secretariat of Agriculture of the Region of Arica and Parinacota (Arzamendia et al., 2010; Badaracco et al., 2013).

Thus, the results and experiences in the production and marketing of vicuña fiber and in the associative management of the Aymara communities have progressively prospered until a technically and economically viable production chain has been established. In addition, with the favorable results obtained in the vicuña fertility studies, part of the reproductive management of the species has been consolidated, has been consolidated in order to obtain higher economic yields in fiber production.

Method

The methodology proposed for the development of the article is based on a rigorous bibliographic review that responds to the new research needs in the field of productive development of camelid fibers in Chile. We chose to analyze international literature and a series of published articles and precursor projects financed by the Foundation for Agrarian Innovation (FIA), in order to lead the reader to a fairly broad scenario that allows understanding at a qualitative level the implications of the process, dissemination and productive and technological practices of the vicuña project, between 2004-2009. The information analyzed was selectively organized in order to establish an analytical and/or conceptual framework capable of responding to a series of scenarios that affect the business performance of Aymara family farming and livestock production.

Literature review

South American camelids

South American camelids comprise four species, two domestic species: the alpaca (*Lama pacos* and *Lama glama*), and two wild species: guanaco (*Lama guanicoe*) and vicuña (*Vicugna vicugna*). These animals are distributed throughout the Andes mountain range in South America, from Ecuador to Tierra del Fuego, and their greatest concentration is in the Peruvian-Bolivian altiplano, northern Chile and Argentina, at altitudes between 3,800 and 5,000 meters above sea level.

The estimated population of South American camelids in Latin America is between 7.5 and 8 million, of which 7% are guanacos, 2% are vicuñas, 45% are llamas and 46% are alpacas (CID- AID- AUC). Alpacas (CID- AQP, 2005). The world population of alpacas is estimated at 3.5 million head, and Peru is the main producer, with approximately 87%, followed by Peru (CID- AQP, 2005). With approximately 87%, followed by Bolivia (9.5%). The world llama population is estimated at 3,321,000 head; Bolivia is the main producer (61%), followed by Bolivia (9.5%).

Bolivia is the main producer (61%), followed by Peru (32.5%) and Argentina (4%), and to a lesser extent Chile and Ecuador (CID-AQP). Ecuador (CID-AQP, 2005). The estimated population of guanacos is 534,000 animals; Argentina has the largest number (93.6%), followed by Chile (5.6%). In the case of the vicuña, population estimates vary according to the authors, and in Chile, the values cover a range between 16,000 and 25,000 animals. According to Bonacic (2008), annual vicuña censuses began in Peru in 1969 and in Chile in 1975; the current vicuña population is estimated to be 120,000 in Peru, 30,000 in Bolivia, 25,000 in Chile and 23,000 in Argentina. This document uses the figures estimated by CONAF, which are indicated below:

- Chile: 16 to 18,000
- Argentina: 40,000
- Bolivia: 60,000
- Perú: 150,000

In Argentina, although there are no census data for the whole country, only in 2002 in the province of Salta 13,000 specimens were recorded, in Catamarca more than 13,000 in 1999 and in Jujuy 18,000 in 1996.

The Vicuña in Chile

Vicuña populations are distributed in Chile throughout the Andean puna ecosystem (low productivity grasslands), at altitudes between 3,000 and 4,600 m, from the administrative border with Chile to the Andes. (low productivity grasslands), at altitudes between 3,000 and 4,600 m, from the administrative boundary with Peru, to the southern limit of the altiplano in Peru, to the southern limit of the altiplano in the Atacama Region (27°30'S) (Torres, 1987). Nearly 95% of the country's vicuñas are concentrated in the province of Parinacota (XV Region of Arica and Parinacota). Arica y Parinacota), with some 15,000 animals, according to the 2002 census. The remaining percentage is distributed among the regions of Tarapacá, Antofagasta and Atacama (CONAF, 2008).

