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A CASE STUDY IN FRANCE AND BRAZIL**

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► **To cite this version:**

M. Derville, J. Bonnemaire. MARGINALISATION OF YAK HERDERS IN BHUTAN: CAN PUBLIC POLICY GENERATE NEW STABILITIES THAT CAN SUPPORT THE TRANSFORMATION OF THEIR SKILLS AND ORGANISATIONS? AND BONDS TO TERRITORIES: A CASE STUDY IN FRANCE AND BRAZIL. ISDA 2010, Jun 2010, Montpellier, France. 10 p. hal-00522045

HAL Id: hal-00522045

<https://hal.science/hal-00522045v1>

Submitted on 29 Sep 2010

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MARGINALISATION OF YAK HERDERS IN BHUTAN:

CAN PUBLIC POLICY GENERATE NEW STABILITIES THAT CAN SUPPORT THE TRANSFORMATION OF THEIR SKILLS AND ORGANISATIONS?

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Abstract — Bhutan is a small Himalayan Monarchy populated with 672,425 inhabitants and located between the subtropical Indian plains and the Tibetan plateau. The yak herders (less than 5% of the population) occupy the Northern belt of the country, alpine region ranging between 2,500 and 6,000m. Yaks ensure their livelihoods with the provision of manure, draught power, meat, hair and dairy products and the possibility to barter the surplus with grains, salt, tools or clothes.

Until the 50's Bhutan was still a feudal state isolated from the rest of the world. An original approach to development was put in place to modernise the economy, prioritizing the growth national happiness over Growth Domestic Product. This communication questions the capacity of this development strategy to prevent the marginalisation of yak herding taking place elsewhere in the world. It highlights the footing of the traditional yak farming systems, presents the driving forces of modernisation and analyses as a transfer of complexity the resulting pressures on the yak herding resources and social linkages.

It appears that the Bhutanese middle path for development may have prolonged the existence of the yak farming system. Yet it failed so far to create a stable environment able to support the transformation of the herders' skills and organisations and to stabilise their income. Just as it benefited some mountainous areas in Europe, it seems worth investigating the opportunity to add value and to restore the image of the herding activity through a work on the quality of the yak products.

Key words : development, highland farming system, supply chain, public policy

Résumé — Le Bhoutan s'étend des plaines subtropicales indiennes au plateau tibétain ; c'est un petit royaume peuplé de 672 425 habitants. Les éleveurs de yaks (moins de 5% de la population) occupent la frange Nord du pays à une altitude comprise entre 2 500 et 6 000 m. Fumier, force de traction, viande, laine, produits laitiers et troc des surplus contre des céréales assurent la subsistance des éleveurs.

Il y a 50 ans le Bhoutan était encore un état médiéval isolé du reste du monde. Une voie originale de développement, privilégiant la croissance du bonheur brut sur celle du produit intérieur brut, a ensuite été mise en œuvre pour moderniser le pays. La présente communication s'interroge sur la capacité de cette stratégie de développement à prévenir la marginalisation des éleveurs de yak. Elle met en évidence le fonctionnement des systèmes traditionnels d'élevage, présente leur ressource et insertion sociale et analyse les pressions exercées par le changement de contexte économique et politique comme un transfert de complexité.

Il apparaît que la voie du milieu choisie par le Bhoutan a probablement prolongé l'existence de ces systèmes d'élevage mais qu'elle a échoué, à ce jour, à créer un environnement stable capable de soutenir l'adaptation des compétences et organisations des éleveurs. S'appuyant sur l'expérience acquise dans les montagnes européennes, la communication conclut sur la pertinence d'une approche systémique centrée sur la valorisation des produits pour restaurer la capacité d'innovation des éleveurs de yaks et la réputation de leurs produits.

Mots clés : développement, système d'élevage, filière, politique publique

INTRODUCTION

Bhutan is a small Himalayan country of 38 394 km² populated with 672 425 inhabitants. It spreads over 150 km from the subtropical Assamese and Bengali plains (150 m) to the Great

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Himalaya (7300m) close to the Tibetan plateau. Bhutan long remained isolated from the rest of the world. The traditional economy was based on agriculture and livestock; there was no merchant class. Since the beginning of the 60's, Bhutan has undertaken a development policy, a private sector is emerging and the exchanges are becoming increasingly monetized. Yet barter is still practiced in remote locations, among them yak herding areas.

