Farmers' Seed Systems in Nepal

Review of National Legislations

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ABBREVIATIONS AND ACRONYMS

ADS	Agriculture Development Strategy
APP	Agriculture Perspective Plan
CBSP	Community-based Seed Production
CGIAR	Consultative Group on International Agriculture Research,
CS	Certified Seed
CSB	Community Seed Bank
DISSPRO	District Seed Self-sufficiency Programme
DoAD	Department of Agriculture Development
DPP	Directorate of Plant Protection
DUS	Distinctness, Uniformity and Stability
FSS	Farmer Saved Seed
IPR	Intellectual Property Rights
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
LI-BIRD	Local Initiatives for Biodiversity, Research and Development
NAGRC	National Agriculture Genetic Resources Centre
NARC	Nepal Agricultural Research Council
NGO	Non-government Organisation
NSB	National Seed Board
NSCL	National Seed Company Limited
NSP	National Seed Policy
NSV	National Seed Vision
PGR	Plant Genetic Resources
PVP	Plant Variety Protection
SQCC	Seed Quality Control Centre
SSE	Small Seed Enterprises
WTO	World Trade Organisation

EXECUTIVE SUMMARY

Seed regulatory frameworks in Nepal were reviewed from the perspective of farmers' seed systems. Nepal has formulated 17 policy instruments (including draft bills) since 1988 when the first Seed Act came into effect. Of these, 16 are either on plant genetic resources for food and agriculture, or on seed or related to overall agriculture development in Nepal. Three out of 17 are actually draft bills: the first was formulated in 2002, the second in 2008 and the third is still in progress. The important finding from this policy review is that there are not any policy instruments which may be hindering or undermining farmers' seed systems. Policy and practices both have been mostly supportive or at least neutral to informal seed systems and as a result Nepalese seed systems enjoy great flexibility. Efforts made to strengthen decentralised seed production and provisioning initiatives in Nepal led by Local Initiatives for Biodiversity, Research and Development (LI-BIRD) with International collaboration proved to be fruitful in strengthening farmers' seed systems. However, due to the lack of analytical capability of public sector organisations, inappropriate polices were developed which failed to create intended changes in the seed systems. Policies and legislations in Nepal were developed without rigorous analysis of the overall socioeconomic landscape, agricultural situation and livelihood strategies including migration. Political instability (for over two decades) is equally to be blamed for adding up inappropriate policy instruments, in particular strategies and visions were changed too frequently which is evidenced by the fact that 50 percent of all the policy instruments formulated in the last three decades were related to strategies and visions for agriculture and seed system development in the country. This is because every new government loves to be popular by introducing new polices and guidelines. It was learnt that fast changing coping strategies of marginal and smallholder farmers (87%) will also have important implications including on farmers' seed systems. Effort to improve the analytical capability of public as well as private sector stakeholders will have high returns from agriculture sector in the country. Based on the analysis, a number of policy recommendations have been suggested for strengthening farmers' seed system in Nepal.

INTRODUCTION

1. OBJECTIVE OF THE STUDY

To review policies on plant genetic resources, including seed laws and strategies and PVP legislations in Nepal, in order to identify concrete policies that supports farmers' seed systems. The study will also identify policies and practices that undermine farmers' seed systems, as well as gap in the existing legislations. Further, the study will establish recommendations for policies and strategies that support the functioning of farmers' seed systems and contribute to the implementation of farmers' rights to seeds.

2. BACKGROUND

Broadly, two seed systems are recognized, e.g. informal and formal systems (Almekinders and Boef, 2000). Informal seed supply system is also known as farmer seed system (FSS). The informal seed supply systems are characterised by farmers producing and preserving their own seeds for subsequent planting, at times exchanging with and/or gifts from other farmers with very little involvement of monetised transactions (Sthapit and Sah, 2002). Farmers plant, select, store, use, sell and exchange seed of farmer-preferred cultivars over generations for their livelihoods (Hardon and Boef, 1993; Eyzaguiree and Iwanaga, 1995). Traditional varieties or landraces are the products of such local selection and maintenance process. Landraces are important for household food security of subsistence farmers as well as for developing improved varieties.

