The economics of pastoralism In Argentina, Chad and Mongolia

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A partnership between

Study carried out by:

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Executive summary

Background and context

Pastoralists are a collective of several hundred million livestock keepers distributed all over the world whose unique livelihoods face challenges that are often linked to the environment in which they live and to the mobility that characterizes them. Pastoralists are the main producers in the world's drylands, mountains and cold areas. Governments often neglect to invest and provide public services and tenure security in rangelands, and private actors are not really keen to be strongly involved. This results from a lack of knowledge and awareness about integrated landscape management within national and local governments, the private sector, and civil society actors. Knowledge about the real contribution of pastoralists to territorial, regional and national economies has yet to percolate down to more national and local actors. One reason is that many integrated landscape management programs lack strong monitoring and evaluation components, especially ones that could be used beyond the household or community scale, making the social, economic and environmental assessment of benefits difficult.

To fill this gap, CIRAD was commissioned by the FAO to support pastoral organizations in Argentina, Chad and Mongolia in collecting and analyzing primary data, provide new insights into the economics of pastoralism, and assess the contribution of pastoralism to national GDPs. To add a more dynamic analysis, CIRAD proposed to identify what stakeholders perceive to be the main shocks impacting pastoral systems in Argentina and Mongolia and the main adaptation and coping strategies implemented by pastoralists to cope with these disturbances.

How was the study carried out?

The study is based on the elaboration of conceptual frameworks for the determination of income and production costs, the analysis of shocks and strategies, and the analysis of economic contributions. These different frameworks were designed to be appropriate and adapted to the intrinsic characteristics of pastoralism in Argentina, Chad and Mongolia. A preliminary step consisted of identifying pastoralists through a census conducted under the impetus of the FAO. For this study, part of this census work was used, and triangulations with information provided by pastoral organizations and national censuses were made to determine the sample of households to be surveyed. Two sampling targets were set based on the capacity of the pastoral organizations to carry out the surveys within the existing time and cost constraints. The main technical constraint was to remain within a margin of error of less than 5% in accordance with standard statistical approaches. Finally, we analyzed data collected on 1,197 pastoral households in Argentina, 803 in Chad, and 765 in Mongolia.

Detailed questionnaires were developed and administered to the households in the samples. Data collection was carried out using tablets and sometimes in paper format due to poor internet connections. Data were then routed to the Open Foris server based at FAO in Rome. This process made it possible to monitor the information collection process on a day-to-day basis and to make certain adjustments. CIRAD was in charge of extracting the information required for the analysis, and of ensuring the accuracy and integrity of this information. Finally, income and cost analyses were elaborated, economic contributions were identified using value-added and production approaches, and shocks as well as adaptation and coping strategies were examined from the perspective of the actors involved.

Main findings

Rapid investigations among pastoral households allowed an idea of the average composition of a household's herd. In Argentina, a pastoral household has 65 Livestock Standard Units (LSU), the equivalent of 30 cattle, 14 camelids, 35 sheep, 137 goats, 11 donkeys, 12 horses and 13 pigs. In Chad, a pastoral household has on average 192 Tropical Livestock Units (TLU), meaning 102 cattle, 36 camels, 73 sheep, 45 goats, 9 donkeys, and 7 horses. In Mongolia, the average animal ownership for a pastoral household is 78 LSU or 757 equivalent sheep, meaning 29 cattle (including yaks), 2 camels, 193 sheep, 173 goats, 19 horses, and 13 mares.

The average annual gross revenue in pastoral and agropastoral areas is estimated in Argentina at Argentinian Peso (ARS) 577,927 (equivalent to US$20,574[1]); in Chad at 3,030,760 XAF (equivalent to US$5,454); and in Mongolia at Mongolian Tughrik (MNT) 11.8 million (equivalent to US$4,773). Overall, the average gross revenue is provided by livestock product sales (37% in Argentina, 54% in Chad and 74% in Mongolia), other monetary revenue including off-

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[1] In 2018: 1 US$ = 28.09 ARS; 1 US$ = 2,472.48 MNT; 1 US$ = 555.72 XAF
(https://data.worldbank.org/indicator/PA.NUS.FCRF?locations=RU;)

farm revenue (28% in Argentina, 16% in Chad and 16% in Mongolia) and household self-consumption (35% in Argentina, 30% in Chad and 10% in Mongolia). The breakdown of the gross revenue allows one to see strong regional disparities of the sources of revenue in the three countries. The diversified sources of revenue and the importance of self-consumption in household economies also indicate that pastoral systems fulfill a range of functions, serving as a source of income, food security, and flexible labor. In addition, as poverty analyses mainly take an absolute poverty approach, which considers the essential nutritional needs of individuals, incorporating self-consumption becomes relevant to improve current figures about poverty in pastoral regions, particularly in Chad. This also reflects the difficulties in carrying out analyses of household poverty in pastoral systems.

Annual average production costs amount to ARS 52,682 (US$1,875) in Argentina; XAF 815,153 (US$1,467) in Chad and MNT 698,653 (US$283) in Mongolia. In Argentina, production costs are dominated by feed purchases (65%) and service charges (18%), whereas in Chad, animal health expenditures and herd restocking constitute the main cost items (27% and 26% respectively). In Mongolia, costs come from the purchase of services (44%) and herd restocking (37%).

Pastoral households in all three countries studied are effectively participating in the creation of national wealth. Even when only their monetary/market outputs are considered, pastoralists contribute 0.6% of the GDP in Argentina, 11% of the GDP in Chad and 9.6% of the GDP in Mongolia. By incorporating self-consumption as an important component of gross revenue, the contribution of the same households jumps to 1.4% of the GDP in Argentina, 27% of the GDP in Chad and 11.9% of the GDP in Mongolia. Given the importance of self-consumption, particularly in Argentina and Chad, the contribution of pastoralists to national economies appears to be underestimated. This leads to two problems:

- One is linked to the temporality of income and production costs, which negatively impacts the measurement method of the economic contribution of pastoral households. Indeed, while revenues are calculated on an annual basis, production costs are calculated on a multiannual basis. A quick simulation shows that the contribution of pastoral households declines more or less sharply depending on the average time period animals are held before being sold. This is because the direct production costs related to health, watering, feeding, etc. are repeated during this period.
- The second is linked to the lack of or insufficient incorporation of the multifunctionality of pastoral production systems. The provisioning of other services from pastoral systems are themselves insufficiently measured (biomass production, biodiversity, water cycling, social impacts etc.). The effective measure and integration of ecosystem services into national accounts remains a challenge. To fully address the multifunctionality of pastoralism, we need to assess the condition of ecosystems in relation to human well-being.

Another big challenge in pastoral systems in all three countries is the high level of economic inequalities measured through the tabulation of the Gini index. In Argentina, despite the implementation of successful policies to reduce economic inequalities (improvement of working conditions, both rate of employment and the quality of jobs; incorporation of people without formal labor income into the social security system), the Gini index measured in the pastoralist community remains very high. On the basis of gross revenue, the distribution of revenue in Argentinian pastoral areas is very unequal (Gini index: 56.6%). In Mongolia, the Gini index is 63.1%, reflecting the unequal distribution of gross revenue. In Chad, although the Gini index is relatively lower (48.3%) compared to Argentina and Mongolia, it remains above national averages (44.0%). The main concern related to these high levels of inequality is that they can reflect asymmetric access to productive resources (basic infrastructures and services, natural resources, land use, etc.) and be a source of instability. It should be noted that self-consumption allows a reduction in the level of inequality.

Working with pastoral organizations, households in Chad and Argentina were presented with different shock scenarios and were asked to confirm or deny whether they had experienced one or more of these shocks over a predetermined period of time (the ***previous year for Chad*** and the ***last 15 years for Argentina***). In Argentina, pastoralists report that most of the multifaceted shocks which they are facing affect the entire pastoral sector, and are thus covariate shocks (78%) rather than household level or idiosyncratic shocks (22%). The reverse is true in Chad, where idiosyncratic shocks are the most reported at 51%, with 43% being covariate shocks. The remaining 6% of shocks carried forward are attributable to a combination of various shocks. In this context of important shocks, households in both Argentina and Chad revealed that their most important strategies consist of strengthening their mobility by increasing the frequency and amplitude of livestock movements, and greater recourse to family labor to complement cattle herding and accompany this mobility. In parallel to these two most important strategies, households use complementary strategies, such as other forms of pastoral adjustments (animal sales) and the mobilization of social capital. However, it is worth noting that households never privilege recourse to official aid, thus showing that pastoral and agropastoral households seek to mobilize endogenous strategies based on their own system of actions rather than relying on third parties in the form of grants, subsidies and credits.

Key messages

1. (Agro)pastoral associations greatly contribute to the collection of reliable and accurate data

A lack of reliable data on the full contribution of livestock to the economy remains a great challenge for policymakers. It exacerbates the limited visibility of livestock sectors, thus weakening the argument that more resources should be invested in them. In addition, gaps in knowledge on the needs and future dynamics of pastoral systems lead to biased policies which do not consider the important role that these systems may continue to play for livestock development. In this context, (agro)pastoral associations representing pastoralists locally and regionally have a key role to play by contributing to the collection of reliable and accurate data. Through close and appropriate cooperation with these associations, it is possible and even desirable to use theoretical and methodological economic tools to analyze pastoral realities and put them in perspective with the rest of a national or even a sub-regional economy. The aim is to better integrate herders into the economic system, to which they already contribute by playing a key role in animal protein production and by implementing management practices adapted to environments in disequilibrium. Economic analyses to complement historical, sociological, and anthropological knowledge will enable policymakers to make more incisive and integrative decisions.

The pilot studies implemented in Argentina, Chad and Mongolia provide very promising results as (agro)pastoral associations showed a willingness to commit themselves and a real potential to handle multiple tasks on data collection and management. In addition, their role during policy dialogues was undeniably useful.

2. (Agro)pastoralists use markets and ensure their food security through self-consumption but markets fail to create an enabling environment (infrastructures, policy regulation)

Producers in extensive systems try to secure both productions and livelihoods over time within an overall uncertain context. The objective function of producers in extensive and pastoralist systems is a composite utility function that balances their short-term consumption needs and long-term herd building strategy to meet future consumption (Fadiga, 2009[2]). For these reasons, they participate in a market(s) in an opportunistic way (Wane *et al.*, 2009a[3]). Their motivations for selling animals therefore are key elements that need to be fully understood. Market fundamentals are not the primary drivers, but cultural, social, and non-commercial factors play a significant role in producers' decision to sell. Understanding their consumption logics and their food security strategy indicates to a large extent their relationship to the market. Valuing the production of pastoral households for their own consumption becomes essential in view of its importance in pastoral systems, and the systematic integration of this value into national accounts appears equally important. Pastoralists know markets well, but markets do not know much about pastoralists - and this is one reason that it can be hard for businesses to expand in most pastoral areas, due mainly to a lack of an enabling environment.

3. (Agro)pastoral households generate wealth

Most of the people living in extensive pastoral areas depend on natural resource-based livelihood activities, such as herding and farming, and their capability to generate wealth in a demand-driven context of livestock products is undeniable. They are able to generate wealth because their financial costs of production are relatively limited compared to revenues provided by diverse sales sources.

4. (Agro)pastoral households contribute to national wealth

Their real contribution to national economies remains poorly known because some aspects related, for example, to relatively high levels of self-consumption are not well addressed. There is a need to better assess the environmental costs of pastoral activities from an economic point of view. Moreover, the annual nature of income measures and the multiannual nature of production costs make the assessment of the economic contribution somewhat more difficult to carry out. This consideration can negatively impact the contribution of pastoralists to national

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[2] Fadiga, M.L., 2013. Valuation of Cattle Attributes in the Malian Humid and Sub-Humid Zones and Implications for a Sustainable Management of Endemic Ruminant Live- stock. Environmental Economics 4(1): 2013, 39-50.

[3] Wane, A., Touré, I., Ancey, V., 2009a. Pastoralisme et Recours aux marchés - Cas du Sahel sénégalais (Ferlo), Cahiers de l'Agriculture, Volume 1, Numéro 1, Octobre 2009, 14-20.

economies. However, this can be counterbalanced by the valuation of provisioning services provided by pastoral systems and thus fully integrate their multifunctionality in national accounts.

5. Economic contribution of (agro)pastoral households is threatened by high inequalities due to asymmetric access to productive resources

Widening income inequality is challenging (agro)pastoral systems around the world. The extent of inequality, its drivers, and what to do about it have become some of the issues most hotly debated by policymakers and researchers alike. The relationships between inequality, level of income and stage of development are widely analyzed in the economic literature. Quantitative measures of inequality become both scientific and political challenges for societies regardless of their level of social and economic development, as persistent inequality can threaten sectorial growth, cause investment-reducing political and economic instability, fuel social resentment, populism and protectionism, lead to political instability and raise the risk of crises.
Scant attention has been paid to the importance of livestock activities, through livestock endowment and productive strategies, in the emergence of socioeconomic inequalities in rural societies. Moreover, the majority of the studies carried out in pastoral environments have had an anthropological basis and have postulated a form of social equality in pastoral societies. Pastoral societies often have been regarded as economically egalitarian in view of the random nature of pastoral activity conducted in an uncertain environment and the absence of differences in social status. However, previous measures made in West and East Africa show strong levels of economic inequality (illustrated by high Gini coefficients). These trends can be observed in Argentina, Chad and Mongolia, where unequal distributions of gross revenue result from important disparities in land use and pose the problem of access to economic resources (natural resources, basic social services and infrastructure etc.).

6. (Agro)pastoralists operate in a shock-prone environment. They take advantage of it, prioritizing own-resource based strategies: mobility, family labor, asset sales …

The impacts of multifaceted shocks lead herders to seek adaptation and coping strategies in a shock-prone environment. In such a context, on the one hand they develop adaptation strategies as sustainable long-term strategies (for instance, mobility) that support an adjustment process to cope with current or expected shocks or to take advantage of potential opportunities (for instance, demand-driven context of livestock products). On the other hand, they also use vital and urgent coping strategies as short-term strategies that designate measures to address shocks without accurate planning (for instance, wage-labor of shepherds).

To dispel a myth, the pastoralists interviewed all rely primarily on their own family resources and social capital; they do not consider official support as a preferred strategy.

7. Implementation of the Observatory of (Agro)Pastoralism leading data generation and visualization tool on pastoralism

The results of the studies carried out in the three countries identified the knowledge gap and above all the possibility of improving it through a relevant partnership in which pastoral organizations will have an important role to play in data collection and management. These findings indicate the need and relevancy to implement a socioeconomic and environmental observatory of (Agro)pastoralism in each of the three target countries. The observatories will provide collaborative tools for information sharing, analysis and decision support. Their aim is to present, compare and disseminate socioeconomic and environmental information on (agro)pastoralism.

On the whole, a standard observatory will consist of some basic platforms: a system that aims to characterize and map information through *innovation platforms* to involve all stakeholders in (agro)pastoral livestock production, including pastoral organizations, in a participatory way; *technological platforms* to allow relevant information to be received in or near real-time; and *simulation platforms* to describe major socioeconomic and environmental trends. The objective would be to combine all of these platforms to facilitate simulation, visualization and participation for the detection and mitigation of environmental and socioeconomic crises, as well as the identification of opportunities for improving production systems and livelihoods of (agro)pastoral and livestock stakeholders. In so doing, the observatories should facilitate the implementation of a network of partners dedicated to the development of (agro)pastoralism through the cross mobilization of information and the construction of adapted and appropriate knowledge while favoring the monitoring of changes in (agro)pastoralism, which allows the capitalization of information on the system from a given time.

Introduction

Pastoralism is a global phenomenon. Due to its complexity, it is not easy to provide a comprehensive definition of this polysemous notion. From an economic perspective, pastoral production systems may be defined as those in which at least 50% of gross household income comes from pastoralism or related activities. In other words, pastoralists are people who earn more than 50% of their income from livestock and livestock products derived from rangeland resources. This strict definition can help to distinguish pastoralists from agropastoralists, who derive less than 50% of their income from animals and animal products and most of the remainder from crop cultivation (Swift 1979[4]).

However, a more realistic definition would go beyond this economic perspective by incorporating other important socio-cultural and ecological dimensions.

Pragmatically, we can consider pastoralism as mobile livestock herding in the dimension of either production or livelihood.

Overall, pastoralism is an animal production system that covers some 25% of the world's land area (Blench, 2001[5]). Pastoralists produce food in the harshest environments, but traditionally suffer from being poorly understood, marginalized and excluded from policy dialogues. Pastoral production systems are characterized by their complexity and a structurally asymmetric distribution of resources.

These systems are structured by strong interactions between ecological, social and economic processes, requiring genuine transdisciplinary approaches. The Pastoralist Knowledge Hub (PKH) is an initiative bringing together pastoralists and the main actors working with them to join forces and create synergies for dialogue and pastoralist development.

As part of this initiative, CIRAD was commissioned by the FAO to provide technical and scientific support to a pastoralist-driven data management system project aiming to analyze pastoral household economies and assess their economic contribution to national economies. More specifically, CIRAD is expected to contribute to the analysis of the economics of pastoralism and the contribution of pastoralism to GDP in three target countries: Argentina, Chad and Mongolia.

Based on permanent interactions with pastoral organizations and primary data collection, the survey was organized around an overall synthesis of approaches and methods adapted to the particular context of pastoral activities in the three target countries. For each of these countries, analyses were then carried out concerning revenue generation, revenue distribution, operational costs, direct economic contribution, the economic function of self-consumption, and strategies used by pastoralists to cope with multifaceted shocks. The study also identifies key messages in the form of policy implications appropriate to the characteristics of pastoralism in the target areas.

Strong recognition of the knowledge gaps

The challenge for poor countries with sizable livestock systems in general, and pastoral systems in particular, lies in finding a way to foster more efficient modes of production that meet increasing demand for livestock products while minimizing adverse impacts on the environment and human health and improving the well-being and nutrition of smallholder farmers.

Several pathways can lead to growth in the animal production sector, including genetics, improved animal nutrition and disease control, mitigation of environmental risks, and development of markets and infrastructures. Each country's livestock trajectory will depend on its particular economic, social and institutional characteristics (Thornton, 2010[6]). Whatever the path undertaken, policymakers will face a number of key tradeoffs between competing objectives – e.g., economic development, environmental sustainability, improvements in rural livelihoods, export revenues and/or food security – which will require availability, access to, and utilization of, the best data and methods available.

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[4] Swift, J 1979(a) West African Pastoral Production Systems Institute of Development Studies, University of Sussex and Centre for Research on Economic Development, University of Michigan, Ann Arbor
[5] Blench R., 2001. You can't go home again' Pastoralism in the new millennium, ODI Report, FAO, 106 p.
[6] Thornton, P. K., 2010. Livestock Production: Recent Trends, Future Prospects. Philosophical Transactions of The Royal Society B: Biological Sciences 365 (1554): 2853-2867. https://doi:10.1098/rstb.2010.0134

A lack of, or low quality and unreliable, data inhibits the development of effective livestock and pastoral policies. In their paper, "Investing in the livestock sector: Why good numbers matter", Pica-Ciamarra et al., (2014)[7] argue that livestock and pastoral data collection in developing countries is conducted irregularly and with inappropriate methods, thus missing the opportunity to obtain a reliable baseline for policy formulation. The data that is available to policymakers is usually outdated and scattered. Due to the absence of appropriate methodologies and a lack of consistency between sources and over time, the data that does exist is hard to compare, combine or analyze.

Multiple knowledge gaps limit the potential for policies to address key constraints affecting livestock and pastoral sector policies in the most vulnerable livestock producing countries in Africa and Asia. Empirical analyses of economic contributions of the animal production systems mostly focus on isolated aspects. Several studies in different parts of Africa have, for instance, measured the important effects of livestock sectors on household revenue generation (Little et al., 2001[8]; Wane et al., 2009a[9]), poverty reduction (Pica-Ciamarra, 2005[10]; Alary et al., 2011[11]), sectorial job creation (Wane et al., 2018a[12]), and inter and intra-household inequality reduction (Little et al., 2001[13]; Wane et al., 2009b[14]).

However, comprehensively measuring and modeling animal production systems and their contributions to national or regional wealth creation remains a challenging task. The main knowledge gaps include: lack of accurate and appropriately disaggregated data on the livestock and pastoral production systems; evaluation tools that focus on intensive and commercialized animal production systems while disregarding informal production systems and markets where most transactions occur, and underestimation of indirect effects from livestock Hatfield and Davies (2007)[15] cited by Krätli (2014)[16].

Ignoring the complex and multiple functions of livestock can lead to a serious underestimation of its real contribution to overall national wealth creation. Indirect contributions from livestock include animal traction, manure and self-consumption of animal products. In addition, pastoral systems provide essential, but insufficiently documented, environmental services, such as biomass production, biodiversity, and water cycling, as well as beneficial social impacts.

Several studies have attempted to overcome the above limitations to obtain a reasonable estimate of livestock's contribution to GDP, making significant progress in understanding the economic significance of livestock. In the Sahel, livestock products are an engine of growth and the main vector of regional integration (Inter-Réseaux, 2018[17]). In Mali, livestock contributes about 19% of the country's GDP, and represents the 3rd largest export commodity after gold and cotton (World Bank, 2017[18]). In Mauritania, a sectorial study initiated in 2001 by authorities of the country, the World Bank and FAO, showed that livestock farming generated 15% of the GDP, 75% of the agricultural GDP, and 68.2% of value added in the rural sector (FAO, 2002[19]). The same FAO study assessed the role of capitalization and livestock insurance, especially for the poorest households, as well as the contribution of livestock in terms of fertilizer and

[7] Pica-Ciamarra, U., Baker, D., Morgan, N., Zezza, A., Azzarri, C., Ly, C., Nsiima, L., Nouala, S., Okello, P., Sserugga, J., 2014. Investing in the livestock sector. Why good numbers matter. A sourcebook for decision makers on how to improve livestock data. World Bank Report No: 85732 – GLB. Washington DC: World Bank.

