

Nepal Seed Sector Overview in the Context of the **National Seed Vision 2013-2025:**

Status, Implementation Gaps and the Way Forward

Tara Bahadur Ghimire, Ramesh Humagain, Madan Thapa, Narayan Khanal, Shrinivas Gautam, Dyutiman Choudhary, Hari Kumar Shrestha, Dilli KC and Abdurahman Beshir

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CIMMYT

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Seed Quality Control Center (SQCC)

SQCC was established in 2001 under the seed act of 1988. It falls under the Ministry of Agriculture and Livestock Development, Government of Nepal. It implements seed policies, acts and regulations. This organization also provides seed quality control services and prepare national seed balance sheet to address the demand and supply dynamics of seed in the country. Moreover, SQCC acts as a secretariat of National Seed Board which facilitates the variety registration and release procedures. This center also facilitates for seed import and export.

Nepal Agricultural Research Council (NARC)

NARC is an autonomous national public research organization established in 1991 to uplift the economic level of the people through agricultural research. NARC conducts agricultural research in coordination with public, private and civil society organizations; and share its research findings through training and publications. NARC has the National Agricultural Research Institute that comprises of eleven national research centers Entomology, Pathology, Agronomy, Plant breeding and genetics, Soil Science, Agri-engineering, Horticulture, Food Research, Biotechnology, Commercial crop and Seed Science along with four cross-cutting national research centers - Agricultural Policy Research, Outreach Research, Agricultural Technology Information, and Agricultural Environment. These centers coordinate with national commodity programs including National Rice Research Program, National Maize Research Program and National Wheat Research Program. These centers and commodity programs coordinate with seven Directorate of Research in different provinces and fifteen research stations spreading across different agroecological domains.

Disclaimer

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MoALD Secretary's Foreword



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Foreword

Seed is one of the important inputs in agriculture. The crop yield and efficiency of other inputs are determined by quality of seed. The Government of Nepal through its programs and policies has been prioritizing for seed sector development in the country to increase farmers' access to quality seed of their choice. The National Seed Vision (2013-2025) was formulated and implemented to contribute on competitive, synergistic and inclusive seed sector development with defined milestones and major focus on domestic seed industry development. We have already spent more than half time period for the implementation of NSV. During this period, several efforts have been made and lessons gathered towards further implementation of the vision.

In this regard, the overview of NSV implementation prepared by the team from Seed Quality Control Center, Nepal Agricultural Research Council and Nepal Seed and Fertilizer Project being implemented by the International Maize and Wheat Improvement Centre (CIMMYT) is highly commendable. I hope the analysis and recommendations made in this report for implementing NSV for the remaining period would help to realize the vision and targets set in the NSV.


5 August, 2020

.....
Rajendra Prasad Bhari
Secretary
Ministry of Agriculture and Livestock Development
Government of Nepal

NARC Executive Director's Foreword



Government of Nepal

NEPAL AGRICULTURAL RESEARCH COUNCIL

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Foreword

Food and Nutrition security to improve sustainable livelihood of the people in developing countries is always a challenge. Generation and transfer of improved technologies are critical prerequisites for agricultural development particularly for an agrarian based economy like Nepal. Seed is pivotal in the improvement of food and nutrition security along with farm household livelihood. Increasing quality of seeds is one of the most economical and efficient inputs to agricultural development.

A good progress has been made towards source seed production and development after the implementation of the National Seed Vision (NSV) 2013-2025. However, the production of hybrid varieties has not significantly increased till date. Nepal Agricultural Research Council is very much dedicated in the development of hybrid varieties and expansion through the involvement of private sectors to help achieve the NSV targets. We are expanding the development of quality varieties in coordination with various national and international organizations. Furthermore, a joint effort between the public and private sector is essential to enhance seed availability through different sources to improve smallholder farmer's access to seed and to enhance improved variety adoption. Along with this, we have to promote private sectors involvement in the seed sector to meet the national demand and promote export of potential vegetable seeds.

I thank the team from Seed Quality Control Center, Nepal Agricultural Research Council and Nepal Seed and Fertilizer (NSAF) project implemented by the International Maize and Wheat Improvement Center (CIMMYT) and other stakeholders for their effort for preparing this report. I believe that the document will well serve to address the challenges to develop a competitive, robust and inclusive seed sector in the country.

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Executive Summary

The importance of seeds in crop productivity, food and nutritional security and livelihoods is well recognized in developing countries. The Government of Nepal has recognized seed sector in its programs and policies including the Agriculture Development Strategy. Policy instruments have been updated to make the country's seed sector more competitive and robust. The National Seed Vision 2013-2025 (NSV) is a seed sector policy instrument of the government to develop a competitive and inclusive seed sector. As more than a half of NSV's implementation period has passed, it is important to assess the progress made towards the vision's targets and to identify any major gaps in its implementation. The required information for this report was collected from literature reviews, field observation, interviews and focus group discussions with seed value chain stakeholders.

The results show that good progress has been made towards source seed production and establishing seed processing facilities. However, there has only been limited progress on the important areas of varietal research and development, the market development of new varieties, enhancing the capacity of public and private sector actors on hybrid variety development, and exporting vegetable seed. Stakeholders identified several gaps in NSV implementation including the lack of a seed vision coordination cell, limited public private partnerships, limited investment, and a limited number of trained human resources – primarily plant breeders and seed technologies. To close these gaps and to achieve the NSV's goals, a fully accountable NSV coordinating committee should be formed both at national and province level. This committee should prepare and implement action plan for the next five years in consultation with the stakeholders, with a focus on hybrid variety development and popularization, capacity building, seed financing schemes, buffer stock establishment and smart policy implementation.