Yak herding concerns a limited share of the Bhutanese population, less than 1400 households, a yak population of 48 400 heads and less than 3% of the market shares of meat, butter and cheese. Yak herders are scattered and isolated. Not connected by road, with no access to electricity and limited access to education, healthcare or extension services, they did not benefit much from the modernisation of the economy.

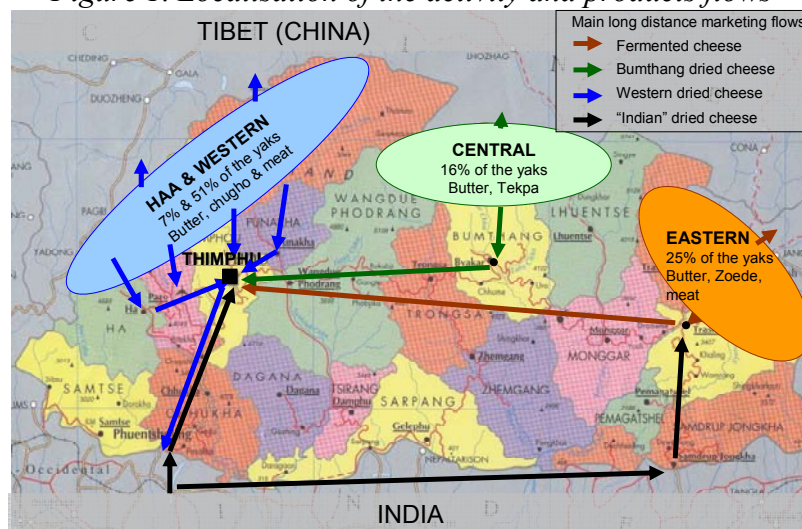
The objective of this communication is three fold: to highlight the skills and organisations on which the traditional systems were based, to analyse the driving forces of change and to point at ways for the public policy to support the adaptation of the yak farming systems to the new economic context. The analysis is based on twelve months of field work, spread over four years and 200 interviews of economic operators, consumers and institutional players. Considering the limited number of references available, the quantitative data collected enabled a first characterization of the farming systems and their corresponding value chains. The dynamics at stake in the different yak herding regions and the strategies of the economic and political players were also assessed through open interviews.

1. YAK HERDING IN BHUTAN, A COMPLEX LIVESTOCK SYSTEM

1.1. Overview of the yak rearing practices

The yak (*Bos grunniens*) is a herbivore that lives predominantly in the Himalayan range and in the Qinghai-Tibetan Plateau, in alpine and sub-alpine regions at altitudes ranging from 2500 to 6000 m with a cold, semi-humid climate. In Bhutan, yak rearing is practiced in ten of the northern districts.

Figure 1. Localisation of the activity and products flows



Source: Based Bhutan DIT map

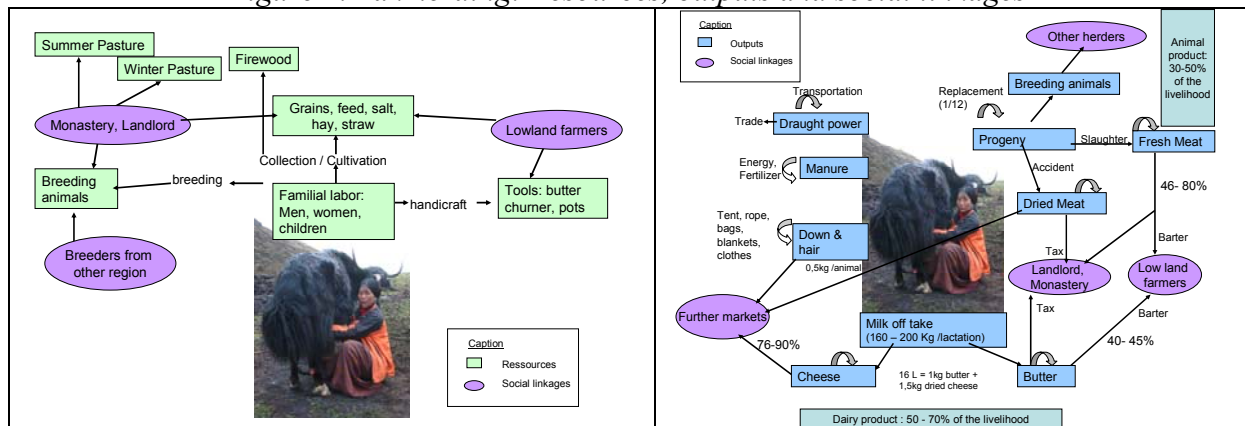
Yaks are multi purposes' animals that provide the herders with animal protein and fat in the form of milk and meat, as well as with draught power and manure. Milk is further processed into butter and skimmed milked cheese, dried or fermented and can be stored in these forms for months.