Farmers' seed systems are very important worldwide and it is estimated that more than one billion hectare each year are planted to farm-saved seed (FSS) with an estimated total value of around $7 billion at 2005 prices (Leask, 2005). In South Asia and Sub-Saharan Africa, due to the predominance of smallholder farmers, 80 to 90 percent of planting materials are FSS (GRAIN, 2007). In addition to developing economies, the use of FSS in developed countries for various crops was reported between 7 to 95 percent in Europe, Canada, Australia, the United States and Argentina (Furtas, 2016, Leask, 2005, Roger and Palle, 2007, Boland and Howe, 2001).

For the farmers, the genetic improvement of crops offers the most cost effective means of increasing or maintaining profitability and this is even more important for the smallholders given their limited capacities to invest on purchased inputs and technologies. Strengthening the farmers' seed system in Nepal is vital and sustainable provision of quality seeds (not necessarily the certified seeds) of farmer preferred crop varieties with built-in genetic traits for high yield, tolerance to biotic and abiotic stresses and resilience to changing climate will directly contribute to improving food, nutrition and livelihood security of smallholder farmers (Joshi et al., 2016).

3. CHANGING FARMING LANDSCAPE AND FARMERS SEED SYSTEMS IN NEPAL

Marginal holdings (0.1 to 0.5 ha/households) comprise 47.7% of all holdings while only 14.7% of all cultivated land and small holdings (0.5 to 3 ha/household) make up 49.4% of all holdings and 68% of all cultivated land in Nepal (Chapagain, 2010). Moreover, most of these marginal and smallholders are dependent on rainfed agriculture which is largely affected by recurrent and severe droughts and other climatic adversaries. Except mountain region, all other regions are facing extreme population pressure (which is bound to increase in future) to produce enough food (NPC-WFP-NDRI, 2010). Coupled with this challenge and due to sheer lack of domestic employment opportunities, migration is increasingly becoming an important livelihood strategy for farmers in Nepal. Whatever may be the case, the people of Nepal are known for their resilience. To cope with seasonal food insecurities many people – mostly men — out migrate to obtain temporary employment, leaving families behind with little to eat (NPC/ WFP/NDRI, 2010). Half a million Nepalese youths took up foreign employment during 2013/14 (Sijapati et al., 2015) . Roughly a similar migration trend follows even today and this has huge implications in terms of labour supply in agriculture and other development sector in Nepal. Paudel et al., (2014) reported that the migration resulted into abandonment of productive agricultural lands in the mid hills of Nepal. Other studies on the impact of migration on agricultural production indicated that the use of purchased agricultural inputs are not significantly affected due to migration, however, whenever remittance is relatively high, farmers tend to neglect subsistence farming altogether due to access to alternative sources of income. Alternatively, when remittances are low, farm households use the extra funds to expand their livestock activity as it is more profitable

than subsistence cereal farming (Maharjan et al., 2013). Feminisation of agriculture due to high male migration was reported by both of the studies listed above. Declining crop production and productivity due to land abandonment and migration resulted in food insecurity and hence food import is also increasing highly (Paudel et al., 2014). Any discussion on farmers' seed system in this context needs to understand and align with the changing agricultural landscape in the country.

4. EXISTING POLICIES, SEED LAWS ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE: IDENTIFYING GOOD PRACTICES, GAPS AND PERVASIVE POLICIES

A number of Policies, Acts, Strategies, periodic plans and guidelines have been developed and issued since 1988 for developing and regulating plant genetic resources for food and agriculture (PGRFA) and associated seed industry in Nepal. A summary of various policy instruments with their implication on farmers' seed systems is given in Table 1.

Several of the policy instruments mentioned in Table 1 may never have been implemented or only partially implemented. Those policies that were implemented in the past were also inefficient in creating dynamism in Nepalese seed industry. Of the various policy instruments listed above, the National Seed Policy 1999 had several useful elements for the development of PGR and was most effective in bringing about changes in Nepalese seed industry. For the first time the provision for private-sector involvement in crop variety development and in the seed trade was made in this policy. It also allows the use of data generated from participatory on-farm trials for the release or registration of crop varieties. This was incorporated in the policy in response to initiatives on participatory crop improvement and community-based seed production by Local Initiatives for Biodiversity, Research and Development (LI-BIRD) with international collaboration . Involvement of other NGOs on this kind of initiatives has been less consistent.