There are two subspecies, whose spatial distribution is fragmented and heterogeneous: *Vicuña mensalis*. It is located in the province of Parinacota and Vicuña vicuña vicugna from the southern limit of that province, up to 27°30'30". The southern limit of that province, up to 27°30'S, coinciding with the Jotabeche snow-capped mountain and the Negro Francisco lagoon in the III Region of Atacama. Region of Atacama. Therefore, the species

covers the administrative regions of Arica and Parinacota, Tarapacá, Antofagasta and Atacama (Torres, 1992). The subspecies sheared in Chile is *V. v. mensalis* (which also exists in Peru and Bolivia), which differs from the subspecies *V. v. mensalis* (Torres, 1992). Differs from the subspecies *V. v. vicugna* (also present in Argentina) in that it is shorter, and the fleece is darker than that of *V. v. vicugna* (Torres, 1992). According to information compiled in Galaz & González (eds.) (2005), it is estimated that in the sixteenth century.

In the 16th century, vicuñas were estimated to number several million individuals. The commercial interest in vicuña fiber led to a strong hunting pressure, which led to the commercial interest in vicuña fiber developed strong hunting pressure, so that by the early 1950s populations were estimated to have declined to about 400,000 individuals. Populations had declined to about 400,000 and by the end of the 1960s, to about 2,000 distributed between Bolivia, Chile and Argentina, and by the end of the 1960s, to about 2,000. between Bolivia, Chile and Argentina, and from 5,000 to 10,000 in Peru.

Protection actions were concentrated in the province of Parinacota, which currently has the following reserves: Lauca National Park, Las Vicuñas National Reserve, and Salar de Surire National Monument. The success of the protection program was reflected in the population growth of the species, which reached more than 26,000 animals at the end of the 1990s. One of the main objectives of the conservation program was to reach a level of population recovery that would allow the use of the species by local communities (Bonacic, 1998; McAllister et al., 2009; Quispe et al., 2010).

After the success of this first stage of total protection, local communities participated in national conservation and management programs for the species. In 1979, the 1969 "Agreement on the Conservation and Management of the Vicuña" was ratified. In 1969, the "Agreement on the Conservation and Management of the Vicuña" was ratified, which also authorizes the economic use of the species "for the benefit of the Andean peoples" (GECS). The adhering countries agree that the vicuña is an economic production alternative for the Andean population and are committed to its gradual exploitation under strict State control.

Operating Modes

The Andean countries have developed different ways of managing vicuñas according to their particular characteristics such as social organization, idiosyncrasy, production systems, land and natural resource tenure system, and legislation. In general, there are two modes of vicuña management: silvetry management and captive management. The first comprises the temporary capture of vicuñas that are found in their natural habitat and that are released after shearing. Since this modality is based on the maintenance of vicuñas in their natural environment, it has the potential to contribute to the conservation of the habitat and the species, at the same time promoting positive attitudes in the local inhabitants towards the conservation of the resource (GECS [online]).

The second option, captive management, refers to the shearing of vicuñas that are permanently inside corrals whose surface varies between 12 and 1,000 hectares. This practice may include pasture and water supplementation, sanitary control, castration of subadult males, among others, and, on occasions, it is carried out outside the natural habitat of the vicuña. Given that captive management is based on isolating groups and restricting their mobility, some authors point out that this would have important genetic and behavioral consequences and would not contribute directly to the conservation of the species or its habitat (GECS), an issue that has not yet been proven. In the case of Peru and Bolivia, the management plans were initially designed for Andean communities to make use of the vicuñas found on their communal lands. In Bolivia, the only management system allowed is silvetry, while in Peru, since 1996 a captive management system was also implemented in pens of 1,000 hectares (Lichtenstein, 2007). In the case of Argentina, where there is an absence of communal structures associated with land ownership and the nuclei of economic production are domestic units, the National Institute of Agricultural Technology (INTA) designed a management system for vicuñas in captivity carried out by small producers and financed by the main fiber exporting company. Since 2003, some experiences of silvetry management have emerged by cooperatives in the town of Cieneguillas (Jujuy) and Laguna Blanca-Catamarca (Lichtenstein, 2007).