Traditionally the whole family (children played a key role to look after the yaks while grazing) migrated with the herd, from the winter settlement to the summer pastures. A herd of 30 yaks -10 females and 5 calving per year- is providing, with a production of roughly 100kg of butter, 160kg of cheese and the possibility to slaughter a yak every alternate year, the livelihood of an extended family. Yak herding is a seasonal activity. Most calving take place in spring and milk off take reaches its peak in July- August. The herders spend their summer, milking,

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processing butter and cheese and collecting grasses to make hay. Falls is dedicated to products trading. Animals are also slaughtered at this time when their condition is at best (FAO, 2003). In winter the workload decreases, time is spent feeding the weak animals.

Figure 2. Yak herding: Resources, outputs and social linkages

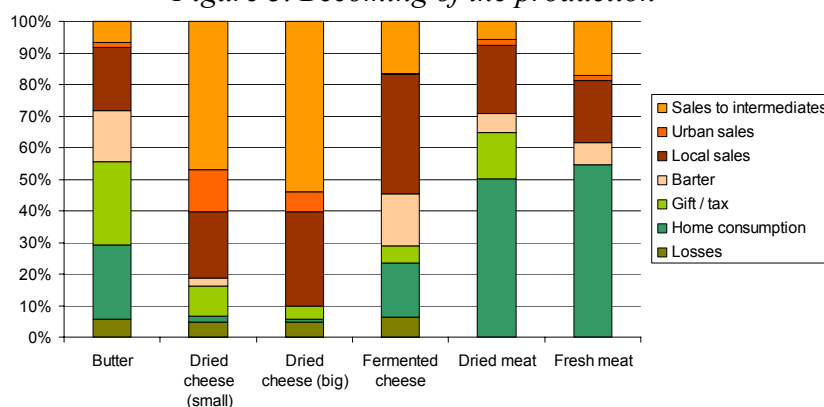


1.2. Social linkages

As a result of the in kind taxation system that persisted until 1956, it was not worth for private people to rear animals for their own purpose. In the 60's, 50% of the yak population belonged to Monk bodies and rich owners (Dr. Gyamtsho P., Personal communication, 2009). The herders were hired by these owners to look after their large herds (60- 200 animals). A variety of agreement existed, defining the owner of the progeny and the quantity of products to be handed over. The right to look after the herd was transmissible. The herders were allowed to rear their own small herd along with the one of the owner. Until now, yak sharing is practiced and a large share of the rangelands grazing rights is registered in the name of monastic bodies, royal families, and other absentee owners.

Depending on the products, 10 – 65% of the production is home consumed or handed over to the owner (especially for butter and dried meat) (Fig. 3). The surplus was traditionally bartered against grains, salt, tools or clothing. Butter and meat were traditionally exchanged locally while cheeses could be taken to further market, India notably.

Figure 3. Becoming of the production



Source: Surveys conducted in 2007

The barter system was more than just a way to exchange food items. It corresponded to a strong social bond that contributed to ensure food safety in the rural area. The host was more than a trade partner, he was considered in some way as a family member that you could occasionally ask for support. This system played as a buffer among individuals and ecosystems.

1.3. Diversity of yak farming systems

Three yak types have been genetically differentiated: western, central and eastern (Dr Dorji T., 2002). This genetic differentiation corresponds to different breeding practices: whereas in

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western Bhutan, yaks reared are pure bred, they are hybridised with cattle in Eastern (53% of the yak population) and to some extent in Central Bhutan. The hybridisation practice leads to a 200% increase in milk productivity (1L/day at the lactation peak for a pure female yak to 3L/day for a hybrid). The willingness to slaughter animals and the type of cheese processed are other differentiating practices. The presence of agricultural land in the extended family and the manpower availability are other factors that impact the production level of the rearing activity as well as the opportunity to venture into other businesses. Based on these criteria we are distinguishing four yak farming systems: Haa, Western, Central and Eastern.