[8] Little, P. D., Smith, K., Cellarius, B.A., Coppock, D.L., Barrett, C., 2001. Avoiding Disaster: Diversification and Risk Management Among East African Herders. Development and Change 32 (3): 401-433. http://doi:10.1111/1467-7660.00211
[9] idem

[10] Pica-Ciamarra, U., 2005. Livestock policies for poverty alleviation: theory and practical evidence from Africa, Asia and Latin America. Working Paper No, 27. FAO Pro-Poor Livestock Policy Initiative

[11] Alary V., Corniaux, C., Gautier, D., 2011. Livestock's contribution to poverty alleviation: How to measure it? World Development, 39 (9): p. 1638-1648

[12] Wane, A., Touré, I., Njiru, N., Mballo. A.D., 2018a. Securing Sahelian pastoralism using a remunerated workforce for livestock for keeping activities: the ambivalence of commodification. Cahiers de l'Agriculture, Vol: 170133
[13] idem

[14] Wane, A., Ancey, V., Touré, I., 2009b. Assets of the Market, Assets of the Rural World - Pastoral Market Income Distribution in the Senegalese Sahel (Ferlo), Journal of Income Distribution, Vol. 18, Number 3-4, September-December 2009, 232-248
[15] Hatfield, R., Davies, J. (eds), 2007. Global Review of the Economics of Pastoralism, WISP and IUCN, Nairobi. https://cmsdata.iucn.org/downloads/global_review_ofthe_economicsof_pastoralism_en.pdf
[16] Krätli S., 2014. If Not Counted Does Not Count? A programmatic reflection on methodology options and gaps in Total Economic Valuation studies of pastoral systems. IIED Issue Paper. IIED, London.
[17] Inter-Réseaux, 2018. Le pastoralisme a t-il encore un avenir en Afrique de l'Ouest ? Grain de seln° 73-74 — juillet 2016 – juin 2017, date de parution : 5 janvier 2018, 44 p.
[18] World Bank, 2017. Mali Livestock Sector Development Support Project (PADEL-M) (P160641), Project Document, 13 p. http://documents.worldbank.org/curated/en/381401487363466910/pdf/ITM00184-P160641-02-17-2017-1487363464632.pdf
[19] FAO, 2002. Etat des lieux des ressources génétiques du secteur dans le secteur de l'élevage. Rapport National sur l'Etat des Ressources Zoo-génétiques, 17 p. http://www.fao.org/docrep/pdf/011/a1250f/annexes/CountryReports/Mauritania.pdf

transportation services. Livestock was found to contribute 24% of household food energy needs, including 4% of protein needs and 84% of lipid requirements. In Eswatini (formerly Swaziland), the beef value chain is estimated to contribute 32% to agricultural GDP, and 2% to GDP, with positive impacts on public finances but a negative impact on the balance of trade (Wane et al., 2018b[20]). In Sudan, livestock and pastoral activities generated between US$14.5 billion and 12.3 billion in 2009 (Behnke and Osman, 2011[21]). In Ethiopia, they provided 80% of exports and a return on investment of between 25 to 30% per year (Behnke and Metaferia, 2011[22]). In Kenya, pastoral systems comprised 70% of herds, with a market value estimated at US$800 million (Republic of Kenya, 2012[23]), and provided 80% of the beef consumed in 2009 (Behnke and Muthami, 2011[24]); while in southwestern Uganda, the pastoral system yields a financial return per hectare of land that is 6.8 times higher than that of the ranching system (Ocaido et al., 2009[25]).

Overall, although important improvements have been made in the measurement of livestock's contribution to GDP, knowledge gaps remain and will require continued efforts to expand this type of work across time and to other low and middle-income countries (LMIC) with substantial livestock sectors. Substantial financial and institutional support will need to be mobilized to allow for costly data collection and calculation. Furthermore, a full and comprehensive accounting of GDP will require a change in paradigms and techniques to allow the overlapping and interdependent contributions of livestock to be captured, and to move away from current methods, which mainly view actors and livelihoods as neatly compartmentalized. Finally, global changes (climate, price variability) and structural constraints imply the need to work at different spatial-temporal scales, considering in-situ and off-site effects, and over a span of several years, in order to obtain representative figures.

The use of appropriate concepts, approaches, methods and tools

Pastoralists in Argentina, Chad and Mongolia have developed adaptive behaviors to make a living in very harsh environment by keeping a mixture of species and various traditional breeds. Pastoral herds include diverse species: cattle, camels, goats, sheep, yaks, horses, donkeys, llamas, alpacas and reindeer. Keeping more than one species allows herders to produce a wider variety of products and manage the asymmetric distribution of natural resources over the year, and in particular during crisis periods. In addition, most economic transactions are realized in an informal manner. Therefore, to produce knowledge about pastoral systems, concepts, approaches and tools must be built that can mediate the intrinsic characteristics of pastoralism.

The main concepts used in this study are revenue, expenditure, and the direct economic contribution of pastoral households, in a static approach within an annual time horizon so that comparisons can be made with more standard indicators such as Gross Domestic Product (GDP). A more dynamic approach also was used more specifically in Argentina and Chad to analyze the multifaceted shocks that pastoral households face and the strategies that they use in priority to deal with vulnerability factors.

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[20] Wane, A., Boureima, F., Ndlovu, F., Morton, J., 2018b. Beef Value Chain Analysis in eSwatini. Report for the European Union, DG-DEVCO. Value Chain Analysis for Development Project (VCA4D CTR 2016/375-804), 127 pages. A Brief Note has been produced by the EU-DEVCO on March 2019.

[21] Behnke, R., Osman H.M., 2011. The contribution of livestock to the Sudanese economy, IGAD LPI Working Paper No 01-12, Djibouti

[22] Behnke, R., Metaferia, F., 2011. The contribution of livestock to the Ethiopian economy – part II. IGAD LPI Working Paper 02-11. Addis Ababa.

[23] Republic of Kenya, 2012. Sessional Paper No. 8 of 2012, on National Policy for the Sustainable Development of Northern Kenya and other Arid Lands, 'Releasing Our Full Potential'. Final 11 October 2012, Ministry of State for Development of Northern Kenya and Other Arid Lands, Republic of Kenya, Nairobi.

[24] Behnke, R., Muthami, D., 2011. The contribution of livestock to the Kenyan economy, IGAD LPI Working

[25] Ocaido, M., Muwazi, R.T., Opuda-Asibo J, 2009. Financial analysis of livestock production systems around Lake Mburo National Park, in South Western Uganda. Livestock Research for Rural Development 21(5), http://www.lrrd.org/lrrd21/5/ocai21070.htm

- *Conceptual framework for pastoral household revenue analysis*

Figure 1– Conceptual framework for household revenue analysis
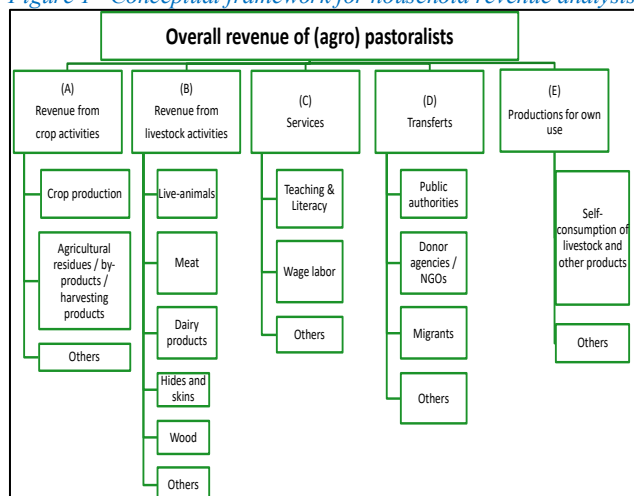
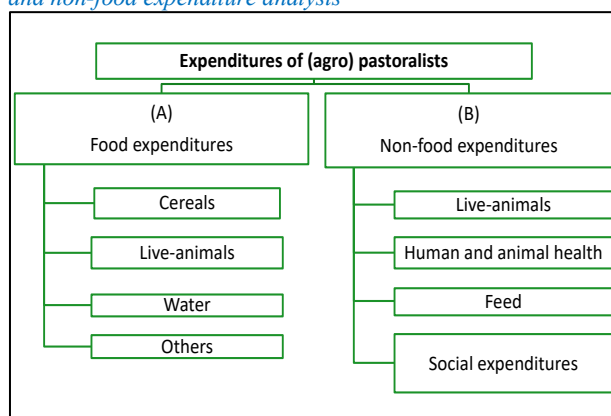**Definition of household revenue (ILO, 2003[26])**

Household revenue consists of all receipts whether monetary or in kind (goods and services) that are received by the household or by individual members of the household at annual or more frequent intervals, but excludes windfall gains and other such irregular and typically one-time receipts. Household revenue receipts are available for current consumption and do not reduce the net worth of the household through a reduction of its cash, the disposal of its other financial or nonfinancial assets or an increase in its liabilities.

Household revenue may be defined as covering: *(i)* revenue from employment (both paid and self-employment); *(ii)* property revenue; *(iii)* revenue from the production of household services for own consumption; and *(iv)* current transfers received.

The terms *revenue* and *income* are often used indiscriminately; however, they are conceptually different. *Revenue* is the total amount of earnings generated by the sale of goods or services related to primary operations. The *revenue* number is the revenue an economic actor generates *before* any expenses are taken out. *Income,* or *net revenue*, is total earnings or profit. *Net revenue* is calculated by taking revenues and subtracting the costs of doing business, such as depreciation, interest, taxes, and other expenses. Therefore, we favor the use of the term revenue to analyze the primary sources of monetary and non-monetary receipts. Pastoralist households derive their revenue from five main sources: *1)* agricultural activities: often food crops; *2)* livestock products: live animals, meat, dairy products, fibers for textile (e.g., cashmere), hides and skins; *3)* services to other economic activities and sectors to earn salaries in agriculture (farm labor), animal husbandry (shepherd), trade, education, and other service activities; *4)* remittances and/or loans from various sources: government; and *5)* production for own use, usually called self-consumption (**Figure 1**).

Conceptual framework for pastoral household expenditure analysis

Figure 2– Conceptual framework for pastoral household food and non-food expenditure analysis

Definition of household expenditure (ILO, 2003[27])
Consumer goods and services are those used by a household to directly satisfy the personal needs and wants of its members. Household consumption expenditure is the value of consumer goods and services acquired, used or paid for by a household through direct monetary purchases, own-account production, barter or as revenue in-kind for the satisfaction of the needs and wants of its members. Household expenditure is defined as the sum of household consumption expenditure and the non-consumption expenditures of the household. The latter are those expenditures incurred by a household as transfers made to government, non-profit institutions and other households, without acquiring any goods or services in return for the satisfaction of the needs of its members. Household expenditure represents the total outlay that a household has to make to satisfy its needs and meet its "legal" commitments.

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[26] ILO, 2003. Rapport 2 : Statistiques des revenus et des dépenses des ménages, Dix-septième Conférence internationale des statisticiens du travailGenève, 24 novembre - 3 décembre 2003, 109 p.
[27] *idem*

Expenditures of pastoral households are spent on food and non-food items (**Figure 2**).

From our perspective, to determine the economic contribution of pastoral households by using a value-added or production approach, we shifted the previous classification to distinguish two types of multiyear running costs:

- costs that intervene directly in the production process (purchase costs of products sold and intermediate consumption)
- other multiyear running costs of pastoral households (**Figure 3**).

Figure 3 – Conceptual framework for direct production and non-production cost analysis
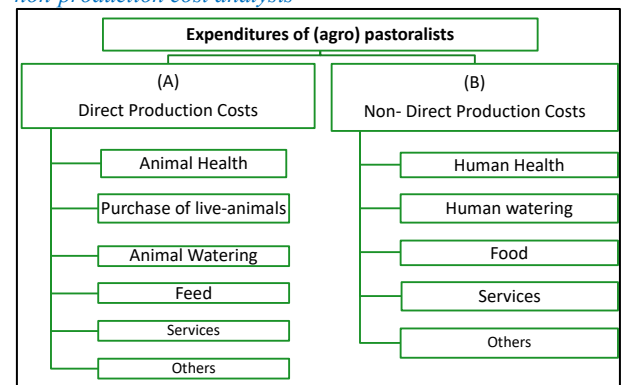
- *Conceptual framework for shocks and strategies analysis*

Risks are a central part of life for most households, and in particular for rural populations in low-income countries (LICs) (Banerjee and Duflo, 2011[28]). Better understanding risks and associated coping strategies is key for policymakers. The main challenge of risk analysis at the household level is that the presence or perception of risk can significantly affect the intertemporal behavior of households in the allocation of their resources. This can affect both poor and non-poor households, but only in the very short term, as the probability of the latter becoming poor remains very high. Hazards are ubiquitous in the lives of most farmers in developing countries, who must act to secure their livelihoods and minimize losses. Those with weak assets are usually pushed to engage in low return and sometimes risky non-farming activities (Barrett et al., 2001[29]), whereas for those who are better endowed or living in regions with favorable alternative activities, the impetus to raise revenues and accumulate wealth prevails (Loison and Loison, 2016[30]). Sometimes they engage in breeding livestock species with short life cycles, which provides fast gains to escape poverty (Alary et al., 2015[31]).

Pastoralists live and operate in a shock-prone environment. They lack contingent markets for their production systems, which affects their livelihoods severely. They adapt their activities to these conditions by using mobility and diversification/multifunctionality strategies to enhance production and secure their livelihoods (Alary et al., 2015[32]). These strategies are characterized by complex relations that limit multi-level strategies. Pastoral production systems and social livelihoods usually evolve in a context of risks, uncertainties and opportunities that lead to permanent change impacting socio-ecosystems simultaneously, sequentially, or sometimes in isolation (Wane *et al.*, 2010[33]). Climate variability plays a central role by having a direct impact on natural resource dynamics, pushing herders to deal with spatiotemporal variations by using mobility as their main strategy of securization. Climate change is also a factor that aggravates economic, social, cultural and political disturbances (price volatility of food and feed at national and international levels, disease, political instability, social transformations, etc.).

In parallel to this context of shocks, pastoral production in these regions is carried out in a sub-optimal environment suffering from severe deficits in infrastructure and basic social and economic services. Investment in the agricultural sector is low, and there are difficulties in applying laws and regulations adapted to livestock dynamics. Extensive modes of livestock production can broadly be described as a combination of non-market inputs and market inputs to produce ruminants and livestock products (meat, fresh milk, curd, butter, hides and skins, fibers). The overall animal production is often supplemented by diversification in productions (usually in the agricultural sector) to be stored, consumed and/or sold. The portion sold passes through a specific value chain involving many stakeholders up to the

[28] Banerjee A., Duflo E., 2011. Poor Economics, A Radical Rethinking of the Way to Fight Global Poverty. New York: Public Affairs, 2011, 320 pages, ISBN 978-158648798-0

[29] Barrett CB, Bezuneh M, Aboud A. 2001. Income diversification,poverty traps and policy shocks in Côte d'Ivoire and Kenya.FoodPolicy26: 367–384. DOI:10.1016/S0306-9192(01)00017-3.

[30] Loison SA, Loison SA. 2016. Rural livelihood diversification in Sub-Saharan Africa: A literature review, The Journal of Development Studies51: 1125–1138. DOI:10.1080/00220388.2015.1046445.

[31] Alary V, Aboul-Naga A, El Shafie M, Abdelkrim N, Hamdon H,Metawi H. 2015. Roles of small ruminants in rural livelihood improvement–Comparative analysis in Egypt.Revue d'Élevage etde Médecine Vétérinaire des Pays Tropicaux68(2–3): 79–85

[32] idem

[33] Wane A., Ancey V., Touré I., Ndiobène Kâ S., Diao Camara A. 2010. L'économie pastorale face aux incertitudes. Le salariat au Ferlo (Sahel sénégalais) = Pastoral economy facing up to uncertainties. Wage labour in the Ferlo (Senegalese Sahel). *Cahiers Agricultures*, **19** (*5*) : p. 359-365. http://dx.doi.org/10.1684/agr.2010.0427

end-consumers. The whole production system and value chain is submitted to multifaceted shocks that generate losses and compromise pastoral livelihoods (**Figure 4**).

In this context, pastoral and agropastoral households develop adaptation and coping strategies that reflect a repertoire of responses to the stress. They have these available and can use them more or less successfully. These multiple responses illustrate the close embeddedness between social and biophysical factors. Extensive systems cannot be measured purely in terms of endowments as they continually evolve and adapt to accommodate an increasingly uncertain biophysical environment and monetized world (Chambers, 1989[34]; Van Dijk, 1997[35]; Bovin, 2000[36]; Ancey *et al,* 2009[37]).

Through the intermediary of pastoral organizations, households in Chad and Argentina were presented with different shock scenarios and were asked to confirm or deny whether they had experienced one or more of these shocks over a predetermined period of time (the ***previous year for Chad*** and the ***last 15 years for Argentina***). The households then classified the shocks according to their severity: most severe, second-most severe and third-most severe. Finally, several options for adaptation and/or coping strategies were presented to the same households, which then ranked the various strategies according to their importance: most important, second-most important or third-most important. Every household that experienced production, economic or social losses had adopted at least one adaptation or coping option during the period of reference.

Figure 4– Shock and strategy conceptual framework

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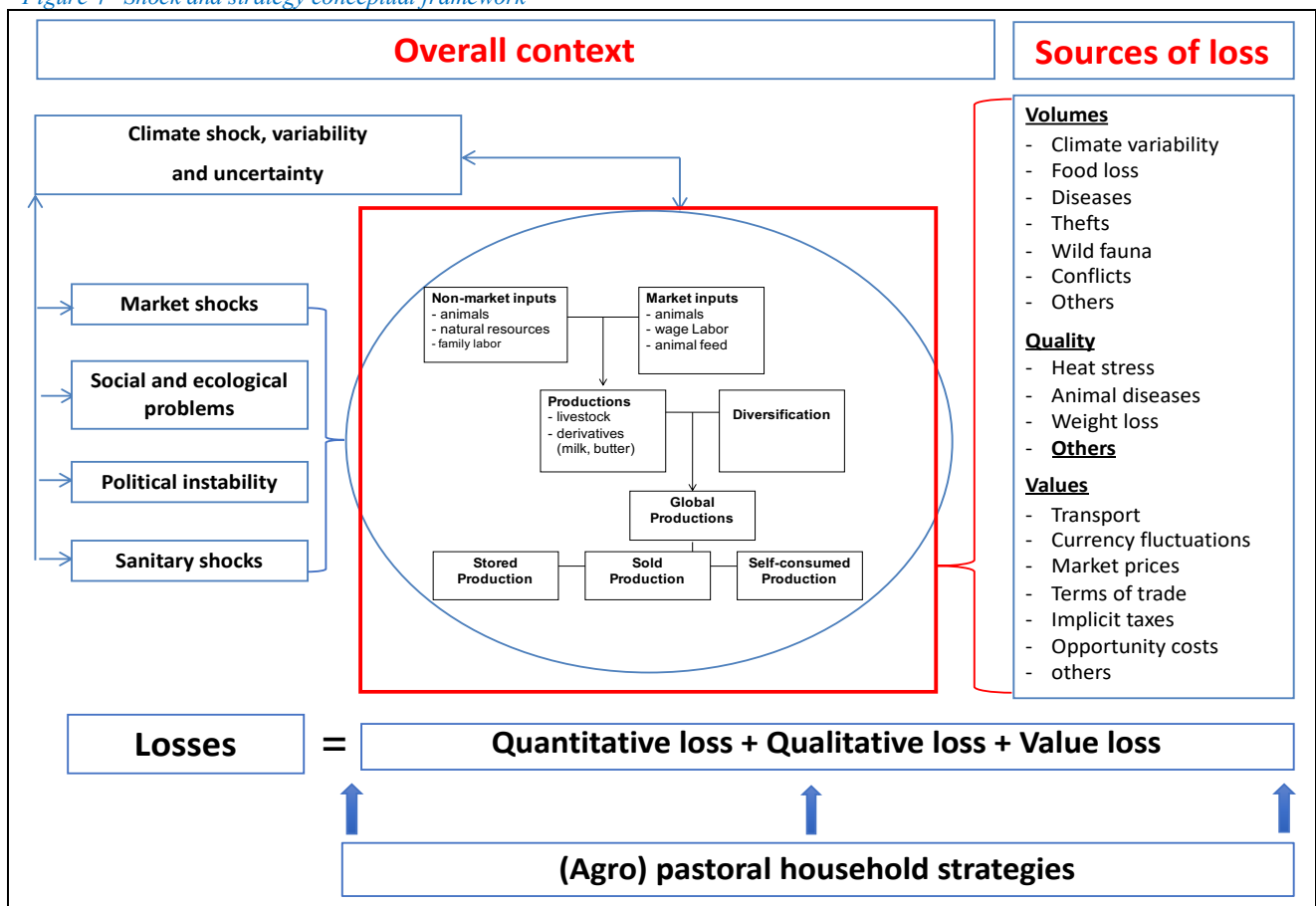
[34] Chambers, R. (1989). Editorial introduction: Vulnerability, coping, and policy. IDS Bulletin, 20(2), 1–7.