Agrobiodiversity policy 2007 was formulated to identify, preserve, conserve, develop and make sustainable use of agrobiodiversity. The policy considers all the national seed and agriculture related legislations, policy frameworks and international conventions, agreements and treaties on PGR, agriculture and biodiversity in which Nepal is a party. A national level committee - National Agriculture Biodiversity Conservation Committee (NABCC) was formed as guided by Agrobiodiversity Policy 2007. The committee is responsible for implementing, coordinating and monitoring agrobiodiversity policy in Nepal. It is chaired by the Secretary to the Ministry of Agriculture Development and LI-BIRD represents NGO sector in it. NABCC has also envisioned farmer representation.

The National Agricultural Policy that opted for transforming existing subsistence oriented farming system into a commercial and competitive farming system also opened up agriculture research and development for private and foreign investment. Variety development, maintenance and promotion by private sector and NGOs was opened up by this policy.

Table 1. Summary of possible implications of various policy instruments and strategies related to seed and plant genetic resources for food and agriculture on farmers' seed systems Nepal

Policy instrument and year when issued	Influence on FSS	Major features from the perspectives of farmers' seed systems
Seed Act 1988	Neutral	To safeguard the economic interest of general public by provisioning quality seeds.
The Agriculture Perspective Plan 1995	Neutral	A growth strategy. Silent about FSS
Seed Production Guideline 1998	Favour	Farmers, farmers' groups get technical and material support for the production and provisioning of seeds.
Local Self-governance Act 1998	Hinder	Imposing local taxes on seed transaction between districts. Not in practice any more.
National Seed Policy 1999	Favour	Conserving indigenous genetic resources and national rights of the resources.

Access to Genetic Resources and Benefit Sharing Bill 2002	Favour	Ownership of genetic resources and genetic material; individual persons or organisations, local communities and the government of Nepal (GoN) Rights to traditional knowledge. Access provisions and conditions. Provision of National Genetic Resources Coordination Council (NGRCC) to be set up to coordinate with for access and benefit sharing. Prior informed consent of communities obtained through local governments for the access to PGR. Benefit sharing: sharing benefits arising from access to and use of genetic resources and material to be shared among four parties (i) the local community, individual or organisation (ii) GoN (iii) NGRCC (iv) local governments.
National Agriculture Policy 2004	Favour	To protect, promote and properly utilize natural resources, environmental resources and biological diversity.
National Biodiversity Policy 2006	Favour	Overall policy framework for agrobiodiversity conservation in Nepal.
Agrobiodiversity Policy 2007 and first amendment 2014	Favour	To identify, preserve, conserve, develop and make sustainable use of agrobiodiversity.
Plant Protection Act 2007	Favour	To prevent prevalence and spread of pests and diseases during introducing and sending out PGR.
Plant variety protection and farmers' rights bill 2008	Favour	Develop agriculture, promote food security and biodiversity, conserve plant varieties and secure the rights of the breeders and farmers. A balance of rights between farmers and breeders through a genuine sui generis system of IPR. Seed saving and local seed exchange.
Community Seed Bank Implementation Guideline 2009	Favour	Production and provisioning of seeds of landraces as well as improved varieties at community level.
Seed Regulation 2013	Neutral	Introducing IPR regime. Incentives to farmers and breeders for increased food production. Balancing between farmers' rights and breeders' rights.
National Seed Vision 2013	Favour	To be self-reliant by substituting imports and promoting seed exports by bridging all the prevailing gaps in seed policies and guidelines, utilise vast agrobiodiversity and ecological diversity, harmonise policies, guidelines with other national legal frameworks and development strategies.
Agriculture Development Strategy 2015	Favour	To transform Nepal from a society primarily based on agriculture to one that derives most of its income from services and industry. Silent on farmers' seed system.
National Biodiversity Strategy and Action Plan 2014-2020	Favour	It includes strategies and plans for the conservation and use of agrobiodiversity that are aligned with International Treaty on Plant Genetic Resources for Food and Agriculture.
Agrobiodiversity Bill (in progress)	Favour	The Bill is formulated to identify, conserve, promote, and sustainably utilize agrobiodiversity and associated traditional knowledge in line with international treaties and agreements

Source: ADS, 2015, APROSC-JMA, 1995, National Seed Vision 2013, Joshi et al., 2012, Bhattarai et al., 2016

Seed Regulation 2013 has provision for Intellectual property rights (IPR) regime and it is expected that it may help increase foreign investment in agriculture as it allows for making profits from the seed sale of novel and competitive varieties. As a member of World Trade Organisation (WTO), Nepal is obliged to comply with Trade Related Intellectual Property Rights Agreements once this Agreement comes into effect in 2021. However, Nepal is yet to put in place necessary legal instruments including the Plant Variety Protection and Farmers' Rights Bill. Considering the predominance of marginal and smallholders (87%) with rainfed farming, poor infrastructure, very thin market coverage and high poverty, it is less likely that Nepal could become a flourishing market for multinational companies to sell their hybrid seeds. In this context it is more likely that informal seed systems will continue to persist even after commercial seed sector and seed markets develop.