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Abbreviations

ADD	Agriculture Development Directorate
ADS	Agriculture Development Strategy
AICL	Agriculture Inputs Company Ltd.
AKC	Agriculture Knowledge Center
ASL	Agriculture Seed Laboratory
CEAPRED	Center for Environmental and Agricultural Policy Research Extension and Development
CGIAR	Consultative Group for International Agricultural Research
CIMMYT	International Maize and Wheat Improvement Center
CSISA	Cereal System Initiative for South Asia
DoA	Department of Agriculture
DoAD	Department of Agriculture Directorate
DoLS	Department of Livestock Services
GMO	genetically modified organism
HVAP	High Value Agriculture Project
IRRI	International Rice Research Institute
IITA	International Institute of Tropical Agriculture
KUBK	Kisankalgi Unnat Biu-Bijan Karyakram
LFD	Livestock and Forestry Directorate
MoALD	Ministry of Agriculture and Livestock Development
MoLMAC	ministry of land management, agriculture and cooperatives (provincial)
Mt	metric ton
NA	not available
NARC	Nepal Agricultural Research Council
NGO	non-government organization
NPR	Nepalese rupees
NSAF	Nepal Seed and Fertilizer Project
NSB	National Seed Board
NSP	National Seed Policy
NSV	National Seed Vision
OP	open-pollinated
OPV	open-pollinated variety
PMAMP	Prime Minister Agriculture Modernization Project
PSB	provincial seed board
R&D	research and development
RISMFP	Raising Income of Small and Medium Farmers' Project
SEAN	Seed Entrepreneurs' Association of Nepal
SQCC	Seed Quality Control Centre
SRR	seed replacement rate
STCL	Salt Trading Corporation Ltd.
USAID	United States Agency for International Development
USD	United States dollar
VHLKC	Veterinary Hospital and Livestock Knowledge Center

Standard exchange rate used: 1 USD = NPR 120

INTRODUCTION

Although seed is the fundamental and most important agricultural input, less than 20% of farmers in developing countries have access to quality seed of the major food crops they grow due to inadequate policies and inefficient seed production, distribution and quality assurance systems (Almekinders et al., 1994; Witcombe et al., 2010). Government parastatals, private companies, cooperatives, non-government organizations and associations are engaged in supplying seed in developing countries. The participation of the private sector in supplying seed started with the adoption of structural adjustment strategy in the late 1980s (Almekinders and Louaars, 1999; Bishaw and van Gestal, 2008). This wave of structural adjustments saw large private seed companies starting to substantially invest in research and development including hybrid seed production and marketing. In the meantime, small companies and other local institutions focused on producing open-pollinated seed for which demand and profit margins tend to fluctuate more (Almekinders et al., 1994). Many developing countries have developed seed policy instruments such as acts, policies, guidelines/directives that provide frameworks for the growth of their seed industries. These instruments should be updated over time to facilitate competitive and inclusive seed systems (Kugbei, 2007). Despite these initiatives, the outcomes of structural adjustments have not been uniform across developing countries due to variation in their socio-economic, institutional and geo-political settings. This demands timely reviews and the updating of strategies and policies drawing on lessons from past initiatives.

Nepal has formal and informal seed supply systems. The formal seed system has vertically organized production and distributes tested, released, registered and notified seed through public and private organizations using approved quality control mechanisms. The formal system provides only about 17% of main main cereals seed used in Nepal (SQCC, 2019). The formal sector produces breeder, foundation, certified and improved seed. The main actors in Nepal's formal seed system are the Nepal Agricultural Research Council (NARC); the Department of Agriculture (DoA) and its farms, research stations; the Agriculture Inputs Company

Ltd; Salt Trading Corporation Limited (STCL); private seed companies; NGOs; agriculture groups and cooperatives.

Imported seed is another important part of the formal seed sector. In 2018/2019, Nepal produced 28,110 Mt seed domestically and imported 4,250 Mt of seed. The total transaction of Nepal's seed industry in 2019 amounted to 32,360 Mt with a value of US\$27.6 million, with rice seed accounting for 58%, maize 37% and vegetables 5% of this (SQCC, 2020). The National Seed Vision (NSV, 2013–2025) (MoALD, 2013) projected that the country would need 190,353 Mt of seed to address its annual seed replacement rate (SRR) target by 2025 of 25% of self-pollinated crops, 33% of cross-pollinated crops and 100% of hybrid crops. This shows that the formal sector contributes only a small part of the country's seed requirement as most seed, i.e., 157,993 Mt or 83% of total demand, is supplied by the informal seed system. In the informal system, farmers produce and preserve seed at home, exchange it between community members and receive seed from relatives, friends and other farmers. This system is vital for maintaining local crop diversity in an integrated way for different uses and serves as an important resource for modern plant breeding (de Boef and Bishaw, 2008; Joshi, 2017).

The Government of Nepal produced and implemented its National Seed Vision (2013–25) to increase farmers' access to quality seed, to promote food security, employment opportunities and genetic biodiversity. More than a half of the vision's period has now elapsed.

This study reviews the initiatives taken to implement the NSV, the achievements, and implementation gaps. The study also assesses stakeholder opinions on NSV's targets, achievements, the likelihood of achieving the targets by 2025 and critical areas of focus to move forward. This study was based on existing data and information on seed research, seed production and distribution in published and unpublished reports, presentations in various forums from 2013 to 2019, and stakeholder consultations. The researchers visited the National Rice Research Program (NRRP), the National Maize Research Program (NMRP) and the National Wheat Research Program (NWRP) to collect primary information. They also held interactions with seed producer

groups (5), cooperatives (5), seed companies (5), millers (2), policy makers (5) and an academic institution (1). The findings were first presented at the International Seed Conference in September 2019 in Kathmandu.

This study report is organized as follows. Section 2 describes NSV's genesis, indicators and framework, Section 3 the implementation of NSV to date, Section 4 the key achievements and implementation gaps, Section 5 gives stakeholders' perception on NSV's targets and Section 6 recommends the way forward.

NATIONAL SEED VISION 2013-25: GENESIS, INDICATORS AND FRAMEWORK

2.1 Genesis

Nepal's formal seed system evolved with the release of short duration, temperature resilient and nutrient responsive wheat varieties in the 1960s, the establishment of commodity programs, the 1988 enactment of the Seed Act, the development and implementation of the National Seed Policy (1999), and the implementation of the NSV (2013-2025) and the Agriculture Development Strategy (ADS, 2015-35). The main milestones are summarized in Annex 1.