[35] Van Dijk, Han, 1997., Risk, agro-pastoral decision making and natural resource management in fulbe society, central Mali, *Nomadic Peoples,* 108-133

[36] Bovin, Mette, 2000. Pastoralists Manoeuvring in the Drought-Ridden sahel », in *Manoeuvring in an environment of uncertainty. Structural change and social action in sub-saharian africa.* Berner and Trulsson eds. Ashgate

[37] Ancey V., Ickowicz A., Touré I., Wane A., Diop A.T**.** 2009. La vulnérabilité pastorale au Sahel : portée et limite des systèmes d'alerte basés sur des indicateurs. In : Duteurtre Guillaume (ed.), Faye Bernard (ed.). *L'élevage, richesse des pauvres : Stratégies d'éleveurs et organisations sociales face aux risques dans les pays du Sud.* Versailles : Ed. Quae, p. 117-132.

The analysis of shocks reported by pastoral and agropastoral households allows covariate and idiosyncratic shocks to be distinguished.

A **covariate shock** (drought or rising food prices) refers to a shock that affects an entire community or region.

An **idiosyncratic shock** (death of a household member or illness) refers to a shock affecting only one household or a limited number of households. However, a shock may have characteristics that are unique to both groups.

- *Conceptual framework for economic contribution analysis: gross value added*

According to the OECD,[38] the gross domestic product (GDP) is an aggregate measure of production equal to the sum of the gross values added of all resident institutional units engaged in production (plus any taxes, and minus any subsidies, on products not included in the value of their outputs). It is the sum of the final uses of goods and services (all uses except intermediate consumption) measured in purchasers' prices, less the value of imports of goods and services, or the sum of primary incomes distributed by resident producer units.

GDP measures the monetary value of final goods and services—that is, those that are bought by the final user— produced in a country in a given period of time (say a quarter or a year). It counts all of the output generated within the borders of a country. GDP is composed of goods and services produced for sale in the market and also includes some non-market production, such as defense or education services provided by the government.

Not all productive activity is included in GDP. For example, unpaid work (such as that performed in the home or by volunteers) and black-market activities are not included because they are difficult to measure and value accurately. That means, for example, that a baker who produces a loaf of bread for a customer would contribute to GDP, but if he baked the same loaf for his family, it would not contribute to GDP (although the ingredients he purchased would be counted).

Moreover, "gross" domestic product takes no account of the "wear and tear" on the machinery, buildings, and so on (the so-called capital stock) that are used in producing the output. If this depletion of the capital stock, called depreciation, is subtracted from GDP, the net domestic product is obtained (Callen, *2016*[39]).

Despite its intrinsic limitations and biases, the GDP is the most common indicator used to describe a country's economic performance and economic growth, and provides a way to measure the relationship between total resource inputs and total economic outputs. Several approaches are used to calculate GDP:
- *Value-added or production approach*
  This measures the output of all economic sectors. More specifically, under this approach, the GDP equals the value of all goods produced in all sectors minus the value of all purchased intermediate goods used for production (*i.e., intermediate consumption*).
- *Revenue approach*
  This method focuses on the sum of primary revenues (from labor, capital, land, and profit) to estimate GDP. The idea behind this is that firms need to hire factors of production to create all goods and services, thus the sum of primary revenues can be used as an indicator of economic output. In particular, all revenues from labor, rent, and interest, as well as remaining profits have to be summed up to calculate national revenue. Adding indirect business taxes, depreciation, and net foreign factor revenue to the calculated national revenue will finally result in the GDP.
- *Expenditure approach*
  This represents a counterpart to the revenue approach, as it measures total spending on final goods and services (as opposed to earnings from them). At this point it becomes quite obvious why the different approaches should result in the same GDP value: according to the circular flow of revenue, economic expenditure by one party is ultimately always revenue for a different party. Thus, to calculate GDP according to the expenditure approach, all economic activities that result in the use of goods or services have to be added up. In particular, that includes private consumption, total investment, government spending, and net exports (exports – imports).

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[38] (https://stats.oecd.org/glossary/detail.asp?ID=1163).

[39] *Callen, Tim. "Gross Domestic Product: An Economy's All". IMF*. Retrieved *3 June* 2016.

In this exploratory study, we used the *value-added or production approach* to determine the economic contribution of pastoral systems in Argentina, Chad and Mongolia through the Gross Value Added (GVA). We calculate the GVA of the pastoral and agropastoral households in the three target countries by sector. The GVA is calculated as total output value minus intermediate consumption (variable inputs). It represents the part of revenue that is left to pay for fixed production factors (land, labor, capital) and to serve as revenue for the farmers and non-salaried workers (usually members of the farmer's family). Thus, we determine the value-added at the level of each pastoral site studied and aggregate it at the national level. We then compare the values found with GDP and agricultural GDP indicators.

However, self-consumption is among the very useful non-market outputs which are not included in standard measures of GDP, representing an important omission that should be urgently rectified. Furthermore, in the livestock sector revenue can be assessed yearly, but actors incur multiyear direct production costs. We developed the following three scenarios to reflect these different considerations:

- S*cenario 1* represents a standard calculation of the direct economic contribution that does not include self-consumption. The idea is to disregard some non-market elements (such as self-consumption) as has been well defined by *Callen (*2016).
- *Scenario 2* represents a paradigm shift that considers the baseline scenario combined with the incorporation of self-consumption. Household production for self-consumption is an item of some interest given its central strategic role in pastoral household food security, it therefore would be key to consider it.
- *Scenario 3* considers the average amount of time animals are kept prior to being sold to consider multiyear intermediate costs. The objective is to illustrate the hidden overall cost of the duration of animal ownership. Indeed, the longer a household keeps animals in its herd for various reasons, including the management of uncertainties (Wane et al, 2010[40]), the less significant its contribution to the national economy will be. Interviews with pastoralist associations in Argentina and Chad noted that cattle are kept for an average of 4-5 years before being put on the market, sheep for 1-1.5 years and goats for 1 year. In a very simple way, we simulate different holding periods to analyze repetitive production costs and potential impacts on the real contribution of pastoralists to GDP. However, it should be noted that in a context of uncertainties, holding animals beyond a non-optimal marketing period corresponds to a form of contingent rationality. Imperfect and incomplete information in markets encourage pastoralists to adopt a prudent position, adapted to the circumstances and therefore contingent on their socioeconomic environment (Wane, 2005[41]; Wane et al, 2010[42]). This explains why pastoralists are not in favor of regular animal "destocking" even if technical services encourage them to do so. Far from being indifferent to the level of market prices (Kerven, 1992[43]), livestock farmers make tradeoffs between their short-term consumption needs and long-term herd building strategy to meet future consumption (Fadiga, 2009[44]). By analogy with the different forms of capital, the various types of livestock can be assimilated, depending on the situation, to cash, insurance and assets, hence livestock marketing decisions are "measured" in terms of the number of animals sold as well as the duration of time animals are held before being sold.

- ### *Sampling strategy in Argentina, Chad and Mongolia*

Data collection in pastoral areas remains challenging. Very few countries have official agricultural data that is disaggregated to show the contribution of pastoralism to the agricultural GDP. Gaps remain in empirical records, particularly in countries that have suffered extended periods of conflict, and in countries that have lacked a capacity to collect, process, and publish statistics. Even in areas for which data are available, the data do not cover all relevant topics. Mindful of the limitations of currently available socioeconomic data, the survey benefited from the strong commitment of pastoral associations that have been trained to effectively handle data collection in the target areas. Several training sessions were provided by CIRAD at the country level and remotely as well, notably on approaches to gathering information and developing appropriate tools.

Particular attention was paid to observing general requirements for sampling and statistical analysis. The objective was to define a sample as a percentage of the total population so that it would be possible to make statistical inferences.

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[40] *idem*
[41] Wane A. 2005. Marchés de bétail du Ferlo (Sahel sénégalais) et comportements des ménages pastoraux. Colloque SFER, 7-9 novembre 2005, Montpellier, 17 p.
[42] *idem*
[43] Kerven, C. 1992. Customary commerce: A historical reassessment of pastoral livestock marketing in Africa. London: Overseas Development Institute.
[44] *idem*

Long and fruitful work of identifying the pastoral population was carried out with a pastoral association as our main partner in each of the target countries. A triangulation with available national statistics also was conducted.

Table 1 – Sampling size determination

Country	Target sample Scenario 1	Target sample Scenario 2	Final sample size
Argentina	**1,100 households** (e=2.54%, ci=95%, p=50%)	**500 households** (e=4.12%, ci=95%, p=50%)	**1,197 households** (e=2.83%, ci=95%, p=50%)
Chad	**1.067 households** (e=3.00%, ci=95%, p=50%)	**800 households** (e=3.46%, ci=95%, p=50%)	**803 households** (e=3.46%, ci=95%, p=50%)
Mongolia	**1.800 households** (e=2.31%, ci=95%, p=50%)	**803 households** (e=3.46%, ci=95%, p=50%)	**764 households** (e=3.55%, ci=95%, p=50%)

Two sampling targets were set based on the capacity of the pastoral associations to carry out the surveys within the existing time and cost constraints. The main technical constraint was to remain within a margin of error of less than 5% in accordance with standard statistical approaches. Finally, we analyzed data collected on 1,197 pastoral households in Argentina, 803 in Chad and 765 in Mongolia (Table 1).

- *Household characterization in Argentina, Chad and Mongolia*

The household, the subject of this survey, can be defined as a group of persons who make common provision for food, shelter and other essentials for living. It is a fundamental socioeconomic unit in human societies. Households are the centers of demographic, social and economic processes. Key decisions, particularly in rural areas, occur primarily at the household level.

The size of a typical household varies; it is larger in Chad (on average 5.8 members) compared to Argentina and Mongolia (3.3 and 3.6 members, respectively). A more disaggregated view confirms the overall trends; in Argentina, 42% of households are made up of 2-3 members, in Mongolia, 40% of households have 3-4 members, and in Chad, 48% of households assemble more than 6 members.

The presence of children in a household has major implications for the household's priorities, particularly with respect to the demand and allocation of resources for education and health care. Chad and Mongolia are characterized by the youthfulness of their populations, with more than three-quarters of households having at least one child under the age of 15. The phenomenon is more pronounced in Chad. In comparison, less than half of households in Argentina have children under the age of 15.

Female-headed households are most common in Argentina (28%), followed by Chad (22%), and Mongolia (17%). The percentage of households including an older person also depends on other factors such as the living arrangements of older persons.

In the three countries, the median proportion of two-parent households is 77% among households with children under 15 years of age. The median proportion of one-parent households (among those with children) is much lower, at 20% for lone-mother households and 4% for lone-father households.

Country	Average household size	Distribution of households by number of members (%)				Headship (%)		Female headship (%)
	Total	*1*	*2 to 3*	*4 to 5*	*6+*	*Female*	*Older person (60+)*	*Female head who is lone parent with children under age 15*
Argentina	3.3	18	42	29	11	28	29	25
Chad	5.8	8	18	26	48	22	17	70
Mongolia	3.6	6	27	40	27	17	14	56

Country	Average household size	Households with children or older persons (%)				Households with children under age 15 (%)		
	Total	*With children under age 15*	*With members aged 60+*	*With both children under age 15 and members aged 60+*	*Average number of children under age 15*	*Two parents present*	*One parent present (mother)*	*One parent present (father)*
Argentina	3.3	48	34	7	2.1	78	19	2
Chad	5.8	84	21	16	3.7	74	20	9
Mongolia	3.6	75	20	10	2.1	77	20	4

Sources: Household Size and Composition Around the World 2017, United Nations – Economic and Social Affairs

Argentina
The economics of pastoralism

Background and macro context

One of the largest economies in Latin America, Argentina depends on services and manufacturing, although agribusiness and ranching dominated the economy up to the 20th century. In the region, Argentina is the leading cereal producer and the second largest livestock country after Brazil.

Argentina has been going through a period of profound economic and social uncertainty. The GDP contracted to reach US$445 billion (-2.5% in real terms) in 2019 and US$443 billion (-3.1% in real terms) in 2020. A slow recovery is expected from 2021, and the country is expected to reach US$580 billion in 2024, still below the level observed in 2018 (US$643 billion) (Figure 5).

The country withstood a number of economic depressions, but these disturbances resulted in very precarious economic and social imbalances in 2019: the *currency has been collapsing* since April 2018 to a degree unseen for the past 18 years; the inflation rate (average consumer prices) is 54.4%; the unemployment rate is 10.6%; the current balance account is -1.2% of GDP; the gross public debt is 93.3% of GDP; and the human Capital Index is 0.61 (World Development Indicators, 2019).

These economic downturns have led to highly volatile macroeconomic and trade policies that also affected the agricultural sector. The emergency revenue measures implemented by the Argentinian authorities (export tax of 12% including agricultural products) hindered the performance of the primary sector. This situation could exacerbate the historical recession trend in the rural population, which fell from 17.0 to 8.1% of the total population between 1960 and 2018 (Figure 6).

Figure 5- GDP evolution (source IMF)

Figure 6- Rural population change (% of total population)

Argentina vacillated between open economic and economic isolation approaches to finally focus on the whole value chain approach from 2015, with a strong decentralization of extension services. According to the OECD (2019), the policy uncertainty potentially led to a lack of an enabling environment and boosted the production of commodities requiring less investment and working capital (such as soybean) to the detriment of more capital-intensive production (such as livestock). In addition, the livestock sector has experienced an important decline in bovine meat production, which fell from 3.0 to 2.6 million tons between 1990 and 2016 due to disincentive policies (export ban, taxes and volatile measures) that favored short-cycle crop productions. The livestock sector did not really benefit from the growth of total factor productivity in the primary sector. The introduction of new technologies in crop production has had a
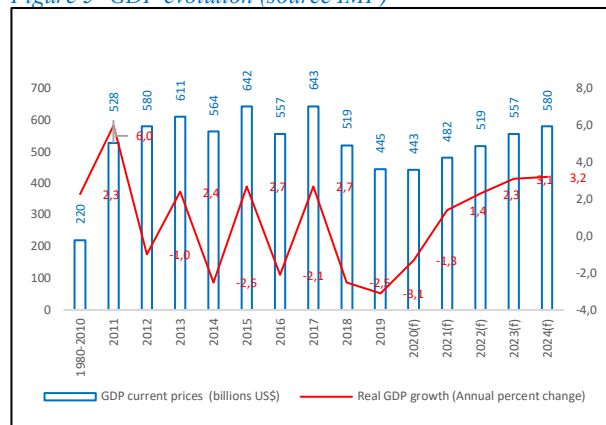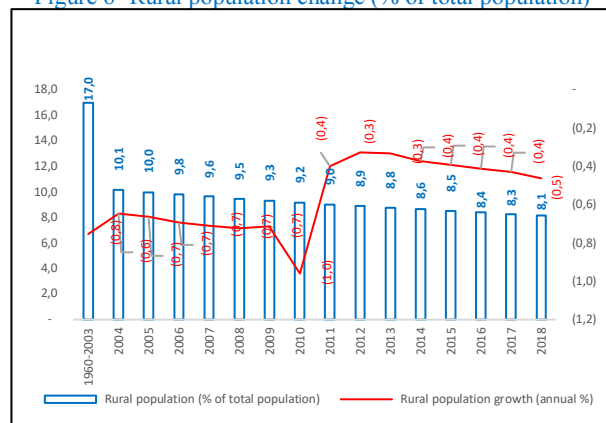
positive impact in that sector, yet livestock production continues to stagnate. This situation illustrates the structural double duality observed in Argentina: duality between the Pampas and other regions and duality between crop and animal production. More specifically, the perception of a country that is very well-endowed with natural resources hides a strong heterogeneity in the distribution of resources, farming systems and livelihoods across the country. That is the case of pastoralism and pastoralists in Argentina, for which there is an urgent need to produce useful knowledge for decision-making.
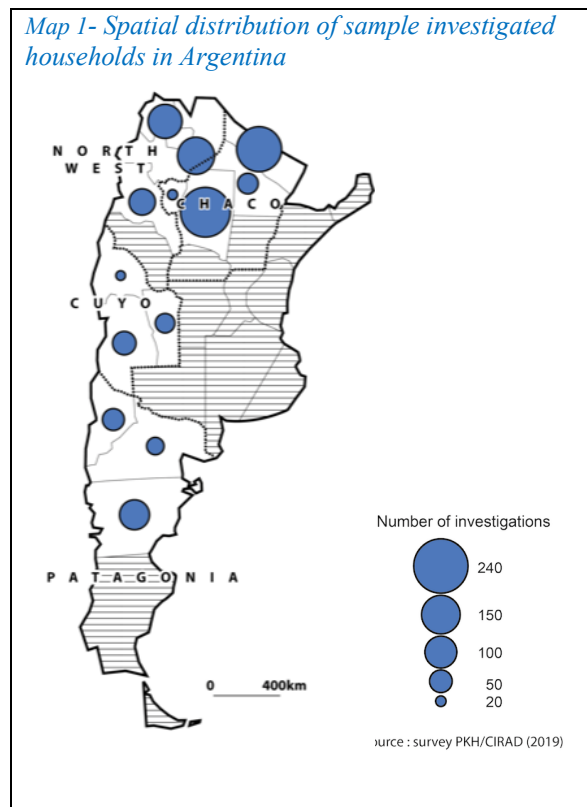
Data collection and management: inclusiveness of pastoral organizations

In Argentina, pastoralism is usually considered as a marginal production system carried out in medium and high mountain areas and dry forests. The difficulty of defining pastoralism is highlighted by growing trends which are challenging how pastoralism is usually understood. In the three zones where pastoralism is supposed to be exercised - Gran Chaco, Puna and Patagonia - the phenomena of deforestation, growing agricultural fronts, ranching, increasing mining activities, emigration, and land grabbing are threatening pastoralism as a production system and source of livelihoods. This subsistence activity therefore could go into a decline if no protection policies are implemented (Grünwaldt et al, 2016[45]). Indeed, pastoral populations in Argentina have very limited access to technology and infrastructure. Their visibility in Argentinean society also remains low, and they are under-represented in national policies.

In this context of a gap in knowledge about the recent and future trends of pastoralism, FAO and CIRAD have supported the Grand Chaco Foundation as a local partner in Argentina to carry out a pastoralist-driven data management project. Created in 2000, the Grand Chaco Foundation is an NGO that develops activities in the Argentinean Gran Chaco area to support local initiatives from a technical point of view and to stimulate artisanal production. It is leading the recently established regional pastoralist association of Latin America, "PastorAmericas".
This organization has been chosen to handle the data collection process. As such, it organizes capacity building activities on the use of FAO data collection software with pastoralists' organizations; it establishes contact with FAO for the progress of the project and provides information to CIRAD. Collaboration with this NGO has facilitated access to field areas and the organization of meetings and has contributed to the process of making the collection of information on pastoralists in Argentina more reliable.

The Gran Chaco Foundation helped to thoroughly investigate 1,197 pastoral and agropastoral households in the Northwest, Chaco, Cuyo and Patagonia regions in Argentina (Map 1).

Map 1- Spatial distribution of sample investigated households in Argentina

Number of investigations

240
150
100
50
20

Source : survey PKH/CIRAD (2019)

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[45] Grünwaldt JM, Castellaro G, Flores ER, Morales-Nieto CR, Valdez-Cepeda RD, Guevera JC, Grünwaldt EG., 2016. Pastoralism in the drylands of Latin America: Argentina, Chile, Mexico and Peru, Rev Sci Tech., Nov; 35(2): 543-560. doi:10.20506/rst.35.2.2526.

Pastoralism: rearing diverse animal species

Argentina's drylands are home to cattle, small ruminants, horses and South American camelids.

To aggregate various species and age as per convention, our estimates are based on *the livestock standard unit (LSU).*[46] This is a convenient way to use specific coefficients established initially on the basis of the nutritional or feed requirement of each type of animal.

Applied to Argentina, a pastoral household has on average 65 LSU, meaning that the pastoral household holds on average 30 cattle, 14 camelids, 35 sheep, 137 goats, 11 donkeys, 12 horses and 13 pigs (Table 2).

Pastoral households in Patagonia and Noroeste regions are better off on average (77 and 69 LSU respectively), while those in the Chaco region have smaller herd sizes (55 LSU) (Figure 7).

Extensive livestock rearing is characterized by low investment in infrastructure and little use of technology and innovation.

Table 2 - Animal species' equivalent of the average LSU of 65

Male Cattle	Female cattle	Male camel	Female camel	Adult male sheep	Female sheep	Male goat
11	19	6	8	11	24	17
Female goat	Male donkey	Female donkey	Horse	Mare	Pork	Female pig
120	6	5	6	6	6	7

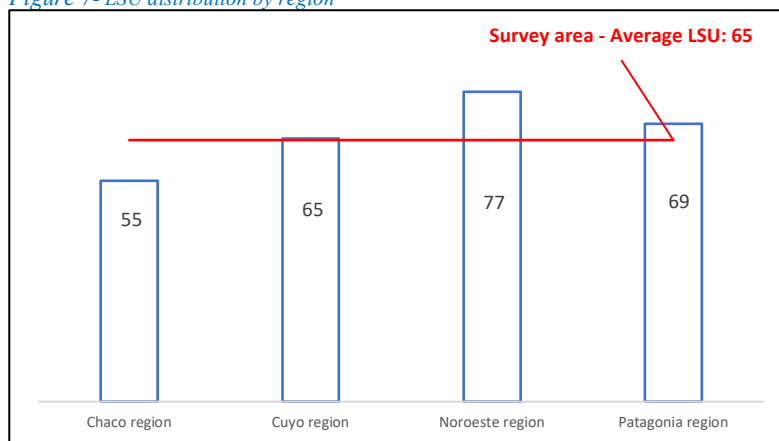*Figure 7- LSU distribution by region*

Continuous grazing predominates, using mainly European and zebu breeds and their crosses. Most of the animals are produced for subsistence with family labor that handles the majority of livestock activities. Meat production is the primarily output; however, sheep wool, goat hair and cashmere breeds are increasingly important within pastoral and agropastoral families.