5. OVERVIEW OF THE GOVERNANCE AND MANAGEMENT OF PLANT GENETIC RESOURCES

Nepal has very high level of dependence on other countries for accessing plant genetic resources (PGRs) for research and development as about 73% of crop varieties released in Nepal have foreign ancestors and for crops like wheat, potato and lentil this is close to 80% (Chaudhary et al., 2016). Landraces are mostly used in pre-breeding research for gene mining for incorporating into more productive genetic background using molecular assisted selection or other advanced plant breeding techniques. Using landraces directly in breeding is less common except in case of back cross breeding. Using landraces directly in breeding would mean going backwards several decades on time line thereby losing the benefits of progress made by advances in plant breeding research.

The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) that came into effect in 2004 provides legal binding of international framework for the conservation and sustainable use of plant genetic resources (PGRs) for food and agriculture. At national level, it also guides on the measure for ensuring farmers' rights to use, save, exchange and sell farm saved seeds, also on a multilateral system facilitating access to crop genetic resources and on a benefit sharing mechanism. Nepal ratified ITPGRFA in 2007 and became a 'party' to it in 2009 and since then, a number of policy dialogues were organised and the status of agrobiodiversity and PGR in Nepal was documented by engaging major stakeholders from local to national level (Bhattarai et al., 2016). Following the ratification of ITPGRFA by Nepal some of the policy instruments such as Nepal's Agrobiodiversity Policy 2007 has been revised in accordance with the provisions of ITPGRFA while National Biodiversity Strategy and Action Plan 2014-2020 has been harmonised with international treaties and conventions. New Agrobiodiversity Conservation and Utilisation Act and Regulations, Plant Variety Protection Act, Farmers' Rights Bill and the Agrobiodiversity Policy that are necessary to implement ITPGRFA have been drafted (Bhattarai et al., 2016).

Governance and management of PGR in Nepal can be divided into four functions:

(a) Collection, characterisation, preservation of indigenous PGR (including exotic germplasm) with some extent of utilisation
(b) Utilisation of PGR for breeding new crop varieties
(c) Variety release/registration and maintaining National Agrobiodiversity Register
(d) Plant quarantine during germplasm introduction and sending out

The first two functions ('a' and 'b') are done by Nepal Agriculture Research Council (NARC). National Agriculture Genetic Resources Centre (NAGRC)-the Gene bank is responsible for collection, characterisation, rejuvenation of large number of PGRs held in their repository with limited role of their utilisation. Based on individual crops of national importance, 17 national commodity programmes under NARC are mandated for introduction/breeding, testing and release of new crop varieties and associated technologies with/without utilising PGRs held in the gene bank (www.narc.gov.np).

In principle, private sector can introduce and evaluate new crop varieties, however, when it comes to formalising and commercialising varieties introduced by private sector, NARC commodity programmes are heavily involved, and, without their support in generating necessary data and defending the proposal during variety registration/release process, no varieties from private sector can be officially released. However, given the open and porous border with India, a large quantity seeds of unreleased and unregistered crop varieties, both open pollinated varieties and hybrids , are freely traded in Nepal through a huge networks of

Agrovets, and there is no mechanism to regulate this free flow of PGR across the open border. On the other hand, the access of smallholder farmers living in rural remote areas of the country to quality seeds of crop varieties of their choice is virtually limited.

National Seed Board (NSB) is a regulatory body within the Ministry of Agricultural Development (MoAD), which is responsible for formulating, amending and implementing policies related to PGR and seed, and gives necessary advice to the Government of Nepal on seed related matters through its Secretariat-Seed Quality Control Centre (SQCC). NSB is also responsible for variety registration, release and maintenance of National Agrobiodiversity Register of Nepal. It is noteworthy that farmers' representation in the governance and management of PGR is legally ensured in Nepal. In a 15-member NSB, two seed producers (including one woman) are nominated by the Government. Other than that, the involvement of farmers in the governance and management of PGR is not visible.