In Chile, in the framework of the precursor projects, the two management systems were used: silvetry and extensive rearing in pens, also known as captivity. Silvetry management, also called extensive system, considered the temporary capture of vicuñas for shearing through rodeos and their subsequent return to the natural environment. The management in pens (captivity) considered the fencing of lands with a minimum of animals and surface (density), to largely maintain the natural conditions of silvetry. In the corral modules, a management of water and pasture supplementation was implemented, as well as basic sanitary control.

Production of Natural Fibers in the World

The year 2009 was declared the International Year of Natural Fibers (IYNF; FAO) by the United Nations General Assembly in New York, whose objectives are: to help agricultural industries that employ millions of people and they provide opportunities for economic development, and strengthen the demand for natural fiber products, improving the livelihoods of the farmers that produce them and income for countries that export them. Every year around 30 million tons of natural fibers are produced in the world, of which cotton dominates with 20 million tons, and wool and jute reach 2 to 3 million tons, followed by other fibers.

The use of natural fibers ranges from their use in haute couture to industrial use; In all cases, the fibers are subject to competition with synthetic substitutes, which entered the market in the 1960s and since then their use has been increasing, widely surpassing today the better-known natural fibers such as cotton and wool (Table 1). The main reason why synthetic fibers took over the textile market was because of their lower processing cost.

Table 1
Share of natural fibers in the world supply of fibers

Fiber type	Participation (%)
Synthetic and artificial, derived from petroleum	60.0
Cotton	36.0
Of vegetable origin (flax, ramie and bamboo)	0.5
Precious (vicuña, guanaco, cashmere, alpaca, among others) Wool	1.0
	2.1
Other unidentified of cellulosic origin	0.4

Source: BTA (2008).

By species and main producers, world fiber production (t / year) is estimated at (FAO)

• mohair (angora goat):	8,000 (South Africa, the United States and Turkey)
• cashmere (goat):	5,000 (China, Mongolia, Iran and Afghanistan)
• alpaca:	4,000 (Peru, Chile and Bolivia)
• camel:	2,000 (China, Mongolia, Iran and Afghanistan)
• angora (rabbit):	8,500 (China)
• call:	500 (Peru and Bolivia)

In recent years there is a greater tendency to use lighter and more comfortable clothing; For this, the type of fiber and diameter is important since, in general, the smaller the diameter the fiber is finer, and the garment is more expensive. The table (Table 2) shows the diameters and average comfort of fine fibers of different animal origin and between different qualities within the same species.

Table 2
Diameter ranges and average length of fine fibers

Cuadro TWO. Diameter ranges and average length of fine fibers		
category	diameter (μ)	Comfort factor (%)
Baby alpaca	22.5	90
Suri alpaca	26.0	70
Flece alpaca	26.5	70
Alpaca huarizo	31.0	55
Thick alpaca	34,055	25
Cashmere	16.0	98
Mohair kid	25.0	80
Mohair young G.	28-31	65
Mohair adult	35-37	25
Vicuña	12.0	95

Source: UNIDO (2006).

International Market For Vicuña Fiber

The total population of vicuñas amounts to 302,210 specimens and the main fiber producing countries are, in order of importance: Peru, Argentina, Bolivia, Chile and Ecuador. Together, the first three represent 93.44% of the world population of vicuñas and, consequently, of the production of fine fiber. However, its percentage of participation in the market is very low and corresponds to 0.006% of the total production of fine fibers, with a volume close to 3 tons per year (Galaz and González (eds.), 2005). From the point of view of the market structure, the vicuña fine fiber offer has four characteristics:

- *It is oligopolistic*, that is, it corresponds to a market with few suppliers. This characteristic is permanent over time, since there is, on the one hand, a ban on exporting genetic material (by the members of the Vicuña Convention) and, on the other, the assessment of maintaining the exclusivity of the genetic resource (by market participants).
- *It is highly segmented*, that is, each country has generated its own market niche and there are large price differentials in the producer and distributor. Only in the case of Peru and Argentina are finished garments produced.
- *In transversal terms, there is a positive externality in favor of the economic and cultural well-being of the high Andean communities*. This implies that there is a social responsibility of each of the market players (private and public), which consists in assuming that the development of this market could be the determining variable in overcoming poverty in the high Andean communities.
- *The market supply of fine vicuña fiber is inelastic*, that is, the quantity supplied cannot increase depending on the prices shown by the market, since it is determined by the vicuña population, their yield, and rates of use. This only allows fiber stocks to be held from one year to the next to produce price increases.

Specifically, vicuña fiber is recognized as one of the finest and most exclusive fibers in the world, which is used as an input for the manufacture of quality fabrics and clothing, and which presents a demand mainly concentrated in Italy, England and Germany. According to the sales of fine vicuña fibers, made by the productive units of the Arica and Parinacota Region, the destination markets between 2002 and 2008 were the Argentine and the Italian, in that order. This is a product of the way in which these sales processes were developed and carried out.

Fundamentals

The Vicuña Fiber Business Model was designed and systematized as a tool for the development of economically profitable and sustainable businesses for the Aymara communities of Chile. Essentially, it confirms that this sector can be inserted effectively and sustainably in the largest and global markets, if it generates competitiveness and is produced based on the attributes expected by the end customer of the product. The proposed Model is based on:

- Increase in the demand for fine natural fibers that stimulates the commercial integration of camelid fibers.

- Valorization of ethnic and cultural products.
- Valorization of natural textures and colors.
- Joint interests of protection and conservation of the vicuña.
- Regulatory framework according to the challenges of a globalized economic activity.
- Participation of the State as inspector and guarantor.

In this context, it should be noted that the main strength of the Model is to generate a "differentiated product" because it originates in sustainable production systems of Aymara communities in the highlands and, also, because its production is technically consolidated and a certified and standardized product is obtained (it is certified in the laboratory of the National Institute of Agricultural Technology, INTA, in Bariloche, Argentina).

This differentiation allows good market prices to be obtained with respect to the competition, that a Chilean camelid fiber marketer operates and that there is a portfolio of clients for these fine fibers. However, the associative links are weak in the commercial production chain and management of the communities that exploit the fiber resource. It is therefore important to highlight the need to strengthen the linking factors required to sustain economic activity and generate greater wealth, taking advantage of territorial and cultural advantages. Therefore, the Model attempts to create the structural conditions for associativity and economic development of rural Aymara communities.

Implementation Strategy

The application of the model involves a notable quantitative and qualitative leap in the mode of fiber production of wild camelids in Chile. Its implementation is based on local producers (productive units), who organize themselves to guide efforts towards the development of profitable and sustainable businesses. The effort is supported by a professionalized management platform, with interdisciplinary capacities (productive and commercial management unit), which actively intervenes in the identification of the productive and business units, as well as in their productive and commercial development (Figure 1).

The installation and initial operation of the model rests, fundamentally, on the public and private resources available for the support of the indigenous communities of Chile and the development of peasant family agriculture. These resources are mainly used to finance technical support and investments in infrastructure, and to equip the business units and, to a lesser extent, to operate the productive and commercial management unit.