The National Seed Policy (NSP) (MoAC, 1999) has been the most important policy for commercializing Nepal's seed sector. It recognizes the importance of the seven components for developing Nepal's seed industry of i) variety development and maintenance; ii) seed multiplication; iii) quality control; iv) the engagement of government, community and private sector across the seed value chain; v) the seed delivery system; vi) institutional development, and vii) innovations in biotechnology. It aims to increase the yield of major food crops. The policy envisions yields of 2.48 Mt/ha for rice, 1.7 Mt/ha for wheat and 1.68 Mt/ha for maize. However, the policy was poorly implemented especially in terms of private sector engagement in the domestic seed industry development (Khanal, 2017). The NSP was not very clear on the various functions of the seed value chain as it did specify targets (except crop yields), the roles of different actors and lacked clarity on the implementation mechanism. Drawing on the lessons from NSP, the NSV was developed in 2013 to be realized in 12 years with the vision of provisioning quality seed for the wellbeing of farm families. The goal of NSV is to increase crop productivity, enhance income and generate employment opportunities through self-sufficiency, import substitution and promote the export of quality seeds. The NSV recognizes the following gaps across the seed value chain:

- low seed replacement rate (SRR) and wide yield gap
- inadequate varietal choices and farmers' limited access to source and improved seeds
- scattered and haphazard seed production systems

- weak variety development and breeding
- low seed processing and storage capacities
- lack of proactive and ensured seed marketing mechanisms
- the domination of foreign seed, especially hybrid maize, rice and vegetable seed
- disappearing local varieties and land races
- the uncoordinated development of the seed business.

2.2 NSV Indicators and Strategies

In line with the key objectives and issues discussed in Section 2.1, the NSV quantifies the indicators across the seed value chain as presented in Table 1 and Annexes 5.1, 5.2, 5.3 and 5.4. In case of variety development and maintenance, a total of 251 additional varieties are expected to be developed, including 191 open-pollinated varieties (OPVs) and 60 hybrids. No target has been given for OPV variety development for the private sector, but private sector companies are expected to develop 20 hybrids including 10 of vegetables, 5 of maize and 5 of rice. In case of seed multiplication, the NSV emphasizes maintaining the seed cycle. The NSV projects that the country would need 88 Mt of breeder seed, 2,978 Mt of foundation seed and 92,527 Mt of improved rice, wheat, maize and vegetable seed per year by 2025. On seed processing and conditioning, the seed storage capacity of public and private institution is envisioned to be upgraded to 50,000 Mt and seed processing capacity to 55 Mt/hr. Similarly, the NSV targets the development of a buffer stock of 10,000 Mt of the seeds of major food crops.

On seed marketing, the NSV calls for training 6,000 traders; developing marketing networks, reducing vegetable seed imports by 30 Mt/year (from 240 Mt per year in 2010 to 210 Mt/year in 2025), and increasing vegetable seed exports from 160 Mt/year to 750 Mt/year in 2025. The NSV does not envision any imports or exports of rice, wheat and maize seed and aims to make the country self-sufficient in these crops from domestic seed production.

Overall, the NSV calls for making available 92,737 Mt (local production 92,527 Mt and import 210 Mt) seeds per year to achieve a SRR of at least 25% in food grains and 90% in vegetables by 2025. More importantly, NSV has set the target of growing 250,000 ha of rice, 150,000 ha of maize and 90,000 ha of vegetables using domestically produced hybrid seed to produce 6.8 million Mt of grains to meet the food requirements of 36.5 million people in 2025.

The NSV calls for the following policy updates to achieve the above targets:

- 1) Establish an agriculture biotechnology center and develop guidelines on genetically modified organisms (GMO) and GMO seed.
- 2) Introduce a subsidy mechanism across the seed value chain to benefit the poor, disadvantaged, vulnerable and women

households for home gardening and semi-commercial seed use, promptly popularize locally developed new OPV and hybrid varieties, and import processing and storage equipment.

- 3) Upgrade the roles of the National Seed Board for inter-ministerial coordination for forestry and agriculture seed and strengthen the role of the private sector and NGOs to achieve NSV's targets.
- 4) Regulate quality assurance across the seed cycle and support strategies for seed grower mechanization, the development of high yielding and short duration crop varieties, seed insurance, and the provision of short-term and long-term credit for market support to entrepreneurs for the development of the national seed industry.

Table 1. Targeted indicators and key strategies of NSV across seed value chain functions.

Seed value chain functions	Major NSV targets	Key strategies
Variety development and maintenance	<p>Additional varieties to be developed during NSV period:</p> <ul style="list-style-type: none"> • 53 rice varieties: 40 OPV, 13 hybrid (8 public, 5 private) • 34 maize varieties: 17 OPV, 17 hybrid (12 public, 5 private) • 50 vegetable varieties: 30 OPV, 20 hybrid (15 public, 5 private) 	<ul style="list-style-type: none"> • Address gaps in variety development and maintenance, seed multiplication, seed processing and conditioning, seed marketing, quality assurance and use. • Identify gaps such as the inadequate availability of seeds of farmer-preferred varieties, the concentration of breeding on open pollinated varieties, inadequate attention to maintenance breeding and maintaining the genetic purity of crops, inadequate infrastructure and human resources in the seed sector. • Promote the use of quality seeds by expanding farmers' choices including the use of local genetic resources. • Support public, community and private enterprises to produce source seed, and to multiply, process and condition seed. • Enhance the marketing skills of seed entrepreneurs and invest in seed-related infrastructure. • Create an enabling environment for developing efficient and effective public, community and private seed related organizations.
Seed multiplication	<ul style="list-style-type: none"> • 88 Mt breeders seed: 11 Mt rice, 1.46 Mt maize, 57.14 Mt wheat, 1.24 Mt vegetables • 2,978 Mt foundation seed: 389 Mt rice, 87.6 Mt maize, 1,028 Mt wheat, 48.14 Mt vegetables • 92,527 Mt improved seed: 19,450 Mt rice, 6,132 Mt maize, 20,570 Mt wheat, 2,407 Mt vegetables 	
Seed processing and conditioning	<ul style="list-style-type: none"> • 50,000 Mt seed storage capacity, 55 Mt/hr processing capacity 	
Seed marketing	<ul style="list-style-type: none"> • 750 Mt/year vegetable seed exports • SRR: 25% in food grains (self-pollinated), 33% in cross pollinated crops, 90% in vegetables and 100% in hybrids 	
Seed use	<ul style="list-style-type: none"> • Area covered by hybrid seed: <ul style="list-style-type: none"> • 250,000 ha rice • 150,000 ha maize • 90,000 ha vegetables • Availability of hybrid seed to farmers <ul style="list-style-type: none"> • 3,000 Mt rice • 3,750 Mt maize • 90 Mt vegetables 	
	<p>Buffer stock of seeds (except potato): 10,000 Mt</p>	