With the exception of the equidae and suidae families, there is a marked tendency for females to dominate herds, with the exception of the Rio Negro province, where male cattle seem to predominate. This could indicate a peculiar strategy of animal possession and also of marketing live animals (Appendix 1).

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[46] The **livestock unit**, abbreviated as **LSU** (or sometimes as **LU**), is a reference unit which facilitates the aggregation of livestock from various species and age as per convention, via the use of specific coefficients established initially on the basis of the nutritional or feed requirement of each type of animal. The reference unit used for the calculation of livestock units (=1 LSU) is the grazing equivalent of one adult dairy cow producing 3,000 kg of milk annually, without additional concentrated foodstuffs. (https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Livestock_unit_(LSU))

Pastoralism and revenue generation

Pastoralism cannot be measured only in monetary terms because, as mentioned in the conceptual framework, it has significant non-market returns. However, generating cash income remains important for households, often to cover expenditures.

In Argentina, the annual average gross revenue in pastoral and agropastoral areas is 577,927 ARS (Argentinian peso). The Noroeste and Cuyo regions report the highest average revenue (846,877 ARS and 596,995 ARS respectively) while the pastoral and agropastoral households in the Chaco and Patagonia regions report the lowest levels. This may be linked to the high average animal possession (77 and 65 LSU respectively) in higher-revenue regions.

A more refined analysis shows the importance of self-consumption as a source of revenue. Overall, the average gross revenue is provided by livestock product sales (37%), other monetary revenue including off-farm revenue (28%), and household self-consumption (35%).

The breakdown of the gross revenue reveals strong regional disparities in revenue sources. Livestock revenues remain the main source only in Patagonia (56%); it is less important than others in Cuyo, Chaco, and Noroeste (16%, 32% and 36% respectively). The self-consumption component represents just over a third of revenues (37-38%) in the Chaco and Noroeste regions. The Cuyo region is characterized by an extensive use of production for self-consumption (73%) while households in Patagonia have weak recourse to self-consumption (11%).

Regarding livestock product revenue, with the exception of the Cuyo region, where live animal sales are dominant, cash is mostly provided by animal fibre sales, in particular in Noroeste and Patagonia (almost 77%).

It is noteworthy that crop sales are relatively marginal, as off-farm revenue (jobs, casual employment and subsidies) constitutes 80% of other sources of monetary revenue.

Figure 8- Distribution of average gross revenue by province/region
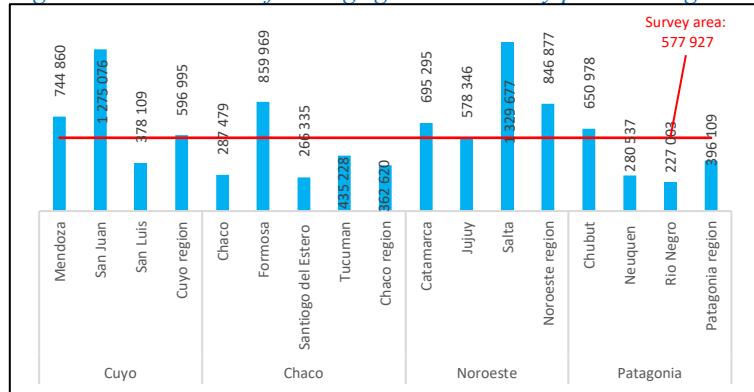

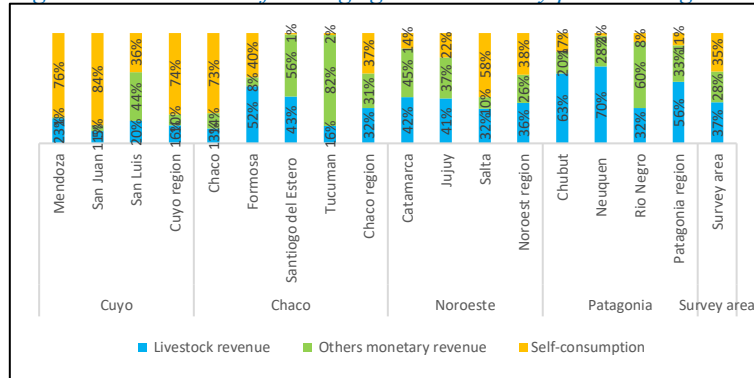Figure 9– Breakdown of average gross revenue by province/region

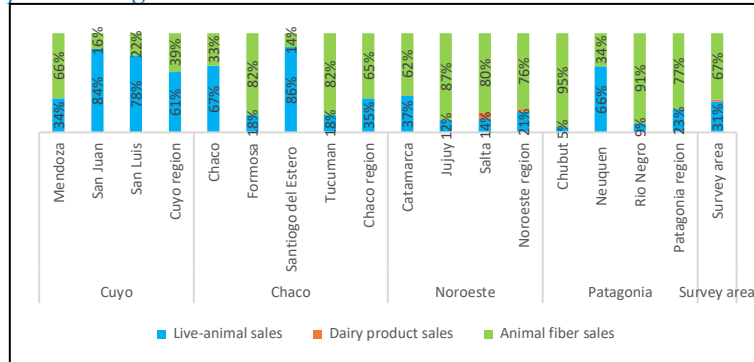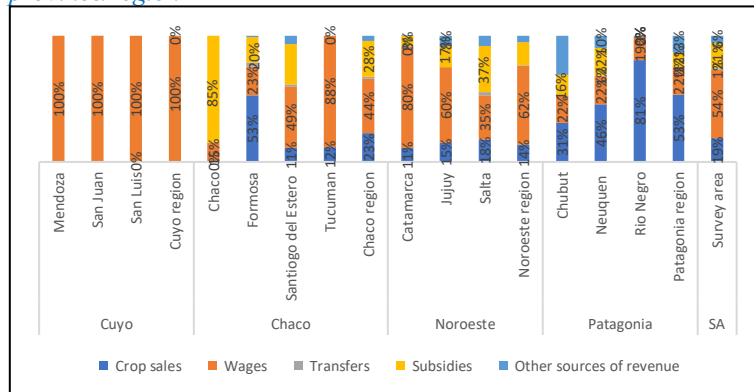Figure 10- Breakdown of average livestock revenue by province/region

Figure 11– Breakdown of other sources of monetary revenue by province/region

The categorization of households was elaborated from the revenue deciles classification that provides a rough ranking of their economic situation. This categorization thus resulted in a distinction between the **low-revenue group,** constituted by households earning no more than 169,400 ARS per year; the **lower-middle revenue group,** which earns a maximum of 310,800 ARS; the **upper-middle revenue group,** which can reach an average gross revenue of 620,000 ARS; and the **high-revenue group,** which can generate more than 620,000 ARS of annual gross revenue.

The analysis by category of household produces fairly instructive and informative findings. It shows a declining contribution of livestock product sales (from 33% to 21%) and other sources of monetary revenue (from 55% to 28%), but an increasing contribution of self-consumption (12% to 51%) moving up the gross income ladder. This illustrates that the low-revenue group, and to a lesser extent the lower-middle revenue group, depend on other monetary revenue (subsidies).

Table 3 – Categories of pastoral households according to their average gross revenue

Category name	Low-revenue		Lower-middle revenue	
Range	Minimum	Maximum	Minimum	Maximum
Revenue (ARS)	0	169,400	169,401	310,800
Category name	Upper-middle revenue		High-revenue	
Range	Minimum	Maximum	Minimum	Maximum
Revenue (ARS)	310,801	620,000	620,001	up to 620,001

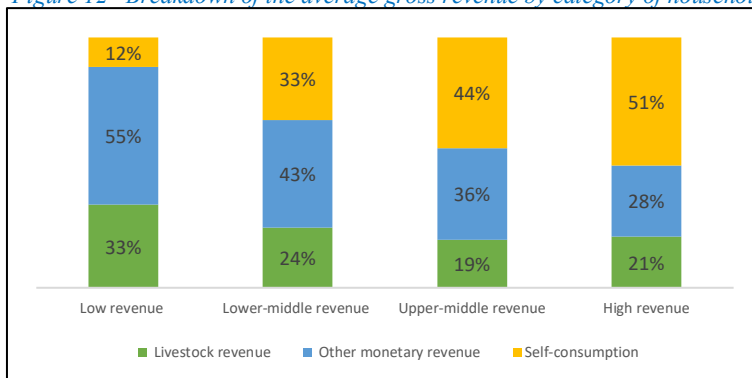*Figure 12– Breakdown of the average gross revenue by category of household*

The importance of self-consumption must also be put into the perspective of the economic context of Argentina, which over the last five years has been facing galloping inflation. This hit 53.8% in 2019, climbing to its highest level in almost three decades and underlining the scale of the country's challenges. In this context, the purchasing power of the population has been halved. Dramatic falls in monetary incomes in real terms were also experienced, leading to sharp increases in own-account production of crops and livestock in order to survive. The use of self-consumption helps to protect against market volatility.

Pastoralism and direct production costs

Our intention to compare our figures with standard measures of wealth leads to an analysis of direct production costs as a proxy of the intermediate costs incurred by households for animal purchase, animal health, animal watering, feed and services. The services include charges related to the use of shepherds, market intermediaries, conveyors, veterinary services, and animal traction.

On average, the direct and intermediate costs of the households reaches 52,682 ARS per year. The Patagonia and Noreste regions report the highest cost levels (144,721 ARS and 60,821 ARS respectively) while the Cuyo and Chaco regions report relatively lower cost levels (20,231 ARS and 22,121 ARS respectively). The prominent costs are feed purchase (65%) and service charges (18%). However, feed costs are proportionnally higher in the Patagonia and Noroeste regions and to a lesser extent in Chaco region.
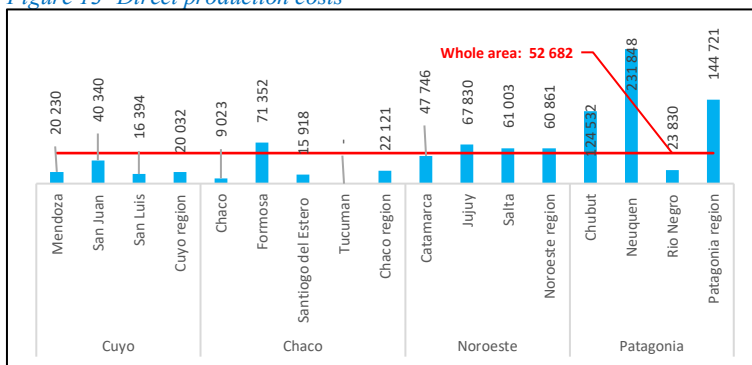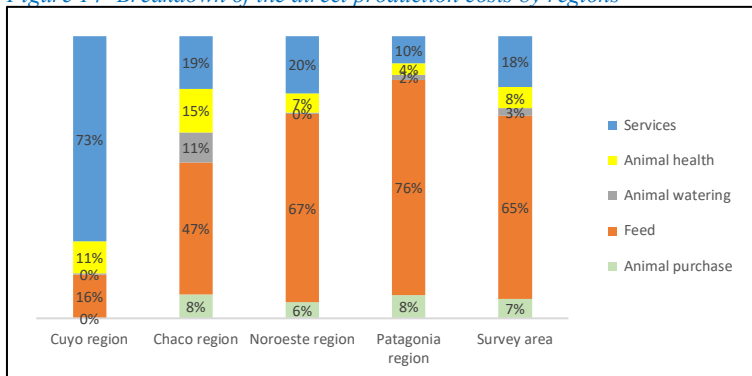
Figure 13- Direct production costs

*Figure 14- Breakdown of the direct production costs by regions*

Pastoralism and wealth creation

The main calculations regarding the economic contribution of pastoral households are provided in Appendix 2.

In **Scenario 1,** representing the base-case model, pastoral and agropastoral households contribute 0.6% of the GDP. In **Scenario 2,** incorporating self-consumption as an important component of the gross revenue, the same households contribute 1.4% of the GDP. In **Scenario 3,** that realistically take into consideration the possession time horizon of the animals sold, pastoral and agropastoral households have a decreasing contribution to GDP proportional to the length of animal possession in the herd. The contribution of pastoralists to GDP thus declines to 0.3% (without self-consumption) and 1.2 (with self-consumption) assuming an average holding period of animals sold of two years. This contribution drops when the average ownership of animals sold is three years to reach 0.1% (without self-consumption) and 1.0% (with self-consumption).

Figure 15- Direct economic contribution
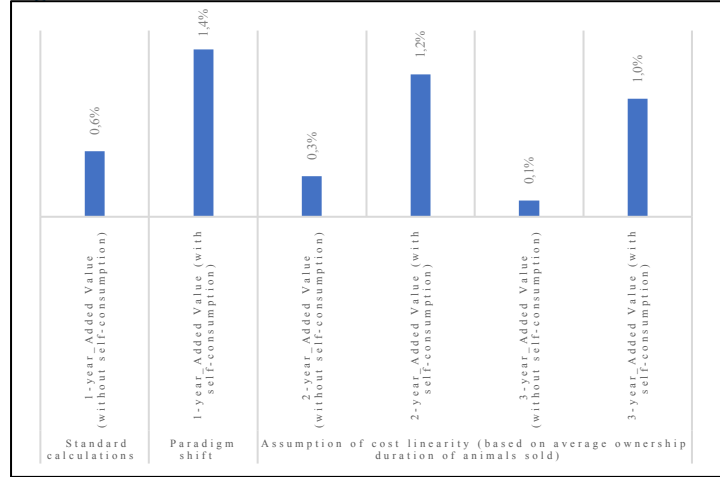
Pastoralism and revenue distribution

Revenue and its distribution have always been a central concern of development researchers and practitioners as well as policymakers. This concern is all the more important as the distribution of revenue can be used to analyze potential sources of instability in pastoral areas. Revenue distribution is how a nation's total GDP is distributed amongst its population. To a larger extent, it is possible to explore how the gross revenue generated in pastoral and agropastoral areas is distributed amongst households. The distribution of revenue within a society may be represented by the Lorenz curve closely associated with measures of revenue inequality such as the Gini index, an accurate index for measuring revenue distribution that can vary from 0 (perfect equality, represented as 0%) to 1 (perfect inequality, represented as 100%).

On the basis of gross revenue, it can be seen that the distribution of revenue is very unequal (Gini index: 56.6%). These levels of inequality in Argentinean pastoral environments are similar to those found in in East Africa (Little et al, 2001[47]) and West Africa (Wane et al, 2009[48]). In Argentinean pastoral and agropastoral areas, the unequal distribution of the gross revenue is explained most by the unequal distribution of livestock revenue that includes live animal sales and fiber sales.

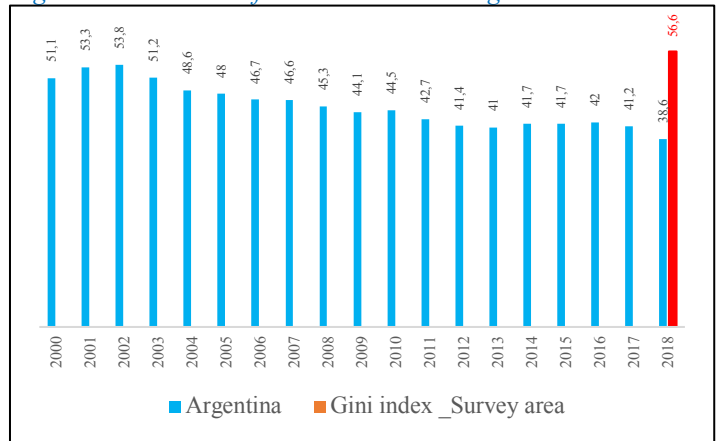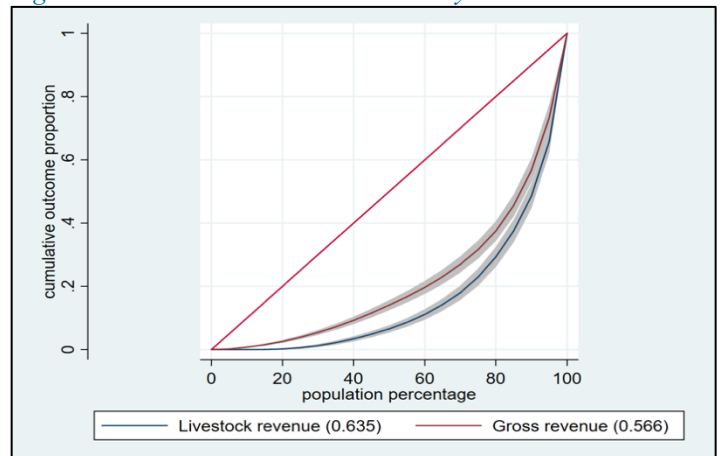*Figure 16- Evolution of the GINI index in Argentina*

Figure 17- Lorenz curve and Gini index by revenue source

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[47] *idem*

[48] *idem*

Integrating self-consumption reveals its impact on overall inequality as the Gini index drops from 0.635 (distribution of livestock revenue) to 0.566 (distribution of gross revenue).This situation is all the more worrying since important efforts have been made by the Argentinean government to reduce economic inequality in Argentina, and the Gini coefficients dropped from 0.511 in 2000 to 0.386 in 2018. Indeed, Argentinian public authorities tried to implement an enabling environment to reduce income inequality (improvement of working conditions, both rate of employment and the quality of jobs; incorporation of people without formal labor income in the social security system with the increasing proportion of the population with access to retirement pensions and size of pensions).

Pastoralism and multifaceted perceived shocks

The adoption of effective *ex-ante* mitigation strategies is a function of household and location characteristics. These include, among others, the decision makers' perceptions of risk that we tried to collect during our investigations in Argentina.

The occurrence of climate shocks and extreme climatic events is widespread while some other shocks affect the household or community levels. Thus, it is possible to distinguish idiosyncratic shocks (i.e., household-level shocks) and covariate shocks (collective-level shocks).

Pastoral and agropastoral households report that most of the multifaceted shocks they are facing affect the whole pastoral sector (78%) rather than the household level (22%).

Overall, pastoral and agropastoral households in Argentina report a range of covariate risks. Natural-related as well as economic-related shocks emerge as the predominant risks households have faced at least once during the last 15 years.

More specifically, the global figures in the whole area indicate that 35% of sample households reported having experienced rainfall issues. The second most important shock is related to rising food prices, reported by 21% of sample households. The third most important shock is a natural-related one and involves thermic stress (14%).

Regarding the idiosyncratic shocks faced over the last 15 years, sample households mostly reported health-related shocks as the predominant one, then social and political-related events that affected their livelihoods. Thus, 35% of sample households experienced animal losses due to diseases, 15% mentioned the death of an active family member as an important shock, and 14% stated that a lack of access to veterinary services and also cattle theft has negative impacted their production systems and livelihoods.

Figure 18- Diversity of shock typology reported by investigated households
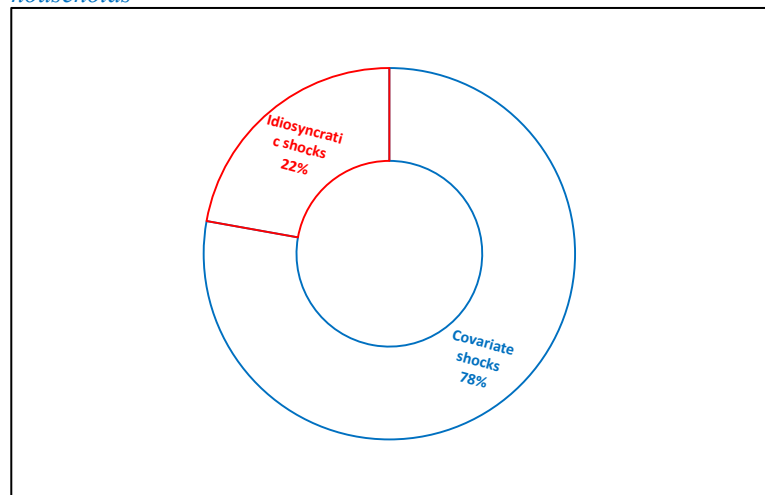
Figure 19- Perceived shocks in the survey area
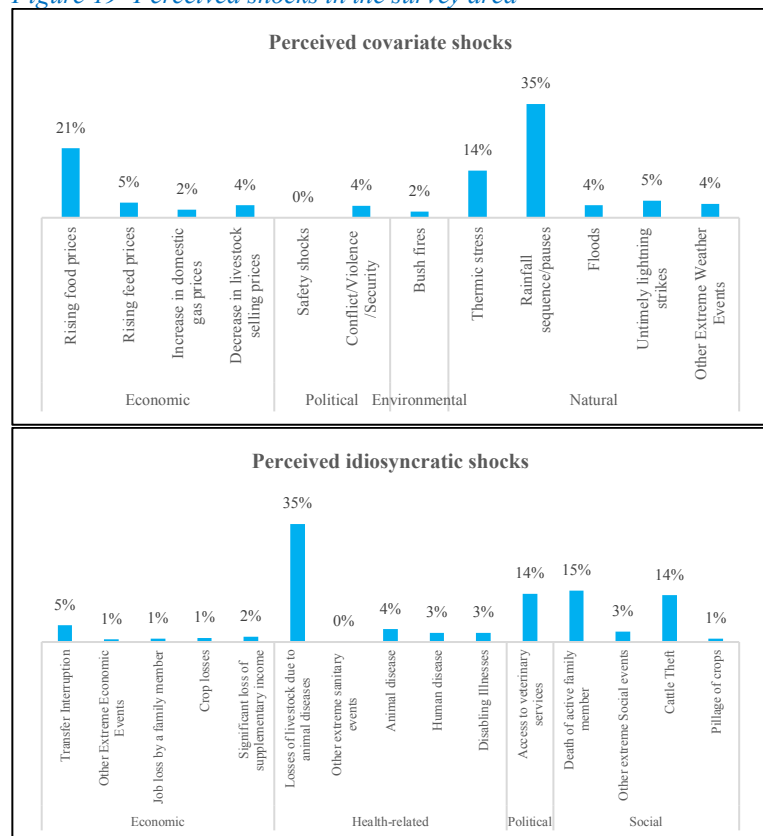
At the regional level, covariate trends are confirmed, although the perception of natural phenomena is stronger in Chaco, where rainfall shortages and thermic stress were reported respectively by 39% and 19% of sample households. In Noroeste and Patagonia, rainfall issues also were mentioned frequently by sample households (36% and 33% respectively). They also often reported inflation problems (25% and 23% respectively). However, in Cuyo, households provided more details by talking about natural-related shocks (thermic shocks, rainfall shortages, floods and untimely lightning strikes). With reference to idiosyncratic shocks, households in Noroeste and Patagonia have extensively reported multifaceted social and political related shocks.