Another important function related to the governance and management of PGR is ensuring that plant protection aspect of PGR are fully respected during introduction (through quarantine check posts), subsequent grow out tests, issuing import permit for the introduction of new PGR in the country and phytosanitary certificate while sending the PGR out of the country. Issuing import permit and phytosanitary certificate is done by the Directorate of Plant Protection (DPP) of the Department of Agriculture Development (DoAD). Very little is known about monitoring and maintaining necessary plant protection compliance done by the concerned Department. It is ironical that that there is little coordination and linkages between NARC commodity programmes, NAGRC and DPP. As a result, most of these functions take place independent of each other!

6. GOOD PRACTICES ON LINKAGES BETWEEN THE INFORMAL, SEMI-FORMAL AND FORMAL SEED SYSTEMS

For the purpose of this report, the farmers' seed system is considered as informal, community-based initiatives that include (i) community based seed production (CBSP), small seed enterprises (SSEs), (ii) community seed banks (CSBs) and (iii) groups organised under district seed self-sufficiency programme (DISSPRO) of the government of Nepal as semi-formal system while seed production and marketing through public sector, government owned national seed company and private sector as formal system (Figure 1). Farmers' seed system is still predominant with nearly 90% contribution in case of major staples. Of the total 10 percent contribution of formal sector, share of community-based initiatives; SSEs, CBSPs, DISSPRO, CSBs is more than 40 percent, private sector 30 percent while the contribution of public sector is reduced to less than 30 percent (NSV, 2013). This is a new trend and was made possible by the National Seed Policy of 1999 as the formal seed industry was nearly dominated by public sector until 1998. For last ten years there is increasing competition between various actors involved in cereal seed business. This sector is now becoming increasingly dynamic and innovative (Joshi et al., 2012). The performance of public-sector in the competitive environment after 1999 has been particularly poor in seed delivery, while private seed companies and SSEs have been emerging as important actors for food crops seeds.

Two good practices currently functioning are CBSPs/SSEs and CSBs. The Concept of CBSP started during late 1990s initiated by the Department for International Development (DFID) funded participatory crop improvement projects in Nepal; their technical, marketing and infrastructural capacity were improved over time. Nearly four dozen CBSP groups have been initiated since late 1990s and over time those groups evolved into different forms, e.g. as cooperatives and also as private seed companies. Now several of these are producing and marketing truthfully labeled (TL) and other classes of seeds of improved varieties in the terai villages from the East to the West. CBSPs have good linkages with District Agriculture Development Offices as well as with Seed Quality Control Centre of the National Seed Board. These linkages are very important for accessing source seeds, for seed certification as well as market linkages and networking. These initiatives have greatly increased access of farmers to new seed varieties. Another good practice i.e. CSB (more than 100 in number) was initiated jointly by LI-BIRD, Bioversity International and Nepal Agricultural Research Council. CSBs work range from PGR conservation, dealing with PGR and improved varieties to commercial production of seed and sale of improved varieties. CSB is reported to strengthen local capacity to produce, multiply and manage adequate quality seeds that could provide a sustainable model for community-based management of the key food security crops (Shrestha et al., 2013). However, other studies indicate that there are several challenges surrounding the CSBs and it is argued that these cannot survive without the strong support of local institutions (Chaudhary et al., 2016).

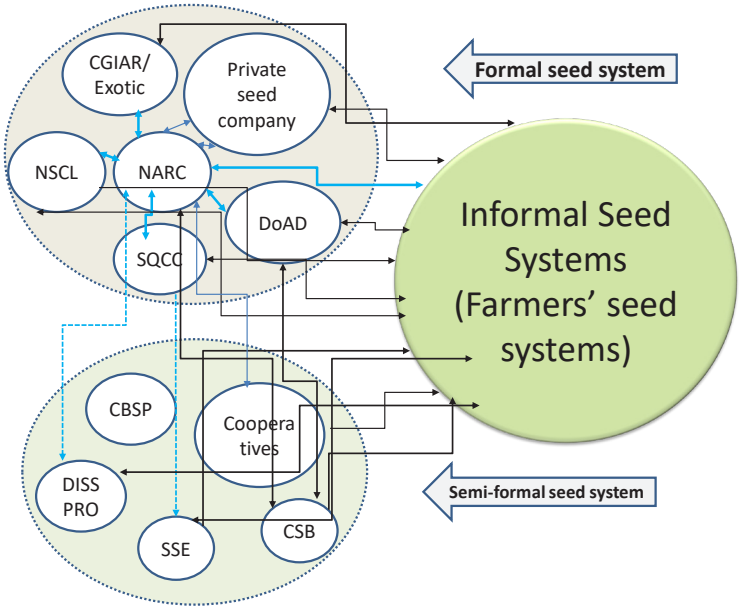

Figure 1. Schematic representation of interactions between formal, semi-formal and informal seed systems in Nepal