- 5) Harmonize policies, acts and regulations to facilitate the seed trade and enhance farmers' access to new seed varieties and compliance with World Trade Organization rules and procedures and regional agreements.
- 6) Harmonize seed policies and trade rules to facilitate foreign direct investment in seed industries.
- 7) Formulate and enforce contract farming law that binds producers and buyers to follow agreed terms and conditions including on price, quality and quantity of seed.
- 8) Formulate or amend acts and regulations to protect the rights of seed producers in quality control operations and to protect the rights of the farmers.
- 9) Subsidize and provide long term soft loans and grants to private sector to strengthening their seed processing and laboratory testing capacities
- 10) Strengthen public-private partnerships for hybrid seed production where the public sector offers inbred lines, processing facility and land. In this mechanism, the public sector could also provide grants, subsidies and tax exemptions for seed equipment and machinery, and skilled personnel for limited periods.

2.3 Policy Framework

The NSV was designed based on lessons learned from previous seed policies and programs. The Seed Act, seed policies, seed regulations, guidelines and Agriculture Development Strategy (ADS) provide the framework for the implementation of NSV.

Seed Act – The Seed Act, 1988 (NLC, 1988) was promulgated to make available quality seeds under a well-planned system of production, processing, and testing to increase crop production. The National Seed Board was established under this act to advise the government on formulating and executing seed-related policies. The act was amended in 2008 to address seed industry demands and issues.

Seed policies – The National Seed Policy (1999), National Agriculture Policy (2004) and the National Agro Biodiversity Policy (2006) provide a framework for the implementation of NSV. These policies recognize the need to grow the domestic seed industry and protect the rights of farmers and breeders, and conserve and use local genetic resources.

Seed Regulations – The Seed Regulations were formulated in 1997 and revised in 2013 and relate to the Seed Act (1988). They define the institutional setup with three sub-committees under the National Seed Board (NSB). The varietal approval, release and registration sub-committee is responsible for receiving and evaluating varietal proposals from the public and private sectors and submitting them to the NSB for approval. The planning and monitoring sub-committee is responsible for preparing seed policy and monitoring plan and submitting them to NSB for approval. It also manages seed in the country, coordinates between public and private sectors and fixes seed prices. The quality control and management sub-committee is responsible for preparing minimum seed quality standard of seed and submitting them to NSB for approval. The Seed Quality Control Centre (SQCC) is the secretariat of NSB and is responsible for all the secretarial activities of NSB, including the regulation of seed laboratories, notification and denotification of varieties, providing import/export permits, licensing of private crop inspector, seed sampler and seed analysts, and seed compensation.

Guidelines – Twelve guidelines exist for maintaining seed quality covering the delegation of authority on the seed value chain, private sector involvement, harmonizing Nepal's seed-related rules and regulations with neighboring countries and quality control mechanisms.

- The Directives of Seed Production and Management in Private Sector, 2016, made provisions of varietal development and promotion, varietal conservation and breeder seed production; foundation/source (FS/SS) seed production, and hybrid seed production to the private sector (persons or organizations). However, they need to get license from SQCC after fulfilling the minimum requirements set by this directive. Previously, these facilities were mostly under the public sector, including NARC, for varietal development and breeder seed production, except LIBIRD and foundation seed (FS) production with NARC, Department of Agriculture (DoA) and/or the Agriculture Input Company Ltd (AICL).
- The Community Based Seed Production (2000) and Community Seed Bank (2009) guidelines provide frameworks to support local institutions engaged in seed production and conservation.
- The Seed Production Guideline for Pipeline Varieties (2017) creates a window for the multiplication of seed of pre-release/pipeline varieties by farmer groups, cooperatives

and companies. It addresses the shortage of source seed while releasing varieties and guides the development of a framework for scaling out new varieties through the fast track approach.

Agriculture Development Strategy (2015-2035) –

Since 2015, Nepal's agriculture policies have been shaped by the ADS. The strategy has a 20-year vision and 10-year action plan and roadmap. It envisages a self-reliant, sustainable, competitive and inclusive agricultural sector that drives economic growth and contributes to improved livelihoods and food and nutrition security. The strategy does not, however, deal with the seed sector separately, but emphasizes the implementation of seed policies, especially the NSV, through investments in resources and capacity building and covers both crop and fodder seed. The ADS is based on the concept of value chains, a welfare and market-based growth strategy, sustainability and inclusive perspectives. Its seed related activities are consistent with the NSV, the Agricultural Biodiversity Policy 2005, and the Seed Regulations 2013. The key seed-related features in the ADS are as follows:

- Enhancing the capacity of seed research stations to produce breeder and foundation seed in partnership with international agencies and increasing funding for public research institutions and stations, universities, and private sector industries.
 - For research to focus on maintaining good quality land races and open pollinated varieties of crops in areas dominated by subsistence agriculture.
 - Strengthening public-private-cooperative partnerships to grow the national seed industry.
 - Hybrid seed production to address increased demand from farmers.
 - Implementing the Biodiversity Policy to promote agrobiodiversity.
 - Piloting a voucher system for distributing subsidized seed in marginal areas.
 - Strengthening and upgrading seed laboratories and declaring seed sovereignty for food security.
- The secretaries of the seven provincial ministries of land management, agriculture and cooperatives (MoLMACs) will serve as the member secretary of the NSB on a rotational basis.
 - Provincial governments can constitute provincial seed boards (PSBs) by formulating and enforcing provincial seed acts. PSBs are responsible for developing seed regulatory guidelines and policies for promoting seed businesses and providing strategic guidance to local governments on seed-related issues.
 - PSBs can take advice from the NSB regarding the formulation of seed-related policies.
 - As per NSB guidelines, standards and requirements, provincial governments can notify or denotify nationally developed and local varieties suitable for their areas after publishing in their provincial gazette.
 - Provincial governments can assign officer level staff (from MoLMACs and local governments with the experience and qualifications specified in the Seed Act) as provincial seed inspectors and seed analysts.
 - Seed management committees will be formed in local level (*palikas*) comprised of representatives from private companies and farmer groups and cooperatives. These committees will be led by the local agriculture officer and will provide strategic guidance for local seed system strengthening including about seed production, processing, marketing, distribution, seed import, agrobiodiversity conservation, and establishing community seed banks.
 - The revised act secures the legal rights of farmers by providing for their right to register varieties and own the production, choice and conservation of traditional seed.
 - PSBs can issue licenses for variety development and maintenance, foundation seed production and hybrid seed production in coordination with the NSB. The enforcement of a provincial seed act is mandatory for this to happen.

Proposed Seed Act amendment, 2020: The proposed Seed Act amendment was approved by parliament in 2020 and is yet to be ratified by the President. It decentralizes several rights to the province and local government. It is anticipated that the provision of authority to provincial and local units will strengthen the Nepalese seed system. The highlights of the revised act are as follows:

2.4 Institutional Mechanism for the Implementation of NSV

The NSV provisions its voluntary implementation and simply recognizes the types of organizations and their potential roles in implementing it. It does not explicitly mention the structure of any

coordinating body and reporting mechanisms to guide its implementation. The institutions and their roles as summarized in NSV are presented in Annex 2. These institutions are grouped into policy bodies, service providers and private sector institutions (Figure 1). The institutions that work in the policy domain include the Ministry of Agriculture and Livestock Development (MoALD), the Nepal Agricultural Research Council (NARC), and the National Seed Board. The service providers are government seed testing laboratories, NARC research stations, the Department of Agriculture, the CG centers such as the International Maize and Wheat Improvement Center (CIMMYT) and the International Rice Research Institute (IRRI), non-government organizations (Forum for Rural Welfare and Agricultural Reform for Development (FORWARD), Local Initiative for Biodiversity Research and Development (Li-BIRD) and the Center for Environmental and Agricultural Policy Research Extension and Development (CEAPRED). The private sector groups, cooperatives, companies and their association fall under the private sector domain.

In 2019, Nepal had about 25 small to medium-sized seed companies, 25 medium-sized seed producer cooperatives, 125 small seed producer cooperatives and at least 200 farmer groups engaged in seed production and marketing. There were 25-30 importers and about 6,000 agrovetts engaged in seed trading. These traders are members of the Seed Entrepreneurs' Association of Nepal (SEAN)

and the Seed Association of Nepal (SAN) (Dhakal, 2019). At the national level there is one seed testing laboratory accredited by the International Seed Testing Association (ISTA), and at least one seed testing laboratory in each province.

2.5 Institutional Structure for Implementing NSV under the Federal System

Since 2015, Nepal has adopted a federal system of governance with the three levels of government of the central federal government, 7 provincial governments and 753 local governments which function under the principles of cooperation, collaboration and co-existence (Figure 2).

Federal government entities

- MoALD is the leading organization for agriculture development including of seed under the federal government. MoALD has a seed Coordination Unit which is led by a joint secretary. This unit coordinates seed-related projects and policies in line with the implementation of NSV. The Seed Quality Control Centre (SQCC) is the regulatory body which is responsible for i) the approval, release, registration and licensing of varieties and ii) facilitating implementation of seed law and policies.