Table 1. Comparison of the yak farming systems

Systems	Resources	Outputs	Main markets	Other sources of income	Trends (2000-08)
Haa 3 counties 15 surveys	3 583 yaks 0 hybrid Community pasture played on dice	- Butter - Dried cheese (big) - Breeding animals - Animal for slaughter	Paro for butter, India for dried cheese	- Trade with Tibet - Agricultural land	- Strong decline of the number of owners (-60%) as well as of the population over the last 3 years
Western 13 counties 30 surveys	24,898 yaks 0 hybrid 45% of grazing rights belonging to monasteries	- Butter - Dried cheese (big) - Dried cheese (small) - Fresh cheese - Animal for slaughter	Paro and Thimphu	- Medicinal plants - Trade with Tibet - Tourism	- Increase of the yak population (+30%) - Some purchase of agricultural land
Central 9 counties 23 surveys	7,750 yaks few hybrids Community pasture	- Butter - Dried cheese (small) - Hair products	Bumthang	- Medicinal plants - Agricultural land - Logging	- Stabilisation after a decline (00-05) of the yak population, - the activity disappeared from some geogs (Shinkar, Ura, Tang)
Eastern 6 counties 30 surveys	12,169 yaks 50% hybrids Community pasture, Conflict with farmers for the winter pasture	- Butter - Fermented cheese - Hair products - Meat	Villages in the low land, Trashigan g	- Trade with India, - Weaving - Sheep rearing - Tourism	- Growth of the yak population (+60%) and stabilisation (06-08) - Pressure on the fodder and genetic resources - District project to increase the value of the products

Source: Census data 2008 and Surveys conducted in 2006, 2007, 2009

Within each system, the size of the herd, the status of the animals (shared or not) and the manpower availability have an impact on the marketing channels as well as on the profitability of the activity.

Considering this diversity of the situations, it is expected that the modernisation of the economy will have a differentiated impact on the systems.

2. THE MIDDLE PATH FOR DEVELOPMENT IS DESTABILISING THE YAK FARMING SYSTEMS

In 1961 Bhutan embarked on the path to modernization with a specific approach to development based on four pillars: good governance, economic development, Buddhist tradition preservation, protection of the environment. In 1987, the King, Jigme Singyue Wangchuck expressed in those terms "I am more interested by Growth National Happiness than by Growth National Products" (Pommaret, 2000). Is this original policy framework able to balance the impact of modernisation and prevent the marginalization of the yak herders taking place elsewhere in the world?

2.1. The middle path for development as factor of changes for the yak herders

To discuss this point we will present the main driving forces resulting from the four pillars of the middle path for development and, impacting the herding activity.

2.1.1. Political driving forces

The third king put an end to serfdom (1956) as well as to the heavy in kind taxation system and set the country with a legislative framework. The monarchy has then been gradually equipped with democratic institutions: community and national assembly (1981) as well as district assembly (1991) where Bhutanese can make proposals and where governmental decisions are explained (Pommaret, 2000). In 2008, with the adoption of a constitution Bhutan became a parliamentary monarchy with an elected prime minister. Yet, the memory of the feudal society is still vivid and the rural communities tend to respect the decision taken by wealthy people, monk bodies or civil servants rather than actively taking part in them. Bhutan has made the choice to preserve its culture and tradition, Buddhism is even gaining in resonance; the slaughter of animals and consumption of meat that didn't die from natural causes is getting more and more stigmatised.

Bhutan has set up over the year a strong environmental policy: the constitution states that the forest must cover at least 60% of the territory and in 2008, 50% of the country was falling under protected areas, including most of the rangelands where the herders graze their yaks. If this conservation policy may have protected the natural resources, the ban of fire (1969), the control over the forest resources and the interdiction to kill wildlife are interfering with the traditional herders' management practices.

2.1.2. Economic driving forces





Bhutan is a small but fast growing economy. The growth rate averaged 7-8% over the last two decades. The GDP per capita has risen from US\$ 239 in 1980 to US\$ 1523 in 2006 (Tobgay, S, 2010). The main resources are hydropower, mineral extraction, tourism and, international aid. They have enabled the establishment of a well fare state -education, health extension services have been created- and lead to an increase in the life expectancy (from 37.5 years in 1960 to 66.3 in 2008).