Figure 20- Multiscale perceived covariate and idiosyncratic shocks in regions

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Pastoralism and contingent strategies

As a way of reducing the impact of multifaceted shocks, pastoral and agropastoral households in Argentina are adopting a range of options to preserve their production systems and livelihoods.

Although the data collection tools were structured around sequential and prioritized strategies, the household responses show that in some cases, strategies overlap. Indeed, the most important strategy revealed by the households is to strengthen their mobility by increasing the frequency and amplitude of movements to other areas. However, this strategy seems to be accompanied by recourse to family labor to complement cattle herding and accompany mobility. Use of family labor appears to be the second-most important strategy but one that is closely related to the mobility strategy.

In parallel to these two most important strategies, households use complementary strategies, such as other forms of pastoral adjustment (animal sales) and mobilizing social capital. The use of alternative strategies related to changing dietary habits and selling assets are more often cited as the third-most important strategy, one which can severely constrain their food security.

It should be noted that there is virtually no recourse to official aid applications, thus showing that pastoral and agropastoral households seek to mobilize endogenous strategies based on their own system of actions rather than relying on third parties in the form of grants, subsidies and credits.

These general trends are observable at the level of the total household sample and are similar to those visible at the regional level.

Figure 21- Strategies reported by investigated households
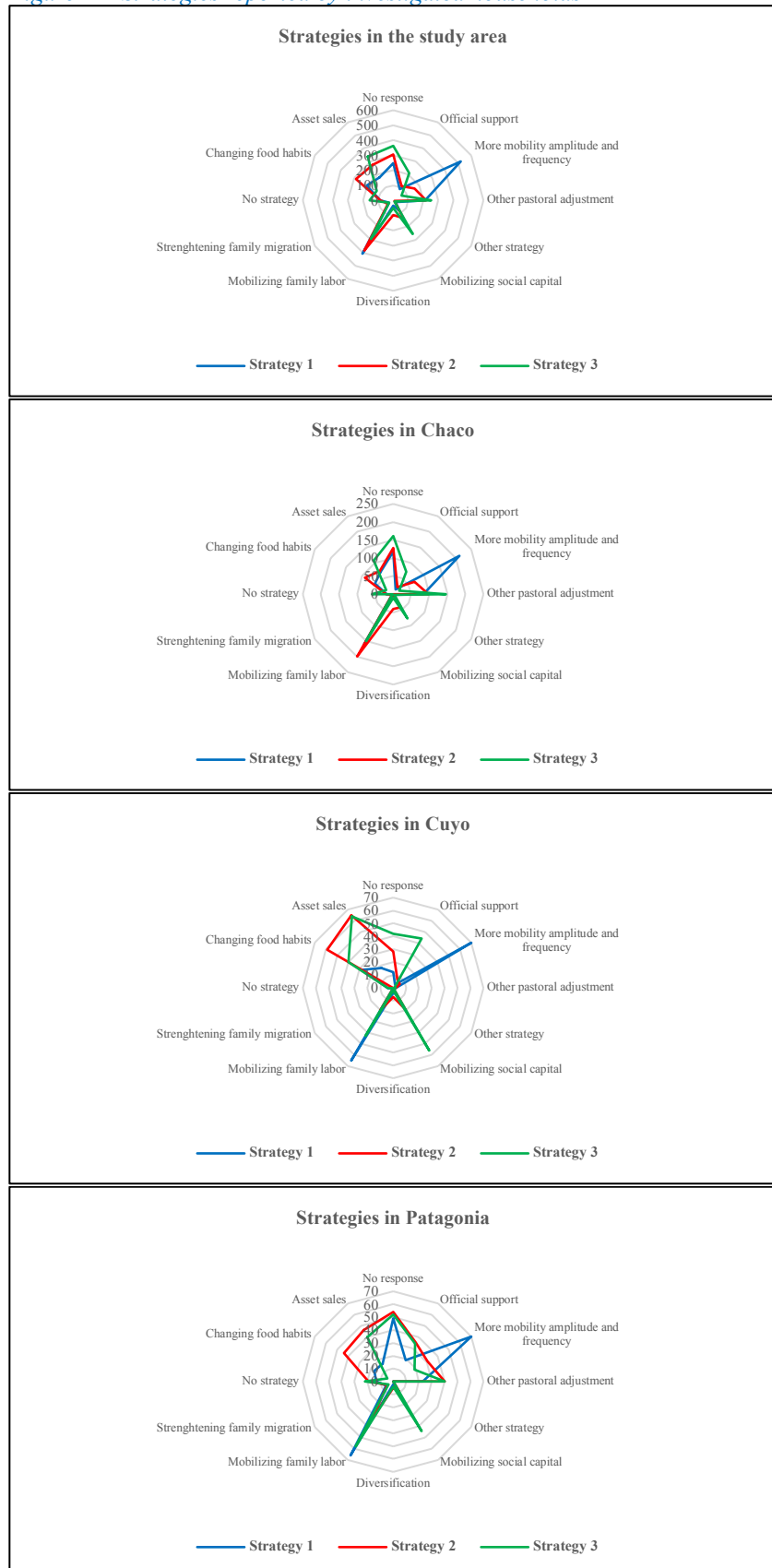
Chad

The economics of pastoralism

Background and macro context

As an arid, low-revenue and landlocked Sahelian country in central Africa, Chad has been heavily dependent on oil since 2003. Although wealth creation has increased sharply, growing from 2.1 billion USD on average during the period 1961-2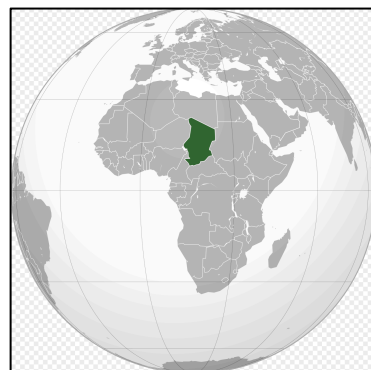010 to 11.3 billion USD in 2018 (Figure 23), the country remains vulnerable to severe and multifaceted shocks. Climate, economic, and social disturbances have deeply affected the newly oil-oriented country, and the oil sector is benefiting from important investments to the detriment of an increasingly neglected primary sector.

Weaker export performances, due to softening external demand and lower commodity prices, were responsible for larger external balances. There has been a slight recovery of the external current account deficit, which decreased from 6.6% to 4.7% between 2018 and 2019, but risks of debt overhang are high. Oil revenues have contributed to improved economic performances, but these were not sufficient to cover the social demand of a growing population (+25% during the last decade according to the World Bank (2019)) (Figure 24).

Although efforts have been made in poverty reduction (from 55% to 47% between 2003 and 2011), poverty indicators still present a challenging picture as the number of poor people rose from 2011 to 2018. The country ranks within the bottom ten of the Global Hunger Index (118 of 119), the Fragile State Index (171 of 178) and the Gender Inequality Index (186 of 189). In addition to its internal challenges, Chad faced the massive arrival of refugees from unstable and conflict afflicted areas of Sudan, Central Africa Republic and Nigeria (WFP, 2019).
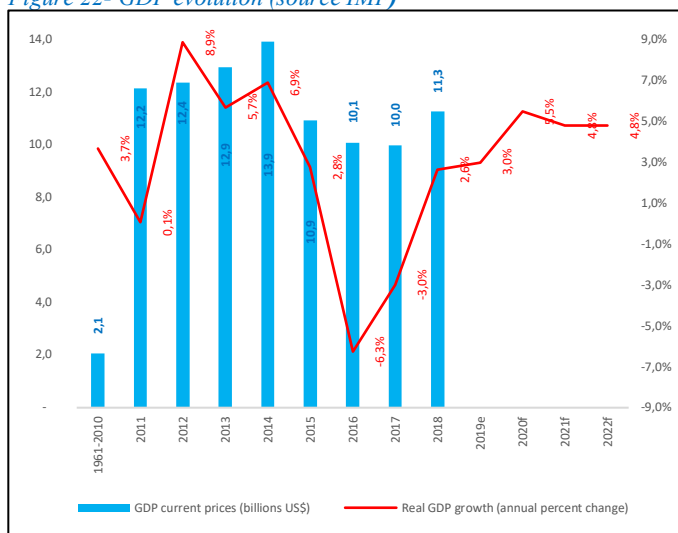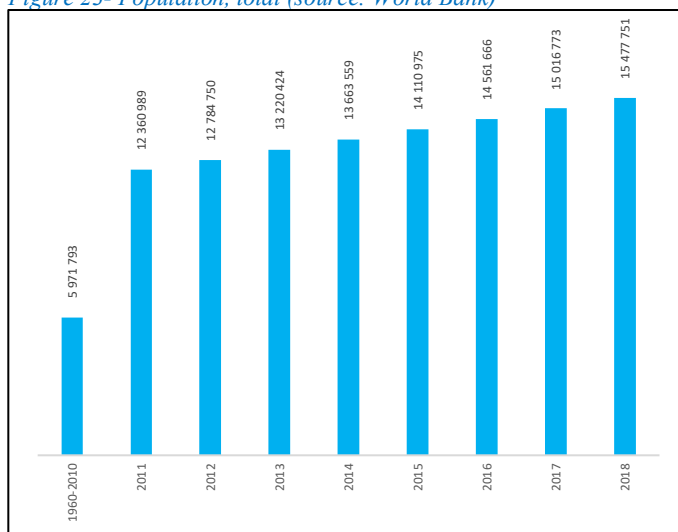
Figure 22- GDP evolution (source IMF)

Figure 23- Population, total (source: World Bank)

Data collection and management: inclusiveness of pastoral organizations

One of the objectives of the Pastoralist Knowledge Hub (PKH) is to ensure a strong inclusion and involvement of pastoral organizations in the collection and management of data on the pastoral and agropastoral household economy in Chad. This approach is expected to contribute to the reliability of the collection process. A regional organization of Sahelian pastoralists and agropastoralists, the *Réseau Billital Maroobé* (RBM) and its Chadian partner, the *Confédération des Organisations Professionnelles des Pasteurs et Acteurs de la Filière Bétail au Tchad* (COPAFIB), have fully fulfilled this function. With the technical and scientific support of CIRAD and FAO, these two organizations have been significantly involved in facilitating the identification and access to pastoral and agropastoral households for the implementation of primary data collection. This partnership was formalized around the census of households to be surveyed, and the recruitment and training of enumerators on data collection tools. The information was closely triangulated with data produced by the first census work realized by the team and those of the *Bureau Central du Recensement Général de l'Elevage* (BCRGE, 2012-2015), the Chadian Livestock Census Bureau (BCRGE, 2012-2015).

Based on these representative data on pastoral livestock in Chad, questionnaires were developed to gather primary information on the revenue, expenditures, perception of shocks and strategies of the pastoral and agropastoral sample households in Chad.

The household economy survey covered the 2017/2018 agropastoral period. The choice of the sample was based on the different production systems and agroecological zones of Chad in order to be representative. Finally, the usable sample consisted of 813 households (Map 2).

Three agroecological zones were distinguished according to rainfall gradients: the Sudanian, Sahelian, and Saharan zones.

The Sahelian zone covers the provinces of Ouaddaï, Batha, Hadjer Lamis, Wadi Fira, Bahr El Ghazal, and the Lake, and represents the majority of households surveyed (58.4%).

The Sudanian zone covers agropastoral provinces, such as Chari-Baguirmi, Logone Occidental, Mayo-Kebbi Est, and Guéra, and regroups 29.6% of the households surveyed.

The Saharan zone is made up solely of the Kanem region, and has 11.9% of the households in the study area. We were unable to investigate in other provinces for security reasons.

The average animal possession of pastoral households is 192 Tropical Livestock Units (TLU), meaning that a pastoral household holds on average 102 cattle, 36 camels, 73 sheep, 45 goats, 9 donkeys, and 7 horses (Table 3).

The distribution of livestock in terms of TLUs shows that the provinces of Kanem (14%), Guéra (12%), Bahr El Ghazal (10%), and Ouaddaï (10%) concentrate the largest numbers (Figure 24).

Map 2 – Distribution of sample investigated household at the provincial level in Chad

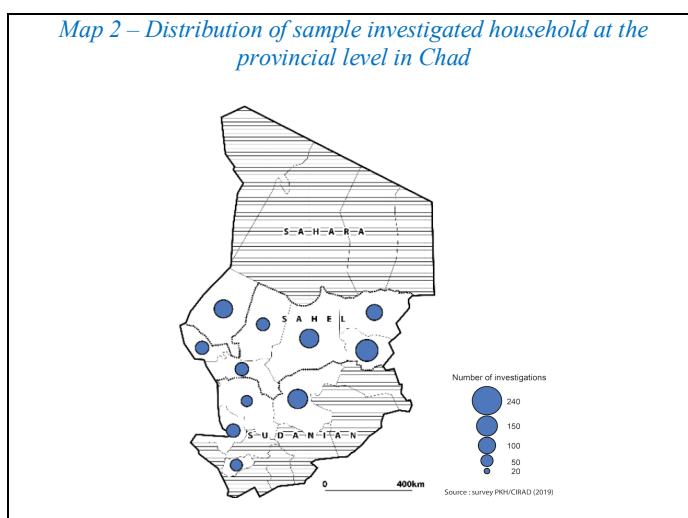*Table 3-* Animal species' equivalent of the average TLU of 192

Male cattle	Female cattle	Male camel	Female camel	Male sheep	Female sheep
24	78	11	25	29	43

Male goat	Female goat	Male donkey	Female donkey	Horse	Mare
13	31	5	4	4	3

Figure 24- Distribution of TLUs by province

Pastoralism and revenue generation

The average overall revenue per year per household is 3,030,760 FCFA (Figure 25). There are significant disparities between agroecological zones. The Sudanian zone has the highest average overall revenue at 5,155,444 FCFA, followed by the Sahelian zone (2,660,617 FCFA), and the Saharan zone with the Kanem region (1,926,280 FCFA).

The disaggregation of average gross revenue allows its main components to be distinguished. Sales of livestock products (live animals and dairy products) remain the main source of cash revenue (54% of the gross revenue). Around 16% of cash revenue comes from agriculture, wage-labor, diversification activities and transfers from household members or affiliates working outside the pastoral activity zone and periodically sending money to support their families. FCFA (Figure 26).

The structure of the revenue also highlights the importance of self-consumption, which contributes 30% of the average overall revenue. At the provincial level, there are some differences in the average importance of self-consumption. Households in Kanem province seem to be more inclined to use their production for self-consumption.

A more detailed livestock revenue analysis shows that pastoral and agropastoral households derive three-quarters of their revenue from the sale of live animals (Map 3). Sales of dairy products represent 26% of livestock revenue. The share of dairy sales is higher in Hadjer Lamis, contributing 62% of livestock revenue. This can be explained by the proximity of the capital city, N'Djamena, which is an important outlet for dairy products. Similarly, N'Djamena offers more possibilities in terms of the presence of small dairy units and equipment for the collection, processing and conservation of dairy products.

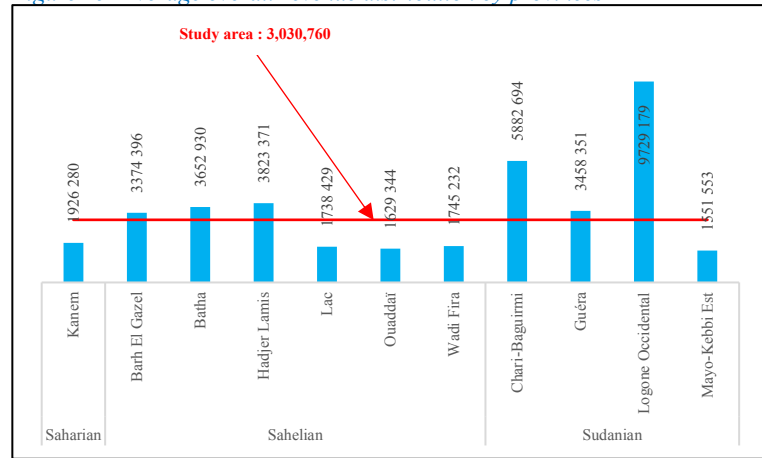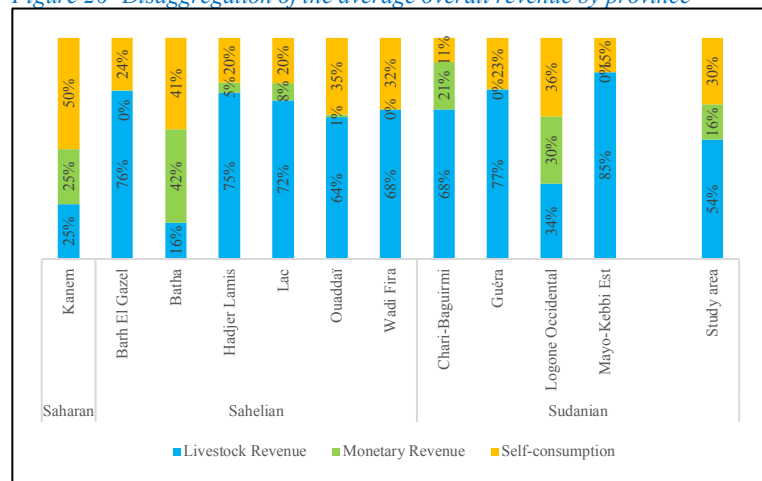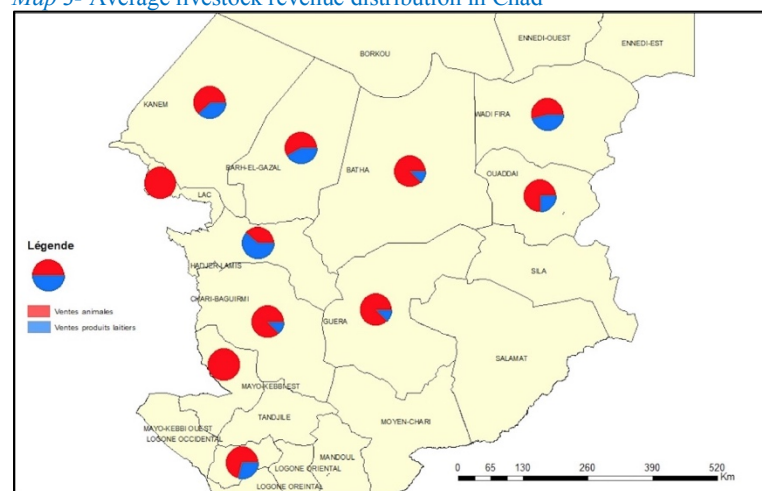*Figure 25- Average overall revenue distribution by provinces*

Figure 26- Disaggregation of the average overall revenue by province

*Map 3- Average livestock revenue distribution in Chad*

A further analysis using deciles allows four categories of pastoral and agropastoral households to be distinguished according to their overall average revenue (low-revenue, lower-middle revenue, upper-middle revenue, and high-revenue) (Table 4). Livestock revenue remains the main source of cash income, accounting for 66% to 68% of overall average revenue for the first three categories (low-revenue, lower-middle revenue, and upper-middle revenue). The high-revenue category mainly derives its revenue from livestock, but to a relatively lesser extent (about 45% of total revenue). This latter category is also characterized by its ability to diversify its sources of revenue (25% compared to 2-3% for the other categories). High-revenue households are mainly located in the provinces of Logone Occidental, Chari-Baguirmi, Batha, and Hadjer Lamis. These provinces facilitate the diversification of activities, in particular crop activities, as the Sudanian zone favor the development of agricultural activities. High-revenue households also are found in Hadjer Lamis province, which is closer to N'Djamena (Figure 27).

Table 4– Classification of households according to their overall average income

Category name	Low-revenue		Lower-middle revenue	
Range	Minimum	Maximum	Minimum	Maximum
Revenue (XAF)	57,000	1,092,500	1,092,501	2,002,313
Category name	Upper-middle revenue		High-revenue	
Range	Minimum	Maximum	Minimum	Maximum
Revenue (XAF)	2,002,314	3,739,600	3,739,601	16,764,725

Figure 27- Breakdown of average revenue by household income category
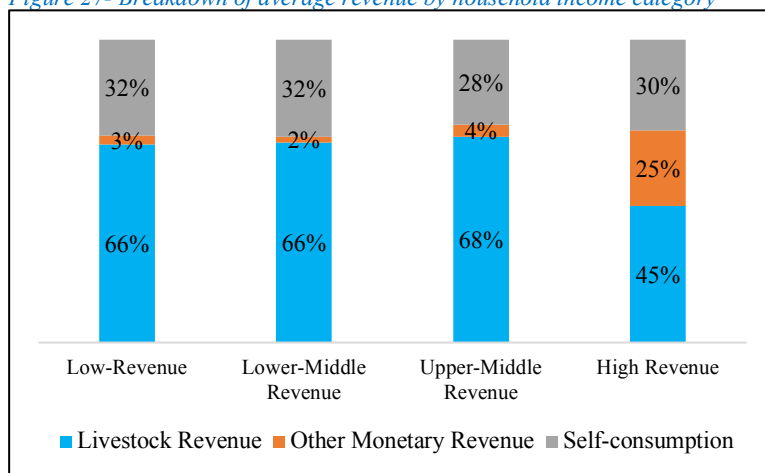
Pastoralism and direct production costs

Pastoral and agropastoral households in Chad use their cash income to purchase food and non-food items. In this survey, we focus on direct production costs, or intermediate consumption expenditures, in order to be able to ultimately analyze them with comparable concepts.