Nepal is among a few countries where farmers have been engaged in various aspects of crop breeding, variety evaluation and scaling up. Access to new genetic resources and knowledge in particular with civil society-led initiatives has also been encouraging while some extent of farmer participation also features with public sector activities. Liberalisation of seed sector in 1999 laid the foundation for the evolution of decentralised, community-based seed initiatives, which greatly improved the access of farmers to quality seeds of improved and/farmer preferred crop varieties locally and in a more affordable prices. This coupled with the widespread use of participatory approaches in research and scaling up has also enhanced the access of farmers to PGR for food and agriculture. The uptake and adoption of new varieties particularly in the terai was accelerated by four to five years in advance in comparison to a conventional system (Witcombe et al., 2016, Joshi et al., 2012, 2014). Plant Variety and Farmers' Rights Protection Bill has a provision for farmers' rights for the first time in Nepal and once passed by the Parliament, it will be instrumental in laying down more farmer-friendly law that will allow them to retain, exchange and even sell part of the produce as seed.

Contrary to the concentration of parastatal seed company at district headquarters, small seed enterprises and private seed companies are located in the grassroots level directly contributing to strengthen farmers' seed systems. Unlike many other countries in similar income strata, Nepal's seed system is evolving in the right direction as it is increasingly developing into a private sector-led industry. Increasingly, private sector actors are taking lead in the production, processing and marketing of food crop seeds while the share of public sector Seed Company is declining in terms of total transaction volume and quality of seeds (Joshi et al., 2012, NSV, 2013).

7. NATIONAL LEGISLATIONS DISFAVOURING INFORMAL SEED SYSTEMS

Several seed policy instruments were formulated in last two and half decades. Formulating legislations and policies is one thing but the more important aspect is how effectively they were implemented and whether or not the policy instruments produced intended results/changes in a given situation and timeframe. Political stability, prevailing socioeconomic conditions, population dynamics and external factors always influence the success or failure of legislations. Generally, policy instruments are ineffective in the countries with lack of political stability and weak law and order situations; this is largely true in case of Nepal as well.

Most of the seed policies and regulations prepared and implemented so far largely consider the formal seed systems (except in case of landraces and indigenous knowledge) that operate with a few released and registered crop varieties. It is nearly a universally accepted procedure and Nepal is no exception to that. Informal seed systems in Nepal probably enjoy most flexibility as farmers do not have to comply with

any seed regulations. Farmers' seed system in developed countries do have some kind of restrictions on FSS which is to safeguard the interest of private seed companies that invest on plant breeding research for developing novel crop varieties. For example, farmer saved seeds in Canada need to comply with cleaning of seeds that involve running grain through optical (colour) sorters which is standard according to seed plant operators (Furtas, 2016). For informal seed system to be dynamic and fully benefiting from the recent advances in plant breeding, regular and consistent flow of new, competitive and farmer preferred varieties is mandatory. Earlier studies reported that emergence and growth of private sector players in agriculture input industry is a positive development in Nepal. However their graphical coverage is a matter of concern that affects the ability of smallholders in accessing new technologies including seeds. Most of Agrovets, small seed enterprises and private seed companies are concentrated in the terai districts. The number of private agriculture input suppliers in the hills is very low and most of them are limited to district headquarters. This means that resource-poor farmers who live in remote areas of the hilly and mountain districts have limited ability to access new seed varieties. This challenge can be addressed in most practical way though decentralised seed production and provisioning through small seed enterprises, CBSPs and CSBs. The other pertinent consideration is that since the motivation for private sector actors is higher profit margins, their limited presence in the remote rural areas is understandable as there may not be enough business for them to be viable entities in the rural areas (Joshi et al., 2012).

In Nepal, due to the dominance of informal seed system, demand for crop variety depends on how widely any crop variety is known and used already. Any such demand is created due to the popularity rather than agronomic performance and genetic merit of the varieties. Such a system favours production of outclassed varieties unless a systematic advertisement campaign for new varieties is in place (Witcombe et al., 2007). New varieties are less demanded because farmers are not aware about the better available options.