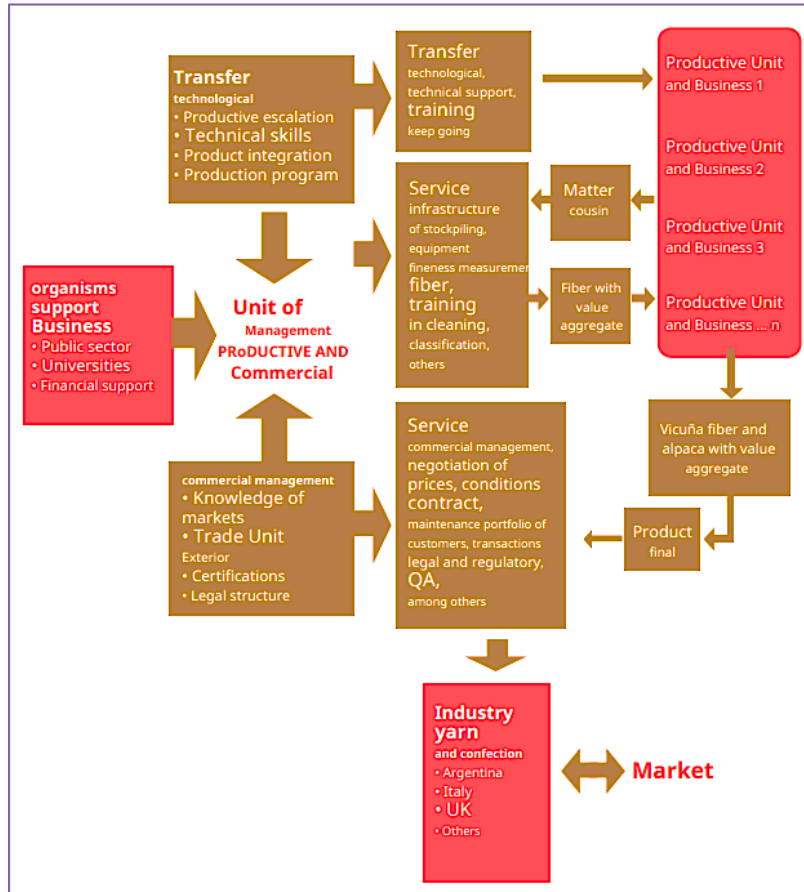


Figure 1. Productive and commercial development
Source: BTA, 2009.

Business support units

They are all public and private organizations that have technical or financial resources accessible to the high Andean communities, including companies that are tactically articulated in the production chain where the business units operate. The resources provided by business support units are essential so that producers and their organizations can access the technologies, levels of efficiency, productive scales and degree of competitiveness that their insertion in the major markets requires. In this group, institutions, such as CONAF and SAG, that exercise a regulatory role are essential, since an adequate process of development of the fiber industry requires as a condition the establishment of systems and public regulations coordinated and compatible with the processes, commercial.

This is due to the fact that it is essential to supervise an adequate sustainable management of productive resources, especially of wild species, in addition to the establishment of programs that support the strengthening of the country's presence as a stable, certified supplier and respectful of international regulations that regulate the commercial management of the species involved. Other agents that influence in one way or another in the operation and development of the camelid fiber production chain as a whole, or in one or some of its components, are the suppliers that offer and provide goods and services such as inputs, machinery and equipment, financing and credit, research contributions and basic and technological development to the processes in their different components and production phases.

Keys to the Viability of the Model

Consolidated commercial

organization It is necessary to generate a structure that allows consolidating the productive and commercial organization of producers, and their farms, in a sustainable system over time. For this, an associative structure must be established based on the social, cultural, productive and commercial characteristics of the beneficiary units, so that it is a flexible, dynamic and attractive organization. In this context, and as explained in previous chapters, within the framework of the precursor projects, a corporate constitution was established through a service cooperative, the objective of which has been the associative commercialization of fibers from wild and domestic camelids, as well as to develop other economic activities, such as rural tourism and handicrafts, in order to generate greater wealth based on raw materials and the natural and cultural advantages presented by the units that are part of the new commercial production structure.