The average annual expenditure is 815,153 FCFA per household (Figure 28). These expenditures vary according to the location of households, with higher average amounts in the Sudanian zone, particularly in the provinces of Logone Occidental and Chari-Baguirmi (Figure 29). This may be the result of additional costs from crop activities.

Furthermore, expenditures related to animal health constitute an important spending item (27% for the study area).

The budget dedicated to the restocking of herds is also important and accounts for 26% of expenditures. The purchase of animals increases with the category scale: the higher the household category, the higher the budget devoted to the purchase of animals.

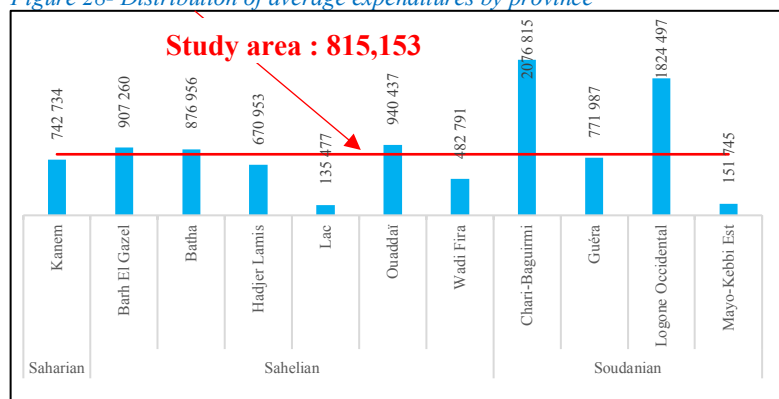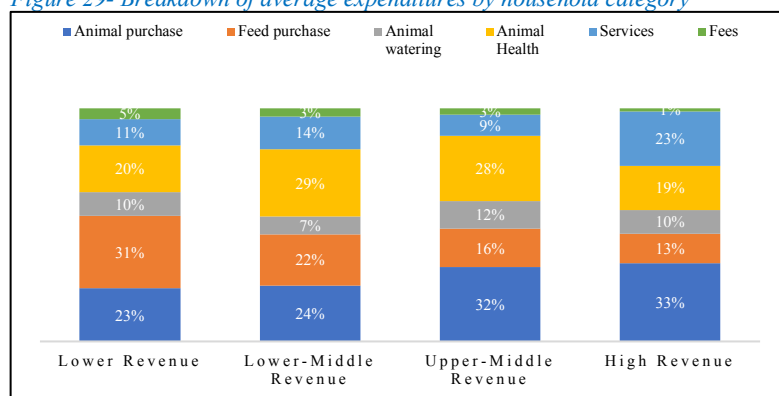*Figure 28- Distribution of average expenditures by province*

Figure 29- Breakdown of average expenditures by household category


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Pastoralism and poverty analysis: a new paradigm to trickle down

The analysis of pastoral and agropastoral household revenues and expenditures provides some initial insight into the role of pastoralism in rural household revenue generation. The revenue structure shows an average self-consumption of 30% for the entire study area (Figure 26).

The conversion of self-consumption into revenue is made possible through the use of current market prices and is recorded as "non-monetary" revenues. This notably reflects the importance of self-consumption of livestock and agricultural products in contributing to food security and illustrates household tradeoffs between consumption and marketing.

The effect of incorporating self-consumption into the poverty analysis is interesting. A more extensive use of this paradigm may call into question some analyses of poverty rates. When self-consumption is considered, the poverty rate improves (in this case, decreasing from 47% to 39%). This also reflects the difficulties in carrying out analyses of household poverty in pastoral systems (Figure 30).

Figure 30- Potential effect of self-consumption on the poverty line
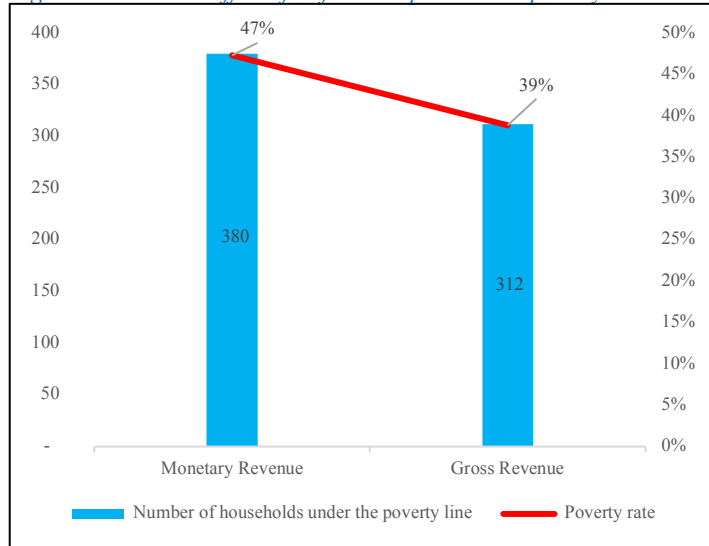
Pastoralism and wealth creation

The value-added approach, under which GDP is considered to be equal to the value of all goods produced in all sectors minus the value of all purchased intermediate goods used for production (*i.e., intermediate consumption*) was implemented in this study to provide insight into the direct contribution of pastoral and agropastoral households. The value added of a production unit reflects the amount of economic value of the primary factors of production used in the production process. The value added is calculated by subtracting the direct pre-tax charges from the pre-tax turnover for a given period. As we have done for Argentina and will do for Mongolia, we describe three main scenarios. The main calculations on which the different scenarios are based are presented in Appendix 3.

In **scenario 1**, the base-case model, pastoral and agropastoral households contribute 11% of the GDP, and 24% of the agriculture GDP.

In **scenario 2,** incorporating the significant self-consumption in Chad, the same households contribute 27% of the GDP, and 61% of the agriculture GDP.

In **scenario 3**, the contribution of pastoralists to GDP and agriculture GDP declines to 1% and 3% (without self-consumption) and 18% and 40% (with self-consumption) assuming an average holding period of animals sold of two years. This contribution drops substantially to reach negative figures when the average ownership of animals sold is three years, -8% and -18% (without self-consumption). This contribution is maintained positive but at a lower level when self-consumption is incorporated: 9% and 19%.

Figure 31- Direct economic contribution to GDP and Ag. GDP
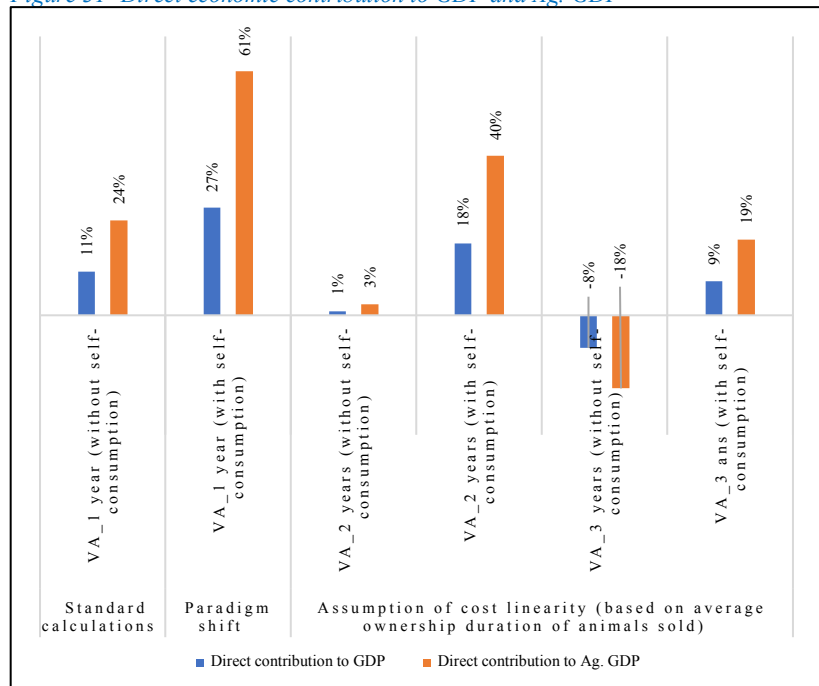
Pastoralism and revenue distribution

The revenue distribution of pastoral and agropastoral households in the study area appears particularly unequal across this Lorenz curve with a high concentration area.

These revenue inequalities are reflected through a global Gini index in the zone of around 49.6 above the national level assessments, resulting in a Gini index of 44.0 (World Bank, Taking on Inequality, 2016).

Self-consumption contributes to the attenuation of inequalities with a Gini index slightly decreasing from 0.496 to 0.483. Although self-consumption in Chad is higher than in Argentina, there is no mechanical effect of self-consumption in the Gini index. (Figure 32)

Figure 32- Distribution of monetary and gross revenue

Pastoralism and multifaceted shocks

In the context of Chad's pastoral and agropastoral systems, idiosyncratic shocks are reported most, accounting for 51% of the total, versus 43% for covariate shocks. The remaining 6% are attributable to a combination of various shocks.

Among the idiosyncratic shocks most reported by investigated households are the occurrence of animal diseases, conflicts and livestock thefts. At the agroecological levels, there are notable differences. In the Sahelian zone, the occurrence of conflict or violence is the most frequently reported shock by pastoral households (32%). This may be due to regular tensions between different communities, notably in the eastern part of the country.

In the Sudanian zone, the idiosyncratic shock with the highest occurrence is related to animal diseases. Rainfall conditions in southern Chad may be conducive to the emergence or reinforcement of animal diseases.

The Saharan zone, together with the Kanem region, report no idiosyncratic shocks.

The covariate shocks are dominated by climate change with the recurrence of drought in the study zone (50% of responses). Pastoral and agropastoral households resort to the purchase of livestock feed, the price increase of which is reported as the second most important covariant shock (21%).

More specifically, in the agroecological zones, the proportion of households reporting drought as the main covariate shock is higher in the Sahelian zone than in the Sudanian zone (59% versus 42%).

Figure 33- Perceived shocks in the study area
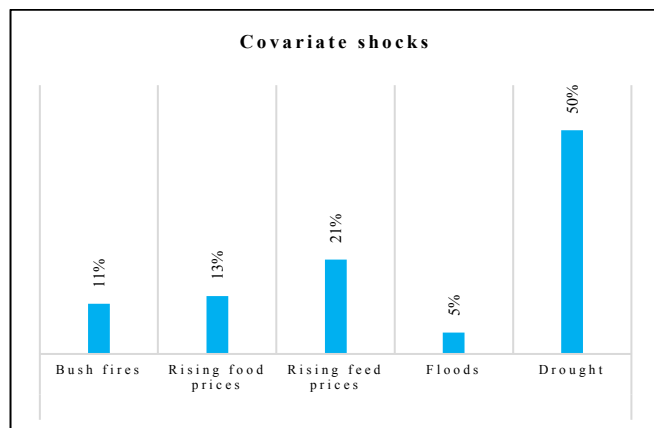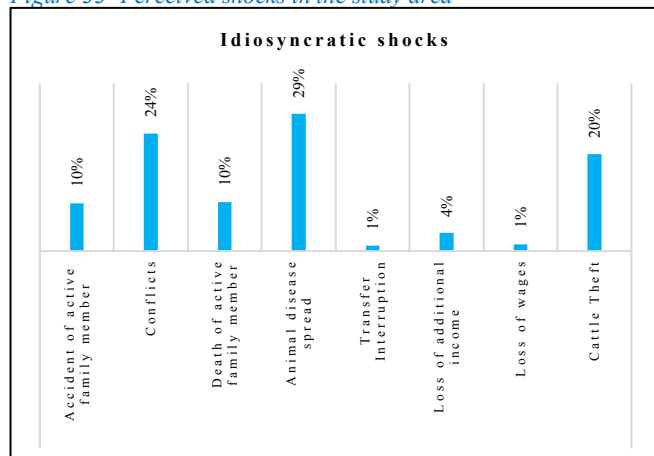
Pastoralism and contingent strategies

In this shock-prone context, pastoral and agropastoral households have used a variety of strategies. The most significant at the level of the surveys are the adjustment of pastoral practices and sales and monetary arrangements. The main strategy adopted by households involves increasing the amplitude and frequency of mobility. Faced in particular with a climate shock, pastoral and agropastoral households are resorting to transhumance as their main strategy, moving towards host areas further south in Chad by mobilizing more family labor or relying on salaried herders. The other preferred strategy is increased sales of livestock in a system where livestock capital is the main asset. The two main strategies used by pastoral and agropastoral households show the low dependency on external support mechanisms.

Figure 34- Strategies prioritized by HHs in the study area
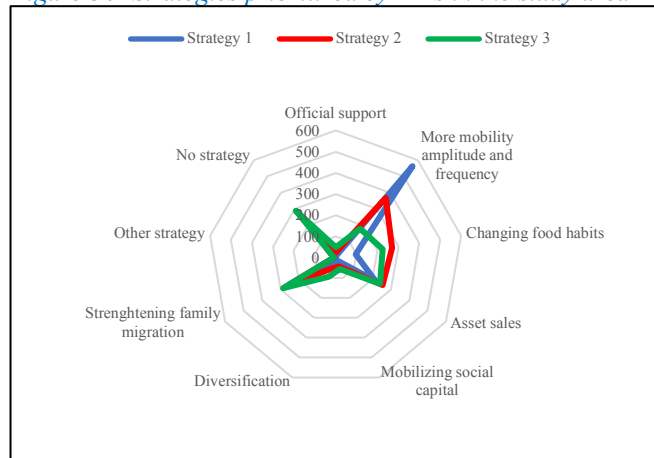
The use of mobility and livestock sales on a larger scale shows the willingness of pastoral people to rely on their own assets, and highlights the resilience capacities in these systems. There were few reports of strategies involving reliance on government support or subsidy programs.

Mongolia

The economics of pastoralism
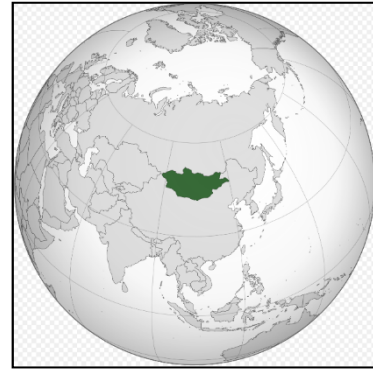
Background and macro context

Located in the heart of Central Asia, Mongolia had high economic growth rates in 2011 and 2012 before experiencing a macroeconomic crisis that lasted until 2017. Persistent economic imbalances sharply affected the country. Efforts made to reduce poverty in 2011 and 2012 appeared to be in vain, with a decrease in the key drivers of the economy: foreign direct investment (FDI) and private consumption. The Mongolian authorities implemented strong economic adjustment measures to improve the fiscal balance. According to the World Bank (2019), the deficit declined from 15.3% of GDP in 2016 to a surplus of 2.6 in 2018 and 3.4 in January-July 2019 (Figure 35).

Like most small commodity exporters, growth is expected to decelerate, but remains relatively strong in Mongolia (due to vigorous private consumption and mining sector investment). Mongolia remains the least densely populated country in the world, with an overall population density of 1.7 per square kilometer (3.2 million people sparsely distributed over 1.6 million square kilometers). (Figure 36).

Despite strong economic imbalances, the Mongolian authorities continue to prioritize the agricultural sector. Given its multiple functions (food security, cash revenue, export revenues, employment, landscape management etc.), the livestock sector deserves close attention. In recent years, the government has focused more on the intensive development of the food and agricultural sector, emphasizing increased production and productivity and reduced vulnerability to climate, market and social challenges.

The Mongolian livestock sector has drastically changed since 1990, when the country started its transition towards a market economy. Between 1991 and 2018, the total number of ruminants soared from 26 to 66 million heads. This pastoral boom has been mainly due to a sharp rise in small ruminants. During this period, the number of goats multiplied by 5.4, reaching 27 million heads. The sheep herd doubled, reaching 30 million heads (NSO, 2019).

Figure 35- GDP evolution (source IMF)

Figure 36- Population, total (source: World Bank)

Figure 37- Animal population in Mongolia (source: NSO)

This "small ruminant revolution" has shown the ability of pastoralists to adapt to the new market context, taking advantage in particular of high demand for wool, meat and cashmere. At the same time, the extension of the national herd has threatened the capacity of the rangeland to support this new grazing pressure. The rise in small ruminant herds has also increased the vulnerability of herders facing exceptional climate events. The dzud[49] that arose in 2000-2002 resulted in a 30% decline in the national herd. And the dzud that came in 2009-2010 had the same dramatic consequences. The collapse of the former socialist institutions based on collective solidarity and public support (such as local cooperatives - negdel) has increased the vulnerability of pastoralists facing climate irregularity.

In this context, pastoral organizations such as the *National Federation of Pastoral Users Groups (NFPUG)* should play a stronger role in promoting solutions for a more sustainable management of rangeland and animal product value chains. The collection of accurate data on the pastoral household economy is in particular needed to support the capacity of these organizations to propose sustainable development policies and strategies.

Data collection and management: inclusiveness of pastoral organizations

In Mongolia, the study was conducted in partnership by the FAO Pastoral Knowledge Hub (PKH), CIRAD and NFPUG. NFPUG is a federation of herders working in Mongolia with several national and international partners (such as the Swiss Cooperation, the World Bank, the European Union, UNDP, etc.), and has been implementing several projects and programs related to pastoralism, with a focus on preventing land degradation.

PKH and CIRAD were in charge of the survey design, and NFPUG was in charge of survey implementation and data collection. All three partners worked together on data analysis under the leadership of CIRAD. Two complementary surveys were conducted as indicated below.

From March to June 2018, the team conducted an initial exploratory survey on a large sample of households to broadly characterize the pastoralist population.

Map 4– Distribution of sample investigated household at the provincial level in Mongolia

Number of investigations
240
150
100
50
20

Source : survey PKH/CIRAD (2019)
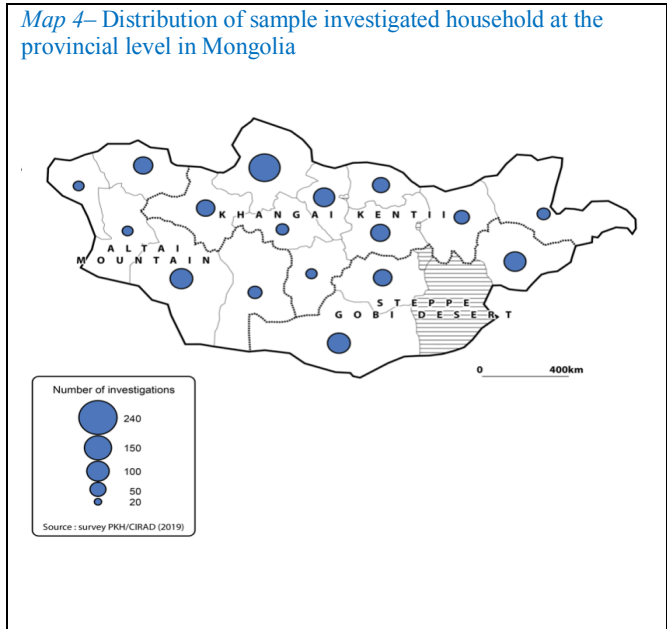
In total, more than 100,000 pastoral households were surveyed in 159 *sums* (an administrative subdivision in Mongolia where Pastoral Users Groups are registered). This sample represents around 30% of the total households registered nationally, and around 50% of the 333 *sums* reported in Mongolia. (Map 4)

In 2019, a second in-depth survey was conducted on a representative sample of 764 households to collect household economics data. The explanation of the sample size is mentioned in the introduction (Table 1). The repartition of the surveyed households is given in the figure below.

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[49] Over the past two decades, Mongolia has been hit by two extremely severe winters, which caused mass livestock mortality. The phenomenon of harsh winters causing mass livestock mortality is referred to as *dzud* in the Mongolian language. Extreme winters are characterized by exceptionally cold temperatures, excessive snow, lack of precipitation during the previous summer and fluctuations in temperature that cause the snow to melt and then ice over, thus hindering animals from grazing.

Pastoralism: rearing of various animal species

Pastoralism is a thousand-year-old land use activity in Mongolia. Despite the changes observed, Mongolian pastoralists continue to manage livestock today in a way that is centuries old. Grazing systems are transhumant with winter bases to protect the livestock from harsh winter conditions.

Herding is the main economic activity in rural Mongolia. *Mongolian herders typically hold multi-species flocks composed of different ruminant species, including horses, cattle (and yaks), sheep, goats and camels (the five "muzzles").* Herders typically own a mix of species well adapted to the extreme continental climate of Mongolia. According to the National Statistics Office (NSO) of Mongolia, the country owned 4,388,455 cattle; 434,096 camels; 30,109,888 sheep; 27,346,707 goats and 3,939,813 horses in 2017.

Cattle are mainly reared for the production of milk and dairy products. Cattle herd stocks remain more than 60% female dominated and contribute to household production objectives.