There are examples of reluctance of public sector regulatory bodies to implement certain policy instruments. For example, popularising and institutionalising the provision of "truthfully labeled" seed production and marketing is key to strengthening village-based semi-formal seed initiatives such as run by SSEs, CBSPs and CSBs as this will help deregulate the market and allow greater flexibility to the private sector (Joshi et al., 2012). The provision is legal as per the Seed Act of 1988, however there is little efforts to create awareness about this provision among various seed sector stakeholders while state machinery is geared towards certified seeds which are probably used by less than 10 percent of households.

Similarly, encouraging private investment in plant breeding and the seed trade would contribute to food security and poverty reduction by increasing the availability and choice of better technologies for smallholders. However, current variety release process is not transparent and impartial to encourage substantial private sector investment on plant breeding. The varietal release process is affected by the following restrictions:

(i) Generating data for distinctness, uniformity and stability (DUS) by an independent authority is mandatory for the system to be transparent. DUS testing in principle is done by SQCC but in practice NARC commodity programmes perform this function as well as that of crop breeding and variety releasing. Hence there is a clear conflict of interest.

(ii) Increasing the representation of stakeholders from outside of NARC on the Variety Approval, Release and Registration Committee is a challenge. Currently the committee is comprised of a majority of NARC scientists, and again there is a conflict of interest.

Although, restrictions mentioned above are not part of any seed policies, public sector organisations express their reluctance by not complying with the provisions of policy regime and this is in no way helpful for the growth of seed and agriculture industry in Nepal. For the seed industry to be sustainable, it needs to be profitable and competitive. These restrictions would disfavour farmers' seed system as well as formal seed system.

It is also becoming evident that conducive policies and regulations alone are not enough to induce intended changes in the country for a variety of reasons. For example, the government of Nepal endorsed the concept of CSB through budget speech of 2008/09 and piloted it in a number of districts in the same year. Conversely, SSEs/ CBSPs were not supported as such by any specific policy regimes. If one compares and contrasts the functioning of two, SSEs are evolving in a far more sustainable manner than CSBs. For a seed enterprise to be financially viable, full

cost recovery model of operation needs to be considered. This includes the cost of source seeds, advisory and inspection services, proper grading and branding of seeds, cost of sales and so on. Considering the portfolio of varieties and transaction volume of seeds by CSBs it is less likely they could afford to go for full cost recovery model, which would mean that they would need continuous source of funding to give continuity to their activities. Similarly, foundation seed demand by seed sector stakeholders can be considered as an indicator of ensuring access of farmers to quality seeds (into informal system) of new varieties from formal system. Past studies indicated that foundation seed indent is not proportionate to the total cultivated area of a crop in a specific agroecological zones, e.g. mountains, hills and terai as most of it goes to the terai region where private sector organizations are concentrated (Joshi et al., 2012). No private-sector organizations demanded foundation seeds of any of the three major cereals for seed multiplication purposes either in hills or mountains suggesting that seed business potential is still very weak in those areas (Joshi et al, 2012). Public sector District Agriculture Development Offices distribute some foundation seed in hill and mountain regions and foundation seeds so distributed are mostly used in crop production rather than for multiplying as seed. This meant that farmers in the hill and the mountain regions are not fully benefitted from the very slow flow of new seed varieties in the farmers' seed system. But it should be noted that this situation is induced more due to socioeconomic conditions rather than any faulty seed policies.

Earlier studies reported an alarming situation of land abandonment and decline in crop production and productivity due to migration. The emerging trend in production systems due to migration is that those families continuing in agriculture may be attracted towards improved livestock farming or other less labour intensive commodities such as fruits and tree crops. Migrant returnees are already taking up off-farm activities or are engaged in livestock farming and commercial vegetable production. However, these trends are less likely to change the scope of farmers' seed system in a short term but may influence in a longer run.