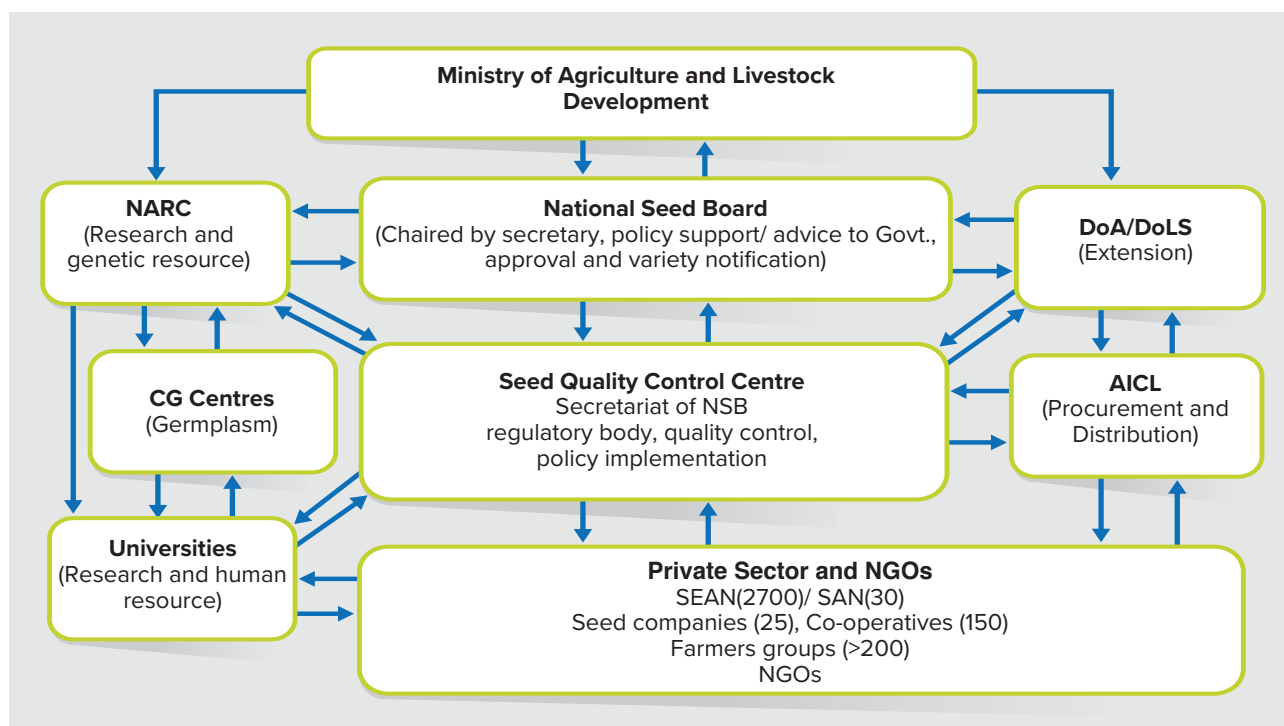


Figure 1. Institutional framework for the implementation of NSV.

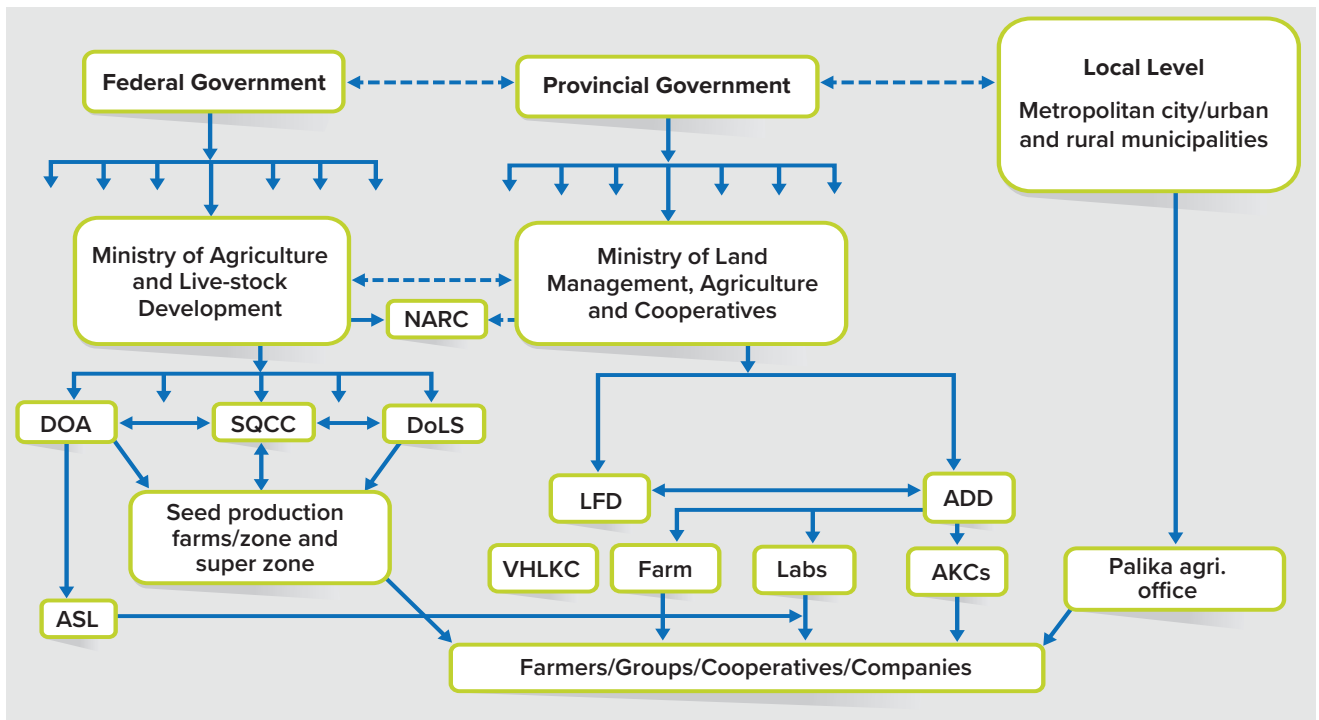


Figure 2: Institutional structure of the seed system under federalism.

- The Department of Agriculture (DoA) coordinates with the Agriculture Seed Laboratory (ASL) which was previously called the Central Seed Testing Laboratory, and the Prime Minister Agriculture Modernization Project (PMAMP). PMAMP's program Implementation Unit (PIU) coordinates with local agriculture knowledge centers (AKC) for technical collaboration and knowledge sharing about agricultural activities including the commercialization of newly released or registered crop varieties.
- The Department of Livestock Services (DoLS) coordinates with ASL and SQCC on the production and promotion of forage crop seed.

NARC centers, including national commodity programs, coordinate with MoALD and develop crop varieties and technologies. These centers also help in conserving local agro-biodiversity in- and ex-situ and their use in the development of new products.

Provincial government entities

- MoLMACs are responsible for developing and implementing seed policy at the provincial level in coordination with agriculture knowledge centers (AKC), veterinary hospital and livestock knowledge centers (VHLKC) and seed testing laboratories through the Department of Agriculture Directorate (DoAD), and directorates of livestock and fisheries (DoLFs) through the Department of Livestock Services (DoLS).

- Agricultural universities and colleges are involved in human resource development and research in the seed sector and their staff could serve as NSB and PSB members.
- Provincial seed testing laboratories capacitate farmers, extension officials and seed entrepreneurs, provide laboratory services, and support provincial governments to monitor and implement seed regulations and policies in their provinces.
- NARC's regional agriculture research stations (RARS), which have recently been renamed as directorates of agriculture research, are tasked to work in collaboration with MoLMACs to develop agricultural technology and produce source seed at the provincial level.
- Agriculture and horticulture research stations are tasked to work in collaboration with local governments to provide technological support to them on agriculture technology and source seed.

Local level entities

- The agriculture units of local levels are responsible for designing and implementing improved seed production and grain production activities in collaboration with groups, cooperatives, companies, agriculture knowledge centers, veterinary hospitals and livestock knowledge centers, PMAMP, agrovet and NARC centers.