The trends observed for cattle are reversed for camels, which remain overwhelmingly or even totally dominated by males. In the Steppe and Gobi Desert, the declared herds are made up entirely of males. This is almost the case in the Khangaï-Kentii Mountains (98% males) and to a lesser extent in the Altaï Mountains (70%).

Small ruminants are constituted by sheep and goats. Sheep provide most of the meat for households' subsistence needs. Households have a net preference for mutton for their main meals. Goats play an important role as cashmere becomes the main source of cash revenue. There is a slightly superior proportion of females in the small ruminant herd.

As with camels, horses are an element of prestige but also are hoarded. Both species play an important role in the transport of goods and people during long migrations. For this reason, males are preferred for these two species in family herds.

Figure 38- Species composition of an average herd
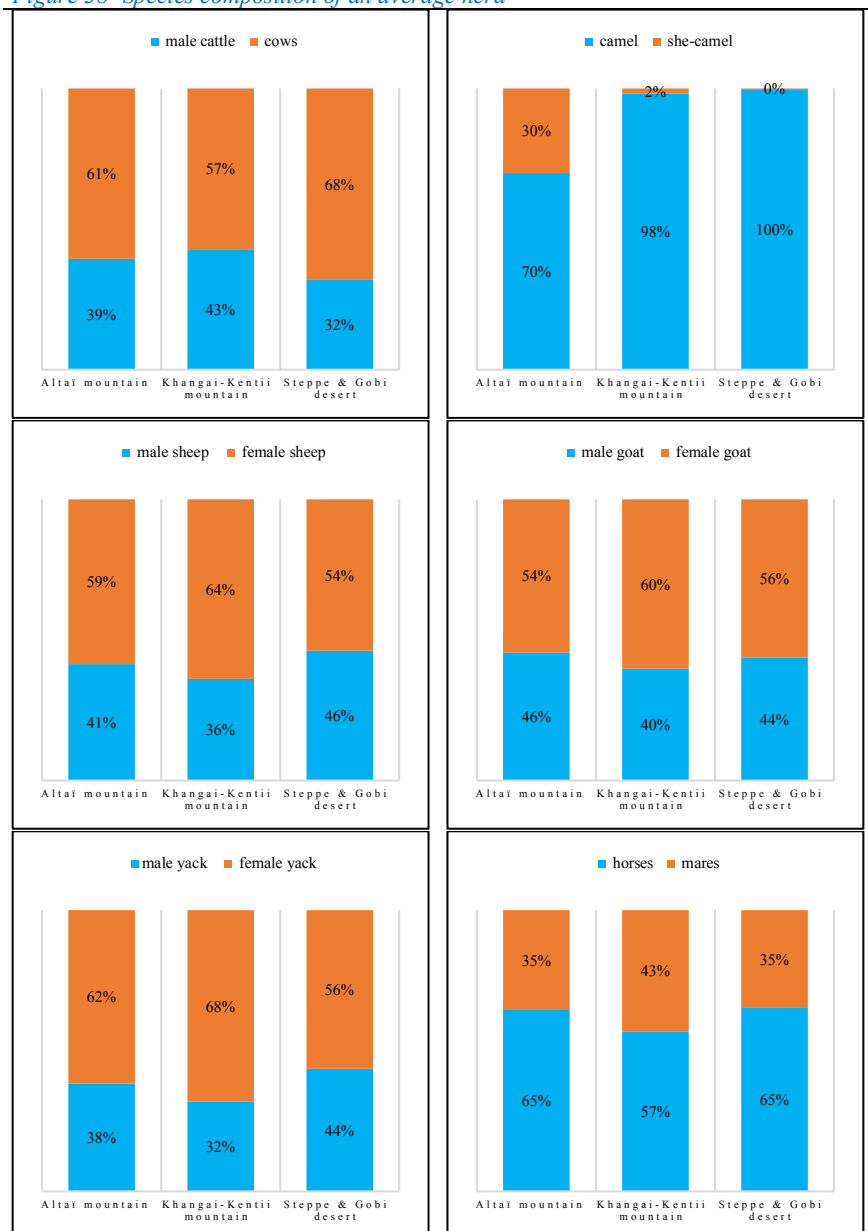
All animal species are sold (alive, slaughtered, as well as their skins and hides) when the need arises. The proportion of each species varies in time and space. FAO has provided a livestock standard unit (LSU) as a convenient way for the aggregation of livestock from various species. In Mongolia, animals are traditionally compared to each other, with 1 horse being equivalent to 1 cattle, 7 sheep, 10 goats and 0.67 camels. FAO recommends some slightly different conversion rates, with 1 horse equivalent to 1 cow, 7.5 sheep, 7.5 goats and 0.8 camels. However, Mongolian authorities are using an alternative measure for the aggregation of various species, the Sheep Forage Unit (SFU), which

seeks to standardize livestock grazing by placing different species as sheep equivalents. In Mongolia, SFU per type of animal is 5 SFU per camel, 7 SFU per horse, 6 SFU per cow or yak, and 0.9 SFU per goat.

Our sample household surveys show that average animal ownership is 78 LSU or 757 equivalent sheep. This would mean that households own an average of 12 male cattle, 17 cows, 2 camels, 77 male sheep, 116 female sheep, 74 male goats, 99 female goats, 19 horses, 13 mares, etc. This would be equivalent to considering that households own on average 12 male cattle, 17 cows, (note that cattle include yaks) 2 camels, 77 male sheep, 116 female sheep, 74 male goats, 99 female goats, 19 horses, and 13 mares.

Households in Khangaï-Kentii are better endowed with live animals than the two other major agroecological zones. Pastoralists' needs of space depend a lot on the ecological characteristics of land. Those living in Gobi arid lands use greater distances. The process to develop protected areas and the potential for a much larger area to be placed under protected status creates real opportunities for local pastoralists to benefit from.

Most protected areas in Mongolia allow grazing by domestic livestock, and even areas that prohibit livestock by law remain largely unmonitored and pastoralists continue to use most of these areas, at least periodically. However, the emergence of mining activities has affected land conservation and pastoralists have been strongly constrained in their production activities. In the Altai Mountains region, pasture conditions have been deteriorating over the past 20 years. The pastures in the high valleys, where the nomad families live, increasingly offer insufficient forage for the livestock (Figure 39).

Figure 39- Livestock distribution according different approaches
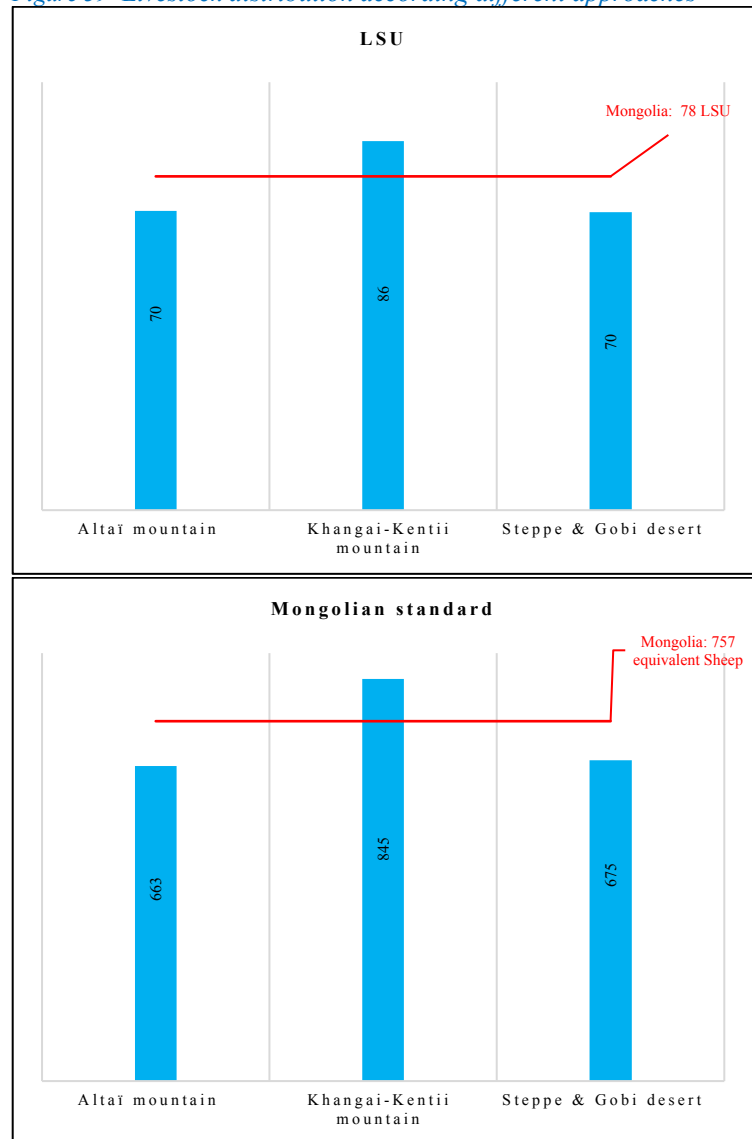
Pastoralism and revenue generation

The annual gross revenue of the households interviewed is estimated to be 11.8 million MNT per household, and incorporates all sales realized by the household as well as self-consumption, wages and salaries, transfers and exceptional items.
The average annual total revenue of households based in the Steppe and Gobi Desert and Khangai-Kentii Mountains regions, representing 70% of the households in the survey area, was around 12.7 million MNT, which is largely superior to those of households in the Altaï Mountains area (8.9 million MNT). (Figure 40).

Figure 40- some average revenue indicators
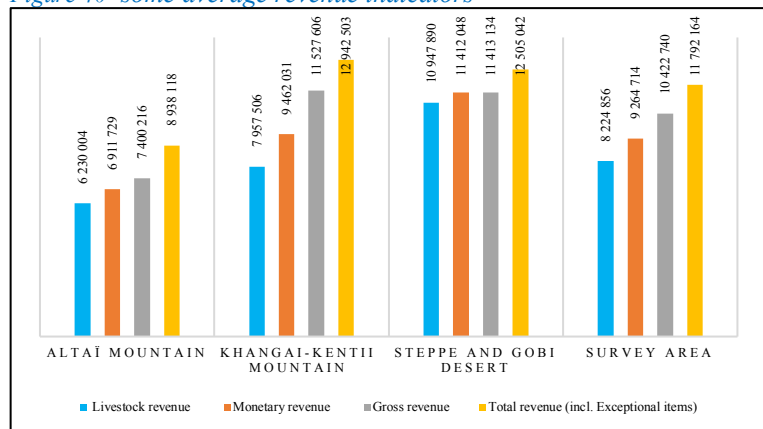
The total revenue is dominated by cash revenue generated from the sale of live animals and livestock products: 74% in the survey area, 76% in the Altaï Mountains, 67% in the Khangai-Kentii Mountains and 88% in the Steppe and Gobi Desert.

Self-consumption contributes 10% of the total revenue. The use of production for self-consumption is most significant in the Khangai-Kentii area (17%), while relatively marginal in the Altai Mountains (6%). The households surveyed in the Steppe and Gobi Desert did not reveal any recourse to self-consumption. This was questionable and surprising as camel herders usually depend on meat and milk self-consumption.

Looking more closely at the revenue generated by the sale of livestock products, live animals remain the main source of cash, accounting for 88% of the total revenue. The sale of other animal products (including fibers) account for only 12% of total household revenue. In addition, the sale of livestock products is not marked by a seasonal pattern with the exception of the Steppe and Gobi Desert, where the warm season seems to be more conducive to trade.

Agricultural products present a different situation, as goods are traded during the warm season, although in the Altaï Mountains slightly less than a third of sales take place in the cold season. There are no sales of agricultural products in the Steppe and Gobi Desert.

The other sources of monetary revenue are dominated by wages (57%) and other sources of revenue (37%). The development of extractive industries offers wage-labor opportunities in the Steppe and Gobi Desert and Khangai-Kentii Mountains. To a lesser extent, households of the Altaï Mountains rely on wages. Transfers are weak (7%).

Almost similar to self-consumption, exceptional items, made up of subsidies, loans and other sources of revenue, represent 8% in the survey area. Overall, the exceptional items mostly come from subsidies and loans. The government supports all Mongolian citizens by providing each of them a per capita grant. This financial annuity represents almost half of the exceptional items received by households (47%). This support can be very significant (98% in the Steppe and Gobi Desert) while others declare also having access to loans (Figure 43).

Figure 41- Components of the annual total revenue by regions

Breakdown of total revenue

Breakdown of livestock revenue

Breakdown agricultural products

Breakdown of other sources of income

Breakdown of exceptional items

39
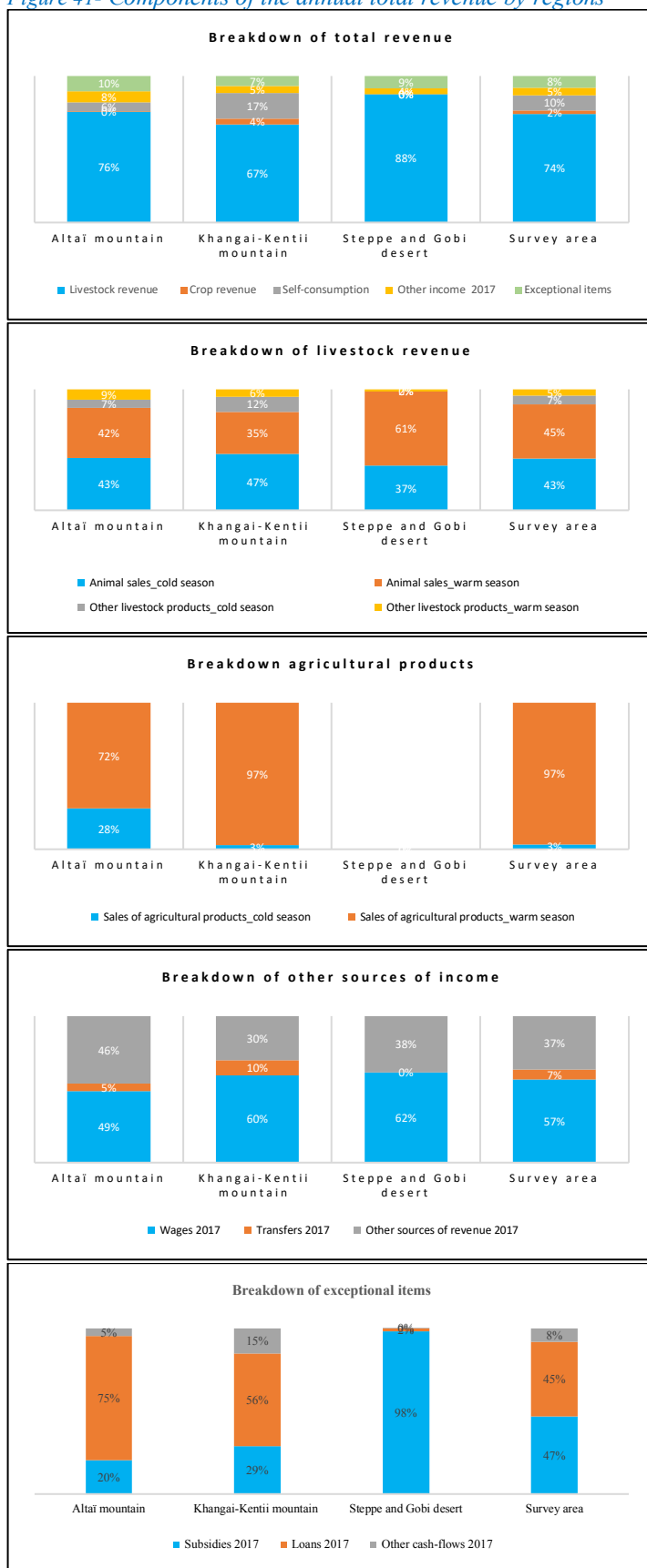
Sales of livestock products play a key role in the total revenue for all categories. Their contribution increases from the low-revenue (18%) to lower-middle revenue (40%), upper-middle revenue (59%) and high-revenue (82%) categories.

The higher one goes up the household revenue ladder, the less recourse is made to exceptional items, which in turn decreases, contributing 78% of the total revenue of the low-revenue category and up to 4% of the high-revenue group.

These general trends, while instructive, hide important disparities from one *aimag* (administrative subdivision) to another.

Figure 42- Components of the annual total revenue by category of household
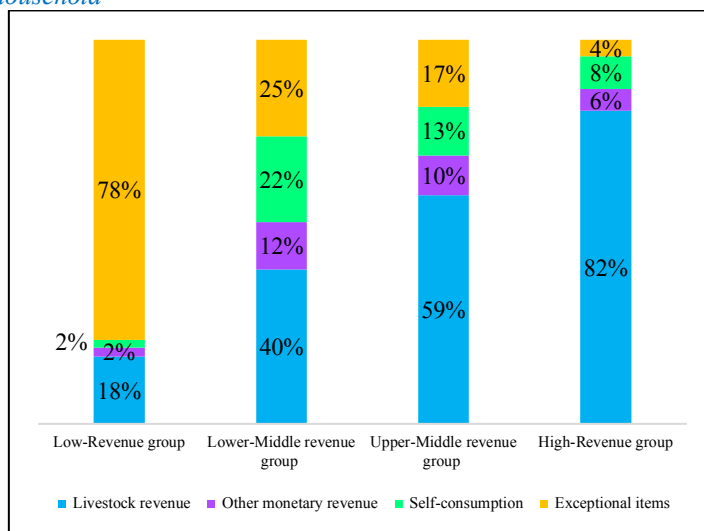
Pastoralism and direct production costs

The average annual expenditure is 698,653 Tugrik Mongol (MNT) per household (Figure 29). Production costs represent 83% of household annual expenditures.

Expenditures vary greatly according to the location of households, with higher average amounts in the Altai Mountains (48%), in particular in Govi-Altai and Bayankhongor, as well as in the Khangai-Kentii Mountains (37%), notably in Arkhangai and Bulgan.

On average, the direct intermediate costs of households essentially come from the purchase of services (44%) and live animals (37%) to reconstitute and consolidate the family herd. The proportion of services in the household budget remains relatively very high. This expenditure, linked to the provision of services related to animal herding and marketing, can also be explained by the large size of the country, which also poses the problem of access to basic infrastructure and social services.

Overall, animal health and animal watering have lower costs. However, in the Steppe and Gobi Desert, animal watering puts a strong strain on household budgets (39%) in comparison to other regions.

In the Khangai-Kentii Mountains and Altaï Mountains, budget components are relatively similar.

Figure 43- Direct production costs by regions
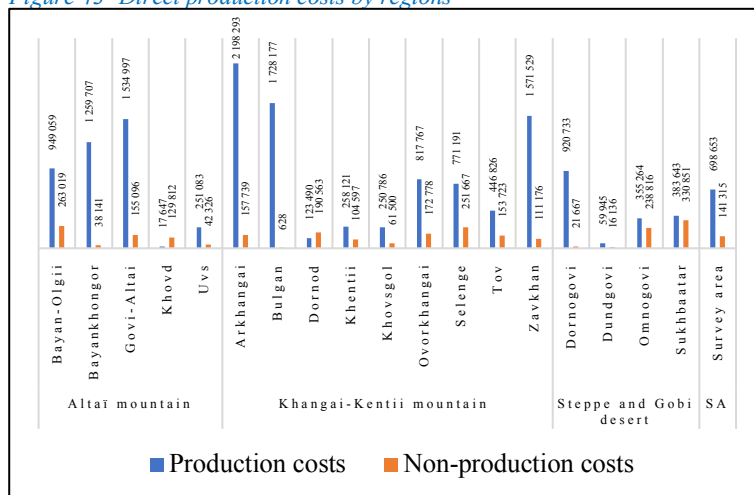
Figure 44- Direct production costs by agroecological regions
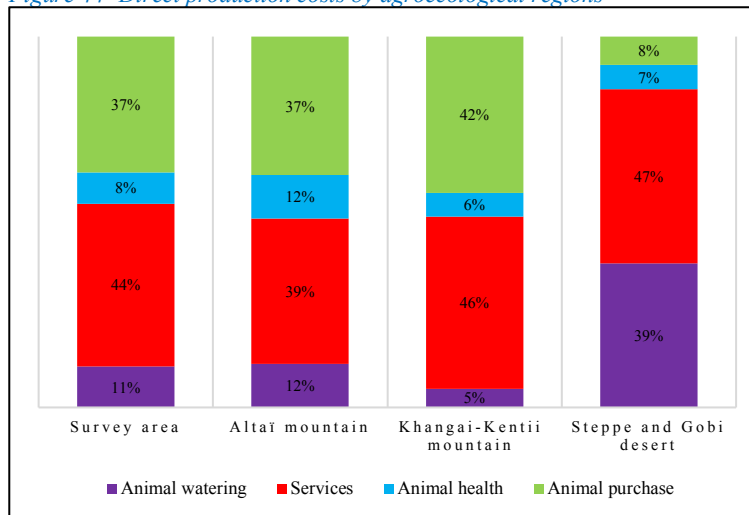
Pastoralism and wealth creation

The main calculations underpinning the different scenarios are presented in Appendix 4

In **scenario 1**, the base-case model, pastoral and agropastoral households in Mongolia contribute 9.6% of the GDP.

In **scenario 2,** incorporating self-consumption, which is weak in comparison to Argentina and Chad, the same households contribute 11.9% of the GDP.