Yet the development is not even over the country. It benefits mostly urban and peri-urban areas. The urban population is expected to grow at a rate of 6.75% for the 10 next year while the rural population will slowly decline (Dixie G., 2006). So far imports have largely benefited from the growth of the urban market; dairy imports have increased 5 fold over the last 10 years to reach 3300 MT in 2008¹. Imports satisfy around 7% of the cheese demand, 28% of the butter demand, 83% of the milk demand (Dervillé M, 2006) and, 75% of the beef demand (Tobgay S., 2010). Meat imports have somehow enabled the Bhutanese to balance their taste for meat along with their spirituality. As far as dairy products are concerned, two reasons, as illustrated by the figure 4, may explain the substitution process:

- the cheaper price of the imported and cattle dairy products,
- the standardised quality of the products: imported products are industrialised products that meet the codex alimentarius standards. Imported products come along with information related to quantity, fat content, solid non fat, expiry date; their harmlessness to health is guaranteed. In addition, they are more convenient: pasteurised, nicely packaged and they have an extended shelf life.

¹ Bhutan Trade statistics, Ministry of Finance, Department of Revenue and customs (<http://www.mof.gov.bt>)

Figure 4. Range of butter available on the Bhutanese market

Imported industrial Butter	Local cattle butter	Cooperative cattle butter	Yak butter
			
Pasteurized branded product, various size, 12 months shelf life	Butter extracted after milk fermentation, 500g or 1kg packing, 3-9 days shelf life	Pasteurized cream butter, packed in butter paper, 2-3 months shelf life	Butter extracted after milk fermentation, sold after few month storage, wrapped in newspaper or clothe
MRP: US\$/ kg 2.8	MRP: US\$/kg 3.4 -5	MRP: US\$/kg 4.8-5.5	MRP: US\$/kg 4.4-6.6

Source: Surveys conducted in 2009

The market of imported products is getting institutionalised under the control of the state² and supermarkets, while the market of local products remains largely informal under the control of the communities. Yet, with the urbanisation and the extension of the marketing chains, direct contact, friendship, familial linkages are not always able to garant the food security and to gain consumers' trust. The food system is changing and farmers need to get organised to access urban markets. If few hundreds of farmers in the vicinity of urban areas have benefited from the technical and institutionnal support from the Ministry of Agriculture, remote farmers remain largely excluded from productivity gains and value addition processes. The centralised approach to tourism³ of the Bhutanese government is not benefiting much the rural communities either; it resulted in a concentration of the profits in the hand of few tour operators of cities from western and central Bhutan Paro, Thimphu and Bumthang. Theses political and economic driving forces are putting pressures on the systems' footing corresponding to a transfer of complexity.

2.2. The resulting transfer of complexity for the yak farming systems

2.2.1. Modification the resources' availability

The development of the horses' population for trekking and trade, together with the sedentarisation of the cattle farming systems, has lead to an increasing competition over winter pasture (Fig 5). In addition, the access to genetic resources has been hampered by the closing of the border with China as well as by the livestock policy limiting the transfer of yaks between regions.

The development of education has lead to a decrease in the manpower availability not compensated by productivity gains through technical innovation. As a result, it is not rare that one sole family member looks after the herd, reducing the productivity of the activity and putting at risk its sustainability.

Finally the social network in which the yak herders are embedded is evolving: landlords are gradually loosing interest in farming activities; with the decline of barter the solidarities