This associative structure, the "Productive and Commercial Management Unit", plays a leading role in the implementation of the Model; for this reason, it is essential that it have highly qualified and motivated professionals, whose competences must be oriented, fundamentally, to their performance in the business world. The operation of this unit allows:

- Integrate the participating units and strengthen the bonds of trust.
- Increase the number of formal associates and achieve a higher level of production.
- The existence of fiber collection and sorting services.
- Transfer technical capabilities to producers through various trainings, in order to improve production yields and add value to the fiber, for example, through the incorporation of the debarking process, the technical management of the vicuña fiber, and cleaning and classification, to alpaca fiber.
- Increase bargaining power with customers, given the higher level of production (supply) and added value.
- Clarity regarding the marketing strategy and the way in which the associative sale will be carried out.
- Formalization of a medium-term associative commercial link.
- Develop strategic alliances with other organizations, in order to create support networks for the sector.
- Provide added value to livestock farms by identifying new businesses as complementary activities, such as alpaca fiber production and special interest tourism.

Definition of the Commercial Strategy

The success of this Business Model requires consolidated marketing channels with the destination market, in order to establish a permanent link that ensures a value and volume of fine camelid fiber, depending on the quality and volumes to be traded. It is estimated that any effort to promote the quality and organized purchase of the products generated in the sector will result in the possibility of achieving better prices that allow the sector to capitalize and, especially, benefit producers, eliminating spaces for speculation.

In order to establish a link with international entities, it is necessary to foresee the conditions in which these activities must be carried out for the benefit of all associates. In this context, the representativeness of the board is essential to constitute contractual commitments on behalf of the Productive and Commercial Management Unit. For this, a commercial strategy must be defined that allows positioning the Chilean camelid fiber in current and potential markets; it is required to carry out relevant activities, such as:

Market research for fine fibers from wild and domestic camelids. Formation of a database of clients and commercial contacts. Definition of a short- and medium-term marketing program. Make commercial visits. Implement workshops with producers for the definition and consensus of the commercial strategy and for the analysis of the profitability of the productive units associated with the defined strategy.

Issues to be Resolved

Management scope:

Summon financial resources for the development of new products and investments in fixed assets for the base organizations of the Management Unit. Obtaining financial resources for the productive and commercial consolidation of the Management Unit.

Economic scope:

It is essential to have operational financing and a commercial chain, which allows to adequately absorb the increase and incorporation of new production costs involved in the production process (handling of the vicuña, cleaning, shearing and classification of the fiber).

Technical and regulatory scope:

Advance in reproductive biotechnology studies, to establish and accelerate fiber quality (length and fineness), through selection and genetic improvement. Lack of application of regulations that regulate the management and structure of the production modules in corral, in order to generate all the necessary conditions for the system and evaluate its sustainability and profitability in that framework. In short, it is necessary to strengthen the lines of applied research and the technological and normative transfer, which allow to "validate" the productive, reproductive and commercial stock of vicuña fiber in captivity.

Conclusion

In conclusion, aspects such as productive and reproductive management, marketing, organizational management and techniques to improve the fertility of vicuña production systems in silvstry and semi-captivity make up a set of technological packages that were not available prior to the implementation of the precursor projects. These make it possible to generate greater profitability of the system in the Aymara communities by positioning vicuña fiber in the national and international market as an exclusive, high-quality fiber.

In terms of economic and social benefits, the development of the Model generated a new economic alternative for the high Andean population and in many cases a complement to family income. It also generated a revaluation of the land and a space for the younger population of the community to return to their villages and practice their traditions, while establishing a flow of information that had been lost, such as the transmission of experiences and knowledge of the older members of the community.

It should be noted that a model for wildlife harvesting was generated, which provides key elements that can be applied to models for harvesting other species in highly fragile natural environments. Future lines of research should focus on the activation of young social capital in Andean communities, developing new strategies for collective development, especially to make sustainable use of the natural and cultural resources and raw materials of the Chilean altiplano.

Finally, it is expected that this updated analysis will result in a set of project and business options that are feasible from the point of view of their profitability and that generate other technical and commercial results, especially to promote the economic development of the indigenous communities of the Arica and Parinacota Region.

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