In **scenario 3**, which incorporates the repetitiveness of production costs during the production process and before the marketing of live animals, the contribution of pastoralists to GDP declines to 8.7% (without self-

Figure 45- Direct economic contribution
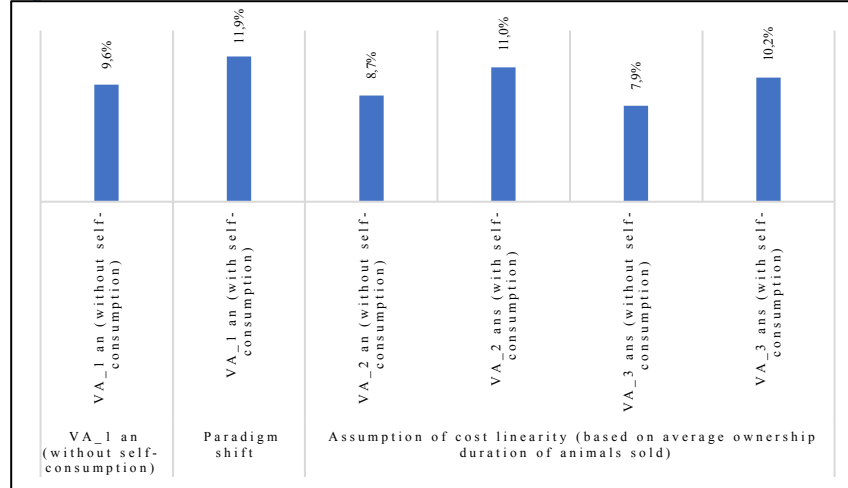
consumption) and 11.0% (with self-consumption), assuming an average holding period of animals sold of two years. This contribution declines even further if the average ownership of animals sold is three years, to reach only 7.9% (without self-consumption) and 10.2% (with self-consumption).

Pastoralism and revenue distribution

In Mongolian pastoral and agropastoral areas, the distribution of all categories of revenue remains strongly unequal.

The revenue from livestock sales presents the worse figures (Gini coefficient of 0.663) and might reflect inequalities related to initial animal endowments.

The strategies and actions developed by pastoralists might also result in reducing revenue inequalities. Indeed, the diversification of activities (crop sales, wage-labor, transfers), slightly contribute to inequality reduction (Gini coefficient of .66). In addition, the use of production for self-consumption affects the revenue distribution by reducing it (Gini coefficient of 0.63). Moreover, capturing exceptional revenue such as grants and loans is also consistent with inequality reduction (Gini coefficient of 0.61).

Figure 46- Revenue distribution in Mongolian pastoral and agropastoral areas
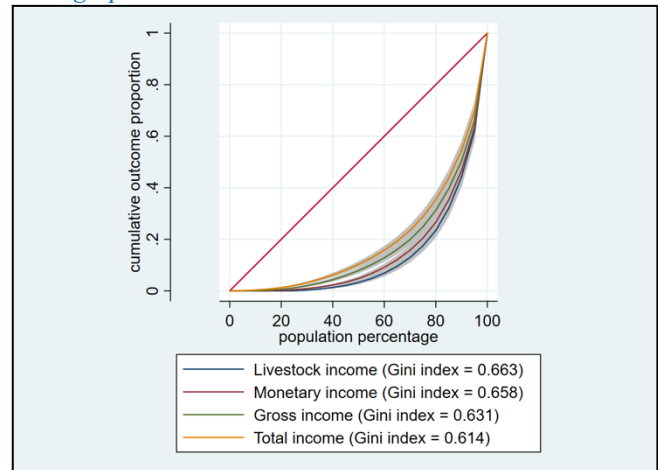
Conclusion

Pastoralism is an important activity in Argentina, Chad and Mongolia. These production systems, which use natural resources that are asymmetrically distributed over the seasons and years, are also based on principles of community management and mobility. These pastoral production systems are intrinsically linked to a way of life rooted in centuries-old traditions. However, these different features of pastoralism make it difficult to establish economic, social and environmental assessments that can only be carried out on the scale of vast pastoral territories.

In this context, pastoralism adds value to natural resources by producing nutrient dense foods (meat, milk) as well as hides and skins, wool and leather. It also contributes to many other services such as animal traction. Yet when calculating the economic components of GDP, which is commonly used to establish the wealth generated by a country within a given period, only market output is considered. An important step taken in this study is the inclusion of self-consumption, which fulfills a vital function of food security and market risk management. In so doing, this study highlights the undervaluation of the real contribution of pastoralism, and produces an approach for incorporating these non-market outputs into national accounts.

GDP, and the economic growth it represents, only provides a partial understanding of the pastoralist contribution. Pastoral systems provide many ecosystem services that often are not considered in the multifunctional assessment of impacts. They ensure a transfer of organic matter through the rapid recycling of the fodder consumed and large fractions of mineral elements, particularly nitrogen and phosphorus, which are limiting factors in crop production. The contributions of pastoral systems are important factors of biodiversity. Moreover, pastoral systems are used to intensify and diversify crops, and contribute to soil carbon sequestration and thus ultimately to the mitigation of GHGs. The tools used to assess the direct contribution of pastoralism to national economies, although very useful for advocating the cause of pastoralism to decision makers, thus need to be complemented by integrating the multifunctional dimension of pastoralism. The provisioning of other services from pastoral systems are themselves insufficiently measured (biomass production, biodiversity, water cycling, social impacts, etc.). The challenge remains the effective measure and integration of ecosystem services into national accounts. Hence, to fully address the multifunctionality of pastoralism, it would be worthwhile to assess the condition of ecosystems in relation to human well-being.

This will involve considering the new social, economic and environmental challenges facing pastoralists and incorporating the value of pastoralist ecosystem services in the economic valuation of this major activity in many parts of the world.

Appendix
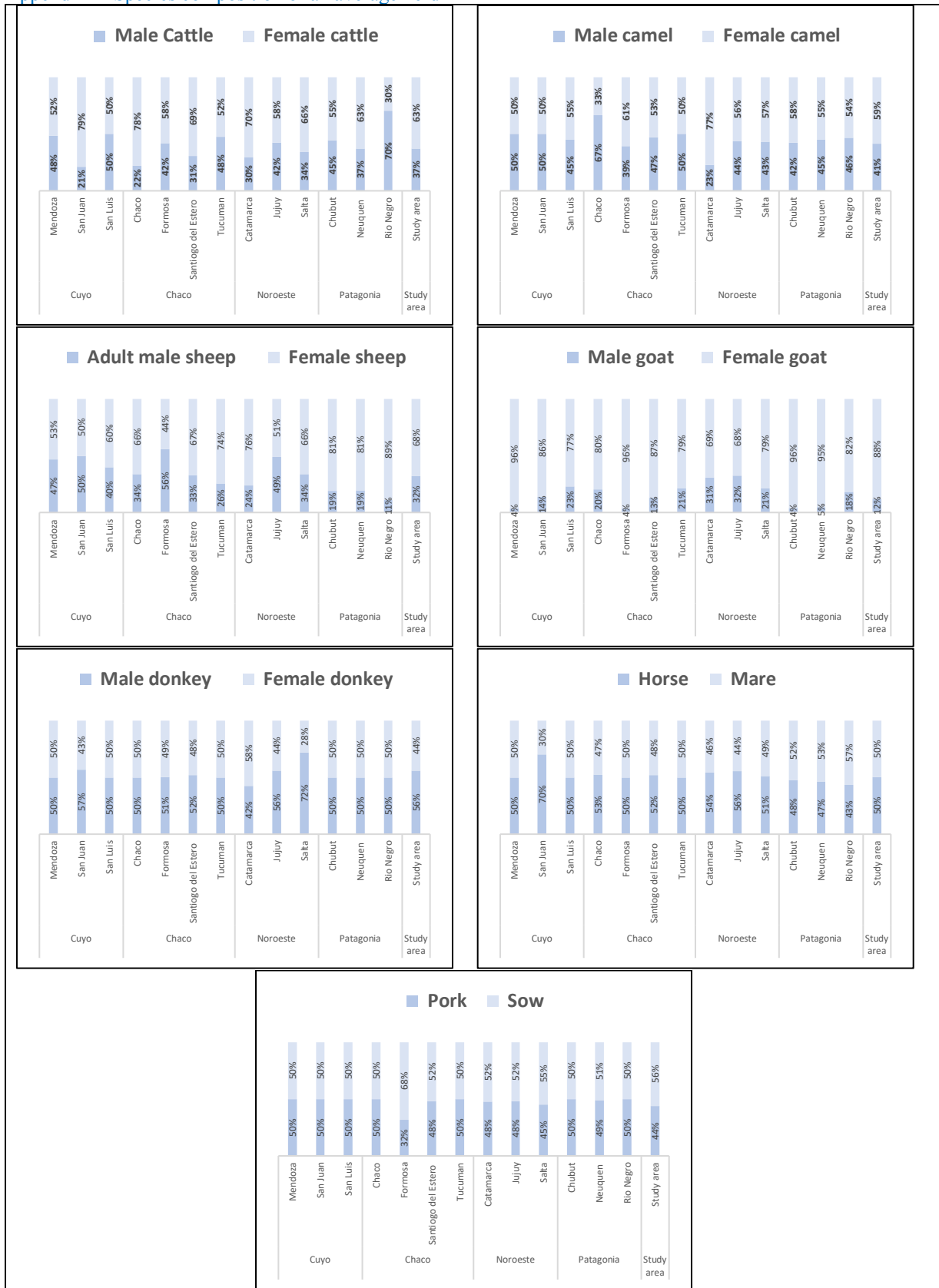
Appendix 2- Argentina - Simulation of the different added-values by regions and provinces

Provinces	Sub-zones	Distribution of HH number	HH number aggregation	1-year added-value (without self-consumption)	1-year added-value (with self-consumption)	2-years added-value (without self-consumption)	2-years added-value (with self-consumption)	3-years added-value (without self-consumption)	3-years added-value (with self-consumption)
Salta	Pilcomayo	600	1,500	545,702,174	1,903,011,568	454,198,323	1,811,507,716	362,694,471	1,720,003,865
	Ruta81	300							
	Bermejo	100							
	Banda Sur	200							
	Anta	300							
Chaco	Oeste	450	800	62,148,764	477,590,106	54,930,582	470,371,924	47,712,400	463,153,743
	Este	350							
Santiago del Estero	Copo Alberdi	1,000	7,000	737,966,513	1,752,917,330	626,540,650	1,641,491,467	515,114,788	1,530,065,605
	Figueroa	1,000							
	Termas	1,000							
	Quimili	1,000							
	Atamisqui	1,000							
	Choya	1,000							
	Ojo De Agua	1,000							
Formosa	Quebracho	300	1,000	388,527,561	78,8616,803	317,175,136	717,264,379	245,822,712	645,911,955
	Juarez	200							
	Ruta28	450							
	Yema	50							
Tucuman	Chaco Tucuman	150	150	11,395,790	65,284,227	11,395,790	65,284,227	11,395,790	65,284,227
Santa Fe	Chaco Santa Fe	-							
Jujuy	Puna	700	2,000	351,176,760	1,016,557,667	215,516,505	880,897,412	79,856,250	745,237,157
	Quebrada	700							
	Valles	600							
Salta	Puna	200	1,200	436,561,739	1,522,409,254	363,358,658	1,449,206,173	290,155,577	1,376,003,092
	Valle Calchaqui	500							
	Quebrada del Toro	200							
	Valle De Lerma	300							
	Prepuna	800							
Tucuman	Valle Calchaqui	200	400	30,388,773	174,091,273	30,388,773	174,091,273	30,388,773	174,091,273
	Trancas	200							
Catamarca	Puna	800	1,600	405,207,476	564,438,749	328,814,109	488,045,382	252,420,742	411,652,015
	Oeste	200							
	Este	600							
Neuqueun	Neuqueun	2,465	2,465	(22,367,330)	120,019,816	(593,872,253)	(451,485,106)	(1,165,377,175)	(1,022,990,029)
Chubut	Meseta	1,409	2,429	759,149,056	1,278,737,614	456,661,856	976,250,414	154,174,656	673,763,214
	Valle	300							
	Cordillera	720							
Rio Negro	Rio Negro	2,427	2,427	266,037,560	493,102,287	208,202,420	435,267,146	150,367,279	377,432,006
Total			22,971	3,971,894,836	10,156,776,694	2,473,310,549	8,658,192,407	974,726,263	7,159,608,121
GDP 2018 (LCU) (World Bank)			707 091 754 400	0,6%	1,4%	0,3%	1,2%	0,1%	1,0%
Ag. GDP: 6,14% GDP (World Bank)			43 415 433 720	9%	23%	6%	20%	2%	16%

* use of national average values

Appendix 3- Chad - Simulation of the different added-values by regions and provinces

Provinces	Livestock revenue	Gross revenue	Direct production costs	Pastoral HH number	1-year added-value (without self-consumption)	1-year added-value (with self-consumption)	2-years added-value (without self-consumption)	2-years added-value (with self-consumption)	3-years added-value (without self-consumption)	3-years added-value (with self-consumption)
Barh El Gazel	2,570,540	3,374,396	907,260	28,243	46,976,019,922	69,679,313,979	21,352,269,978	44,055,564,035	(4,271,479,966)	18,431,814,091
Batha	598,704	3,652,930	876,956	67,558	(18,798,164,058)	187,539,265,004	(78,043,543,994)	128,293,885,067	(137,288,923,931)	69,048,505,131
Chari-Baguirmi	3,985,469	5,882,694	2,076,815	74,096	141,423,591,794	282,000,375,394	(12,460,108,912)	128,116,674,688	(166,343,809,617)	(25,767,026,017)
Guéra	2,698,456	3,521,807	771,987	83,008	159,912,324,283	228,257,027,242	9,5831,208,348	164,175,911,307	3,1750,092,414	100,094,795,373
Hadjer Lamis	2,876,971	3,823,371	670,953	63,727	140,582,920,116	200,894,152,916	9,7825,099,510	158,136,332,310	55,067,278,905	115,378,511,705
Kanem	484,788	1,946,345	742,734	64,140	(16,544,691,183)	77,199,617,558	(64,183,669,318)	29,560,639,422	(111,822,647,454)	(18,078,338,714)
Lac	1,245,673	1,738,429	135,477	78,705	8,7377,986,775	126,160,329,592	7,6715,274,031	115,497,616,848	66,052,561,286	104,834,904,104
Logone Occidental	3,302,829	9,729,179	1,779,997	80,492	122,575,816,903	639,845,581,103	(20,699,699,658)	496,570,064,542	(163,975,216,219)	353,294,547,981
Mayo-Kebbi Est	1,311,264	1,551,553	151,745	115,683	134,136,621,198	161,933,936,479	11,6582,271,623	144,379,586,904	99,027,922,047	126,825,237,328
Ouaddaï	1,046,785	1,626,137	943,169	131,239	13,598,530,963	89,632,101,575	(110,182,015,190)	(34,148,444,577)	(233,962,561,342)	(157,928,990,730)
Wadi Fira	1,178,229	1,745,232	482,791	52,518	36,523,022,687	66,300,868,735	1,1167,797,247	4,0945,643,295	(14,187,428,194)	15,590,417,854
Borkou*	1,641,808	3,043,172	814,467	20,213	16,723,061,048	45,048,823,381	260,248,546	28,586,010,880	(16,202,563,955)	12,123,198,379
Logone Oriental*	1,641,808	3,043,172	814,467	98,922	81,842,311,629	220,468,001,115	1,273,650,952	139,899,340,438	(79,295,009,724)	59,330,679,762
Mandoul*	1,641,808	3,043,172	814,467	56,737	46,940,895,199	126,450,061,455	730,506,198	80,239,672,454	(45,479,882,804)	34,029,283,452
Mayo-Kebbi Ouest*	1,641,808	3,043,172	814,467	79,183	65,511,410,624	176,475,584,120	1,019,505,301	111,983,678,797	(63,472,400,022)	47,491,773,474
Moyen-Chari*	1,641,808	3,043,172	814,467	51,265	42,413,680,533	114,254,585,200	660,052,527	72,500,957,194	(41,093,575,479)	30,747,329,188
Tandjilé	1,641,808	3,043,172	814,467	91,664	75,837,464,398	204,292,056,915	1,180,201,986	129,634,794,504	(73,477,060,425)	54,977,532,093
N'Djaména*	1,641,808	3,043,172	814,467	12,258	10,141,556,539	27,319,471,479	157,825,493	17,335,740,433	(9,825,905,554)	7,352,009,386
Ennedi Est*	1,641,808	3,043,172	814,467	9,105	7,532,947,649	20,292,363,177	117,229,655	12,876,645,182	(7,298,488,340)	5,460,927,187
Ennedi Ouest*	1,641,808	3,043,172	814,467	12,154	10,055,512,985	27,087,686,112	156,486,461	17,188,659,587	(9,742,540,064)	7,289,633,063
Tibesti*	1,641,808	3,043,172	814,467	4,043	3,344,943,146	9,010,656,158	52,054,859	5,717,767,872	(3,240,833,427)	2,424,879,585
Total added-values					**1,208,107,763,150**	**3,100,141,858,688**	**139,512,645,643**	**2,031,546,741,181**	**(929,082,471,865)**	**962,951,623,674**
GDP in 2018 (source: World Bank)					**11,303,000,000,000**	**11,303,000,000,000**	**11,303,000,000,000**	**11,303,000,000,000**	**11,303,000,000,000**	**11,303,000,000,000**
Ag. GDP in 2018: 44,82% PIB					**5,066,004,600,000**	**5,066,004,600,000**	**5,066,004,600,000**	**5,066,004,600,000**	**5,066,004,600,000**	**5,066,004,600,000**
Direct economic contribution (% GDP)					**11%**	**27%**	**1%**	**18%**	**-8%**	**9%**
Direct economic contribution (% Ag. GDP)					**24%**	**61%**	**3%**	**40%**	**-18%**	**19%**

* use of national average values

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Appendix 4 - Mongolia-Simulations of the different added-values by Aimags

Aimags	Pastoral HH Number (169,743 HHs in 2017)	1-year added-value (without self-consumption)	1-year added-value (with self-consumption)	2-years added-value (without self-consumption)	2-years added-value (with self-consumption)	3-years added-value (without self-consumption)	3-years added-value (with self-consumption)
Arkhangai	15,160	194,838,713,902	207,442,186,629	188,091,997,084	200,695,469,811	181,345,280,265	193,948,752,993
Bayanulgii	9,261	52,527,435,030	77,163,870,936	43,738,197,230	68,374,633,136	34,948,959,430	59,585,395,336
Bayankhongor	11,821	48,688,146,102	77,140,417,472	33,797,153,157	62,249,424,528	18,906,160,213	47,358,431,583
Bulgan	8,499	148,033,940,763	220,323,971,381	133,346,164,308	205,636,194,926	118,658,387,852	190,948,418,470
Dornod	5,028	20,283,339,575	25,528,591,075	19,662,433,950	24,907,685,450	19,041,528,325	24,286,779,825
Dornogovi	4,169	6,507,531,067	6,507,531,067	2,668,993,800	2,668,993,800	(1,169,543,467)	(1,169,543,467)
Dundgovi	7,001	118,824,854,373	120,952,999,259	118,405,176,245	120,533,321,132	117,985,498,118	120,113,643,005
Gobialtai	7,183	40,525,656,072	43,266,601,511	29,499,770,486	32,240,715,925	18,473,884,899	21,214,830,339
Khentii	7,846	52,585,098,620	60,038,323,105	50,559,879,589	58,013,104,074	48,534,660,559	55,987,885,044
Khovd	7,863	20,807,579,382	22,195,167,618	20,668,820,559	22,056,408,794	20,530,061,735	21,917,649,971
Khuvsgul	16,657	17,925,333,701	100,365,525,165	13,747,988,444	96,188,179,908	9,570,643,186	92,010,834,650
Umnugobi	5,819	5,537,234,832	10,072,992,201	3,469,955,454	8,005,712,822	1,402,676,075	5,938,433,444
Uvurkhangai	16,087	81,791,402,217	98,926,291,522	68,635,989,850	85,770,879,156	55,480,577,483	72,615,466,789
Selenge	4,679	20,890,051,785	26,649,677,976	17,281,650,545	23,041,276,735	13,673,249,304	19,432,875,494
Sukhbaatar	7,625	136,737,098,874	138,760,207,446	133,811,822,088	135,834,930,660	130,886,545,303	132,909,653,874
Tuv	11,897	183,375,541,581	197,469,870,826	178,059,657,325	192,153,986,570	172,743,773,068	186,838,102,313
Uvs	8,950	45,027,202,447	46,824,438,617	42,827,825,638	44,625,061,809	40,628,448,830	42,425,685,000
Zavkhan	9,121	17,604,334,794	22,861,652,368	3,270,415,029	8,527,732,603	(11,063,504,735)	(5,806,187,162)
Darkhanuul*	1,371	10,231,501,237	13,208,419,726	9,341,317,694	12,318,236,183	8,451,134,152	11,428,052,640
Gobisumber*	712	5,313,514,866	6,859,514,840	4,851,216,775	6,397,216,749	4,388,918,684	5,934,918,658
Ulaanbaatar*	2,113	15,768,900,157	20,356,959,068	14,396,939,671	18,984,998,582	13,024,979,185	17,613,038,096
Orkhon*	881	6,574,728,366	8,487,686,199	6,002,699,408	7,915,657,241	5,430,670,450	7,343,628,283
Direct contribution-Value Added (MNT)		**1,250,399,139,744**	**1,551,402,896,007**	**1,136,136,064,330**	**1,437,139,820,592**	**1,021,872,988,916**	**1,322,876,745,178**
GDP Mongolia in 2018 (MNT)		**13,009,574,621,000**	**13,009,574,621,000**	**13,009,574,621,000**	**13,009,574,621,000**	**13,009,574,621,000**	**13,009,574,621,000**
Direct contribution-Value Added to national GDP (%)		**9,6%**	**11,9%**	**8,7%**	**11,0%**	**7,9%**	**10,2%**

* use of national average values

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