NSV IMPLEMENTATION EFFORTS

A number of initiatives have been carried out to implement NSV, although there has been no specific project focused on implementing NSV.

3.1 Stakeholder Workshops and Meetings

The following events have promoted the implementation of NSV.

- The 2015 National Seed Summit was attended by more than 150 public and private seed sector stakeholders.
- The 2017 seed vision review workshop was attended by more than 100 participants from the national seed industry with five thematic papers presented to guide stakeholders on aligning their programs and policies towards the implementation of NSV.
- The national commodity programs and private sector stakeholders presented their progress at the June 2019 national level workshop on the Preliminary Mid-term Review of NSV, which was attended by 70 seed sector stakeholders.
- The Seed Entrepreneurs' Association of Nepal (SEAN) and Seed Association of Nepal (SAN) have held periodic meetings to contribute to the NSV implementation, convening public and private sector actors associated with the seed value chain.

The combined recommendations of these events are as follows:

- Established and strengthen a hybrid research coordination cell in NARC and hybrid research units in major commodity programs.
- Agricultural universities should design a program that will mobilize and engage graduates to support the private seed sector in strengthening R&D activities continue to work on training and plant breeding. Promote fast track variety release and the registration of crop varieties by bringing in market ready products developed by CGIAR centers and

establishing regional agreement signed between Nepal and neighboring countries.

- Develop an incentive package for public and private plant breeders to encourage them to develop more new varieties.
- Arrange patent rights and exclusive licensing systems over hybrid varieties for the private sector to attract their investment in the hybrid seed industry business
- Develop the infrastructure of molecular breeding facilities.
- Strengthen the capacity of private sector research and development (R&D) focusing on hybrid variety development and seed production.
- Provide financing mechanisms and insurance for seed businesses.
- The private sector to work on business intelligence and farmer-responsive businesses.

3.2 Seed-Related Research and Development Projects

The nine agricultural research and development projects implemented in coordination with MoALD that have contributed to the implementation of NSV are listed in Annex 3. Most of these projects have provided competitive grant for farmer groups, cooperatives and seed companies to develop infrastructure including seed testing laboratories, seed warehouses, seed processing plant and seed drying floors. The Cereal System Initiative for South Asia (CSISA), Nepal Seed and Fertilizer Project (NSAF), KisanKalagi Unnat Biu-Bijan Karyakram (Improved Seed for Farmers, KUBK), Raising Income of Small and Medium Farmers' Project (RISMFP) and High Value Agriculture Project (HVAP) have or had seed sector development components implemented in line with NSV's objectives. NSAF and CSISA focus more on providing technical support and small grants to enhance technical capacity such as research and development; parental line testing and maintenance; OPVs and hybrid seed production, and business skills and marketing. KUBK, RISMFP

and HVAP focused on infrastructural development in the seed sector and provided about NPR 667 million to develop storage facilities for 3,200 Mt of seed (Annex 4). No independent review has been carried out of the impact of these projects towards NSV's goals; but their support in strengthening the national seed industry is recognized by the Government of Nepal. Also, DoA's Directorate of Agricultural Engineering has supported the development of seed storage structures and processing plants for some farmer groups and cooperatives.

3.3 Regional Agreements

To fast track variety release by capitalizing on innovations in nearby countries with similar geographies, Nepal has signed the following agreements while implementing NSV:

- The Dhaka Agreement was signed on 17 February 2013 between Bangladesh, India and Nepal to develop a joint varietal evaluation and release system and for the reciprocal recognition of evaluation data for similar agro-ecologies such that varieties developed in one country can be easily and quickly released or registered in the other countries. It aims to harmonize seed systems and policies and germplasm exchange and reduce research time to give farmers more varietal options.
- The Kathmandu Agreement was signed in October 2014 by India, Bangladesh, Nepal and the International Rice Research Institute (IRRI) for speeding up the release, registration and dissemination of rice varieties. They agreed to share their varietal evaluation data and varieties for the release and commercial cultivation of the same varieties in other countries. These protocols are working to some extent for the adoption of rice varieties. The DRR 44 rice variety released by National Rice Research Institute (NRRI), Orissa, India has also been released in Nepal as Hardinath 3, while Ciherang sub-1, which was bred in Indonesia, has been introduced through IRRI and released in Nepal after one season's field evaluation.

- The Siem Reap Agreement was signed on 10 June 2017 in Cambodia. Policy leaders from Cambodia, India, Bangladesh, Nepal, Myanmar, Sri Lanka, Thailand, Laos, and Vietnam discussed collaborative ways of improving farmer and consumer welfare through innovative agricultural technologies. The agreement, which was formalized as 'Seeds Without Borders: Regional Cooperation for Seed Sharing' expanded the scope of the Kathmandu Agreement as two additional countries, Sri Lanka and Cambodia signed the agreement, and other cereals, plus pulses, oil seeds, vegetables, sugarcane and fiber crops were included in addition to rice. Partner countries agreed to recognize each other's breeding, seed releasing and registration as well as seed certification systems. This implies that if seed is certified as a breeder seed in one country it will be accepted as breeder seed in other partner countries. This supports the sharing of data generated during the evaluation of varieties released in one country for use and commercialization in other countries, if they have the same agro-climatic conditions. Currently, this applies to rice varieties developed by IRRI and public sector organizations in the five countries. However, Nepal has yet to act to implement this agreement.

3.4 Fast Track Registration and Domain Expansion of Crop Varieties

The four maize hybrids Rajkumar, Nutan, Bioseed 9220 and TX 369 have been domain expanded using on-farm and on-station data generated by NARC's National Maize Research Program with support from CIMMYT. These varieties were only registered to grow east of the Narayani river in 2010; but with domain expansion in 2017, the government recommended production and marketing of these varieties across the country at altitudes up to 700m above sea level. This happened through the submission of agronomic performance data of these hybrids recorded by CIMMYT in partnership with NARC stations and district agriculture offices. Also, the Sarju 52, Sawa Masuli and Ranjit Masuli rice varieties were registered through the fast track approach in 2019.