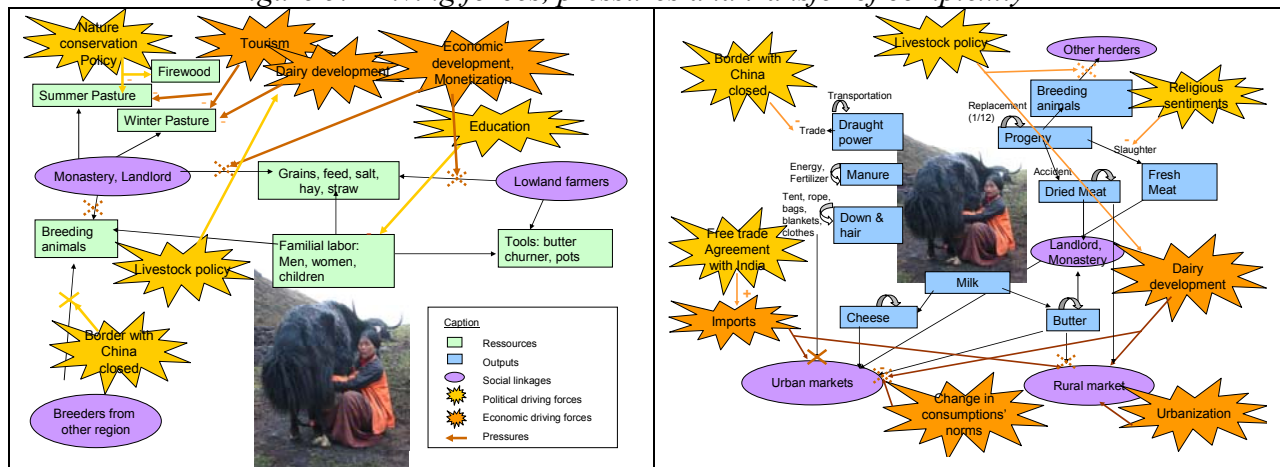
² The Bhutan Agriculture and Food Regulatory Authority (BAFRA) was established in 2000 as a perpetual, public-sector instrument to promote the quality and safety of goods and products related to the Ministry of Agriculture.

³ The Royal Government of Bhutan operates international tourism through a centralised system charging a minimum daily tariff of US\$ 200. After deducting a royalty of 65 US\$ and taxes, the government transfers the remaining amount to a local tour operator that organizes an all-inclusive package for the visitors (Ritsma and al, 2009). There are 254 operating tour operators according to 2008 data out of which 30 cater to the 72% of the total (27,636 in 2008) tourist arrivals (Tashi Dorji, personal communication, 2009).

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between lowland farmers and herders are fading, and the yak herders do not really have the political capacity yet to set new collective projects.

Figure 5. Driving forces, pressures and transfer of complexity



2.2.2. Reduction of the outputs' marketing value

Yak products used to be appreciated as delicacies in the traditional food system, served for guests or at the occasion of religious ceremonies. They were even considered to have medicinal value as yaks graze on medicinal plants. Nevertheless, the remoteness of the herders, the backward image they have has led to a depreciation of the reputation of the products. With the rise of health consciousness, they have even been associated with sinusitis and pressure problems. Butter is particularly affected as many cheaper substitutes are available on the market (fig 4). If it is still used by rural consumers to make butter tea and religious sculpture, urban consumers barely consume any. Its marketing value (in rice) has gone down. Yak cheese is still appreciated but suffers from an unorganised supply. The supply of meat is hampered by the growing religious sentiments. The traditional yak hair and down industry has nearly been wiped out by imports of clothes and sheep wool.

With summer pasture 10 days walk from the road head and winter pasture one to 3 days walk, the yak herders have a limited access to urban markets and social services, they didn't benefit much from the modernisation of the economy, rather, their future is threatened by the competition over the resources and on the markets.

2.2.3. Changes in the complementary sources of income

The political changes have reopened two seasonal complementary sources of income for the herders - cordyceps collection⁴ and trade with China - and created a new one –tourism. As the access to the latest is limited⁵, the second only tolerated and the first one hazardous, most of the herders still consider the yak herd as the most reliable source of livelihood. Yet the higher return to familial labour of these alternative sources of income (Fig. 6) is changing