Large number of laws, policies, guidelines, plans, visions and strategies were prepared in Nepal, while, several of those were either not at all implemented or implemented partially or new policies replaced the old ones too quickly. If anything is dynamic in Nepal, it is the policy environment! Policies keep changing before being fully implemented (Joshi et al., 2012). Implementation failure, as is the common phenomena in development process in Nepal also applies to putting seed policies into practice. It can be safely stated that no seed-related polices so far imposed any kind of restrictions or undermined farmers' seed systems. Some of the bills drafted long time ago (one starting in 2002, e.g. Access to Genetic Resources and Benefit Sharing Bill 2002) are yet to be submitted to the Parliament including the ones related to ITPGFRA. It is noteworthy that extended Parliament will be running just for next days and it is far behind the schedule putting in place the laws needed for the upcoming elections that are scheduled for about two month time, it is less likely that other bills will get priority at this stage. It is worth mentioning that currently Nepal is undergoing a major state re-structuring into a three-tier Federal state structure with each of the tier having the constitutional rights to formulate their own new policies and laws. This meant that policy environment is on the active move again. It is understandable that after just a couple of years, several of the existing policy instruments on seed and PGR will either cease to exist or will emerge in new avatar just to give continuity to policy dynamism!

8. WAY FORWARD

Although, several policy instruments have been developed and endorsed in Nepal in last two and half decades, however, few were implemented and not many of those were effective in creating positive changes in the seed systems. Of the implemented policy instruments, very few actually created important and lasting changes; for example, evolution and development of private sector seed actors including community-based seed initiatives.

Given the current agricultural productivity, a farm household would need 0.64 ha in mountains, 0.52 ha in the hills and 0.42 ha in the terai to produce enough food to feed a family of six members (NPC/ WFP/NDRI, 2010). No policy instruments have considered the implications of such farming realities on farmers' seed systems. It is important that all future policy instruments factor in such elements to make more practicable legislations.

Lack of analytical capacity with the government institutions is one of the biggest constraints in the country. This has huge implications in formulating appropriate legislations and policies by harmonizing with international policy regime in a timely manner.

Currently, two legal frameworks are urgently needed in Nepal: first, putting in place plant variety protection (PVP) and farmers' rights provision (sui generis) by harmonizing with international and regional treaties and giving due consideration to safeguarding farmers' rights to seed and PGR, and second, necessary legislation for the implementation of ITPGFRA to get maximum benefits from multilateral system. Currently, there is neither a national authority to make decisions or coordinate implementation of the ITPGFRA in Nepal nor a regulatory framework to make such an appointment. And the law regarding access and benefit sharing is in the draft form for many years. However, implementing the ITPGRFA is urgent as the country can have from monetary and non-monetary benefits including capacity building, access to information in addition to the benefits that accrue from multi-lateral system to have access to range of plant genetic resources for food and agriculture (Bhattarai et al., 2016). Two bills related to above two policy instruments have been drafted for quite a long time and there is a need to speed up the process of enacting these as soon as possible.

It is vital to use indigenous plant genetic resources for food and agriculture through pre-breeding process to develop climate resilient crop varieties with high yield and better agronomic performance. Coordination between all the institutions for PGR exchange needs to be in place to regulate the exchange of plant genetic resources for food and agriculture in the best interest of the country. Popularising and institutionalising 'truthfully labelled' seeds as flexible means of promoting seed trade in the rural areas by informal, semi-formal systems and formal systems can directly contribute to strengthening food and nutritional security as well as create additional business opportunities in seed industry.

Refinement in variety release process in particular independent body such as SQCC taking full charge of generating data for Distinctness, Uniformity and Stability for all the crop varieties either developed by NARC or other organisations including private sector companies will make the system more transparent, competitive and responsive to the needs of the farmers. This is bottom line for IPR legislation to be implemented and for seeking functional collaboration with foreign private sector companies. The slow pace of testing, release and scaling up of new varieties delays their benefits for smallholders so policies are needed to fast track entire process of variety testing to scaling up new varieties.

Since, Nepal is undergoing through a major state restructuring and it is likely that Provincial and Local Governments may introduce new policy instruments or revise or replace existing ones in future and any discussion on appropriateness or inappropriateness of individual policy instrument at this stage may not be relevant. Formal and informal seed systems are integral part of the production systems and these are fully integrated as there is a great interdependence between the two. Informal seed system will benefits from a dynamic formal seed system that is fully linked with modern advances in plant breeding. As every new batch of high yielding, disease resistant, climate resilient and biofortified crop varieties are deployed into farmers' seed systems, all the stakeholders from the producers to the consumers will enormously benefit. Similarly, formal seed system will benefit from the informal system in many ways and most importantly in terms of acquiring precious landraces and indigenous knowledge associated with the traditional varieties for using in pre-breeding research. Strong and live interactions, learning and sharing between the two systems for continuously internalising good practices will make overall seed system more dynamic and responsive to the needs of the farmers and country as whole.

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