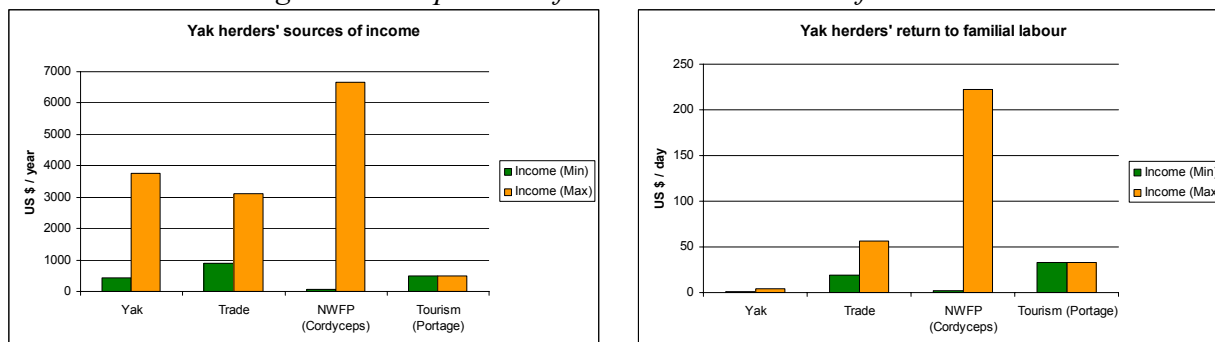
⁴ Cordyceps sinensis, or fungus caterpillar, is the result of a parasitic relationship between the fungus *Cordyceps* and the larva of the ghost moth (*Thitarodes*): Its use has a long history in Traditional Chinese medicine as well as Traditional Tibetan medicine. It grows on the Tibetan Plateau (Tibet, Qinghai, West-Sichuan, SW-Gansu & NW Yunnan), and in the Himalayas (India, Nepal, Bhutan) (Wikipedia, 2009). The value of cordyceps, "Dbyar rtswa dgun'bu" (Tibetan name) has increased 8 fold between 1998 and 2008 at an average annual of 22.8 %, from an average price of Yen 4800 (US\$ 54) per pound to an average price of Yen 40 000 (US\$ 450) (Winkler, 2008). Increasing price and demand have lead to a commoditization of the "Dbyar rtswa dgun'bu" which is now estimated to represent 40% of the rural income in Tibet (Winkler, 2008).

⁵ Despite the fact that yaks are emblematic animals appreciated by trekkers, less than 5% of the herders interviewed mentioned earning money this way. Like most rural communities, the yak herding communities do not benefit directly from tourism.

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the long term perception and investment strategy of the herders. The money earned is rarely reinvested in the herd: the herders buy houses and agricultural land in the valley, they save their money in the bank in provision of the education of their children.

Figure 6. Comparison of the herders' sources of income



Source: surveys conducted in 2009

The legalization of cordyceps -Chinese medicine sold at gold price- in 2004 has been a strong factor of change: during the month of harvest (15th May- 15th June) the herders often stop looking after their animals and, the money earned this way may constitute a capital sufficient to quit yak herding and venture into other full time activities.

2.3. Transformations at stake in the four yak farming systems

The decline of the herding activity seems the fastest, in areas where animals were not slaughtered for meat (Central) and where the family traditionally has agricultural land in the valley (Central and Haa) guaranteeing an easier access to social services and economic opportunities. As a result, most of the communities have stopped yak rearing in Bumthang district (Dr. Roder, personal communication, 2009) and only 10% of households are still having yaks in Haa whereas they used to be 60% ten years ago (personal discussion with village heads, 2009). Even in western Bhutan, where the dependency on the herding activity is higher and where some herders still invest in the activity purchasing animals from neighbouring areas, others have started to invest in agricultural land in the valley. In Eastern Bhutan, more populated and poorest part of the country, economic alternatives are scarce, cordyceps is not available. Pressures on the fodder, as well as on the animal resources (back cross not always completed leading to a decline in the animal productivity) are strong. The herding community remains vivid but ways to add value and create employment opportunities need to be found.

In a way a middle path for the herders' community may have been reached in Bhutan, between economic integration as it has happened in some part of China (Goldstein, 1989) and forget as in Ladakh where the herders sell out their yak to Muslims' butcher to settle down in Leh (Jest, personal communication, 2009)...Yet much is left to be done to prevent the decline of the activity.

Yak rearing communities lack a long term coherent policy that examines the problems faced by the yak herders of different farming systems from every angle. The following section is exploring few possibilities.

3. LEARNING FROM THE EUROPEAN EXPERIENCE TO SUPPORT THE EMERGENCE OF NEW STABILITIES

The Bhutanese planning commission and the ministry of agriculture are aware that something needs to be done to preserve the attractiveness of the activity. The aim, as reported by the Minister of Agriculture, is "not to keep everyone up there but to support the development of economically viable businesses". The undergoing reform of the rangeland status, aiming at a privatization of the rangeland usage, goes in this direction. Yet yak herding may be best practiced as a community (Goldstein, 1989) and, the experiences of

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mountain farming in Europe show that maintaining enough inhabitants in the highlands, through the continuation of the dairy activity, is required to prevent from depopulation (Barjolle, 2010).

3.1. Using a systemic approach to development

Livestock farming is a “total social reality” (Digard et al., 1993, quoted by Bonnemaire et al 2004) that requires an integrative approach. Approaches that explain causes of phenomena must link with approaches that focus on the motivations and rationales of stakeholders. In this perspective, livestock farming approaches may be developed for Bhutan’s mountains leading to systems that are more “viable, liveable and reproducible”. This can occur if efforts are made to enhance the value of biomass resources as well as the heritage of cultural, professional and ecological understanding that livestock-based cultures have accumulated over generations of animal husbandry (Bonnemaire et al 2004).

3.2. Re-enchanting the yak products

Just as it benefited some mountainous areas in Europe, it seems worth investigating the opportunity to add value and to restore the image of the herding activity through a work on the quality of the yak products; butter and cheese to start with. The low productivity of the herding activity, the fact that the production is scattered leading to high transportation and marketing costs makes indeed price competition for yak products impractical. It calls for high-end market segmentation which should be possible considering the limited volume produced (estimates based on the surveys: ~120 MT butter, ~250 MT cheese and, ~ 200 MT meat). Local fresh, hygienic, well packaged cattle dairy products supplied to supermarkets with the support of government or through private initiatives are selling like hotcakes. Similarly, yak products could be adapted to meet the expectations of the middle and high end urban consumers. Two strategies can be implemented and combined:

- research and promotion⁶ of the specificity of yak products;
- improvement of the functionality of the products.

Developing a voluntary certification guaranteeing few basic technical requirements (place of fabrication, date of processing and expected shelf-life, weight, level of pathogens respecting Indian standards) accompanied by a modernisation of the packaging would already be a way to differentiate the products and, to stabilise / increase the income of the herders. The strengthening the supply chain would also be required to support this market segmentation.

3.3. Supporting income diversification compatible with sustainable yak herding

To turn tourism into a real source of income for the herders, two political measures could be taken: a small share of the daily tariff could be handed over to the communities visited and the tour operator could be encouraged to use yaks or herders’ ponies on trekking roads. The sell of yak products to the tourists could be promoted as well: yak hair products in tourists’ shop, yak dinner in hotels, fresh dairy products with trekkers...

To ensure the sustainability of cordyceps resources as well as its compatibility with yak herding, the herding communities could be given the responsibility to overlook the collection; some of the profit could even be reinvested collectively.

3.4. Enhancing the capacity of the stakeholders

Experiences of collective development through products’ certification conducted in the world tend to demonstrate that the key to success is the motivation of the stakeholders. In order to help the yak herders and owners as well as the development agencies to take the best decisions for the future development of yak herding, it would be interesting to create “a

⁶ It is likely that yak products have an interesting fatty acid composition with a higher linoleic acid content than the one of cattle products as demonstrated for cheese (Or Rashid and al, 2008). Beyond these characteristics, considering the Bhutanese attachment to tradition, it is likely that ethnic attributes could be promoted as well.

space” for the yak herding communities to debate. Yak herders and owners should be given the opportunity to participate to the debate on the rangelands status; they should be invited to share their point of view on the best ways to benefit from tourism as well as on the way to improve the marketability of their products. Yak herders of different communities should be given the opportunity to share their experiences. They should be trained and their awareness raised on quality product marketing and market chains organization. Civil servants should be identified at field and national level (policy, project implementation and research) to follow up the issue of yak herding development. Few urban retailers, meat processors, hotels’ managers and entrepreneurs having activities in the highlands could join this focus group on yak development.

Compared to other countries, the Bhutanese middle path for development may have prolonged the existence of the traditional yak farming systems. Yet it failed so far to create a stable environment able to support the transformation of the herders’ skills and organisations and to stabilise their income. The analysis of the diversity of the yak farming systems has highlighted their complexity and the need for a systemic approach to research, policy and development. It highlighted as well the pressures put on the herding systems by the political and economic driving forces. Yet the limited number of surveys conducted over a wide range of ecosystems and communities, the absence of reliable long term quantitative data limit the reach of the study. More in depth research on the transformation over time of the farming and agro-food systems would facilitate the emergence of product, technical, organisational and institutional innovations required by the herders to ensure their sustainable development.

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