NSV IMPLEMENTATION

The National Seed Vision is built around the five key seed value chain functions of i) variety development and maintenance, ii) seed multiplication, iii) seed processing and conditioning, iv) seed marketing and v) seed use. The figures in this section summarize the key achievements made towards NSV's targets across the seed value chain based on the progress reports and database available at NARC stations and SQCC.

4.1 Variety Development and Maintenance

The NSV envisions that the total number of locally developed varieties in Nepal will reach 483 by 2025, comprising 423 OPVs and 60 hybrids. By the end of 2019, 288 varieties (279 OPVs and 9 hybrids) have been released or registered in Nepal (Figure 3). Among the released OP varieties 167 are cereal crop varieties (82 rice, 44 wheat, 36 maize and 5 millet) while the hybrid varieties comprise 2 rice, 6 maize and 1 tomato varieties (Annex 5.1).

Only one vegetable, the OP 'Baitadi Local' onion variety, proposed by NSAF partner CEAPRED, has been registered by NSB against the NSV target of 70 vegetable varieties by 2025.

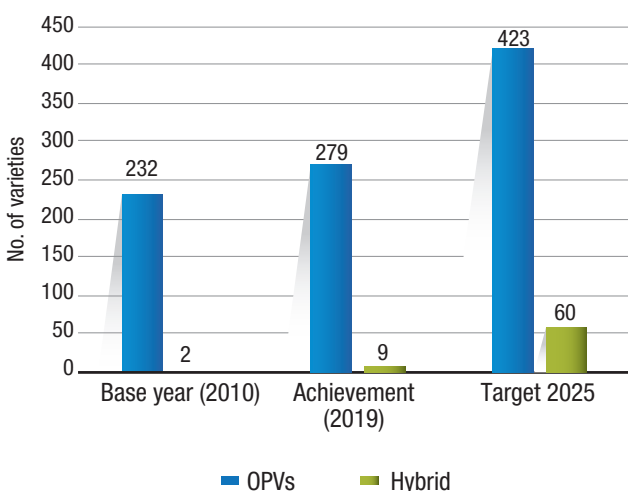


Figure 3. NSV target and achievement in variety development.

This means that there has been 46% progress on OPV variety development over the first half of the NSV period. Although there has been relatively slow progress developing new OP varieties, there is a good opportunity to meet the national target by the end of the NSV period considering the easy access to breeding materials from CGIAR centers, especially for rice, wheat, maize, lentils and potatoes, and from local germplasm in NARC's national gene bank. A total of 12,000 germplasms of edible crops are held in NARC's gene bank.

However, meeting the hybrid variety targets is a daunting task considering the inadequate resources allocated to the national breeding programs and the zero resources allocated to the private sector for such work. The NSV targets the development of 60 hybrid varieties locally by 2025; but only 9 such varieties have been developed to June 2020. All these hybrids are in the public domain and developed using the market ready products provided by CG centers. And private seed companies are expected to develop 20 hybrids; but their limited technical expertise and the lack of hybrid production guidelines and a licensing mechanism makes it very challenging for them to achieve this. Private seed companies and NARC stations do not have full confidence in the seed production technology for the existing hybrids. As a result, there has only been very limited production of the seed of domestically developed maize hybrids.

The Nepal Seed and Fertilizer (NSAF) project has introduced 785 entries of maize (751), tomato (15), onion (8), and lentil (11). Among the total entries of maize comprises 751 entries, including 298 normal hybrids, 80 normal open pollinated, 345 biofortified [296 hybrid & 49 OPV], and 28 heat tolerant varieties from CIMMYT in Zimbabwe, Mexico, Colombia, India and from IITA in Nigeria. In addition, 10 entries of maize including Zinc and provitamin A enriched biofortified maize have been selected and their parental lines and/or F1 seed imported for field testing by various public and private seed NSAF partners in Nepal. By August 2020, a total of 10 maize hybrids and synthetic varieties have been allocated to seed companies, and at least eight of them are expected to be registered and commercialized soon. In addition, through NSAF, SSSC has selected two hybrid tomato varieties using

the parental lines from NARC and their own source. The NSAF partners are in the process of submitting proposals to NSB to register these varieties.

In addition:

- Eleven commercial cultivars of lentils from ICARDA Ethiopia and 15 varieties of tomatoes and 8 varieties of onions from the World Vegetable Centre (WorldVeg, Taiwan) were introduced and tested from 2017–2019 by NARC and/or private seed companies in the different agroecology of Nepal.
- Tomato and onion seed imported from WorldVeg in 2018/19 were shared with the National Horticulture Research Center, NARC and private seed companies. NARC’s National Horticulture Research Center also increased seed from the previously imported tomato and onion lines in 2017, and they shared some seed materials to some of the private seed companies for multilocation testing. Using the information, the National Horticulture Research Center submitted variety release proposal of four tomato lines at NSB, and two lines are in the process of release.

4.2 Seed Multiplication

NARC stations, including commodity programs, regional agriculture research stations and agriculture research stations produce source seed (breeder and foundation) in Nepal. SQCC also licenses private seed companies, cooperatives and farmer groups to produce source seed (foundation and certified) for seed production, and improved seed, which is used by farmers for grain production. Up to 2019, 42 organizations comprising 25 seed companies, 16 cooperatives and 1 farmer group, had received foundation seed production licenses from SQCC.

Eight tissue culture laboratories (7 private sector and 1 government) are engaged in the pre-basic seed production of potatoes. In 2019/20, these labs produced 500,000 potato tubers. The country overachieved NSV’s source seed (breeder, foundation and certified) production targets in 2019 for the major food, forage and industrial crops (Annexes 5.2 and 5.3). A total of 4,273 Mt of foundation and certified seed was produced in 2018/19, of which more than 80% was produced by the private sector, although the progress is low as the 28,110 Mt produced amounts to only 30% of the target 92,527 Mt for improved seed production of major food crops, especially cereals (Figure 4, Annex 5.4).

Nepal has very poor source seed production for millet, barley and legumes. However, the source

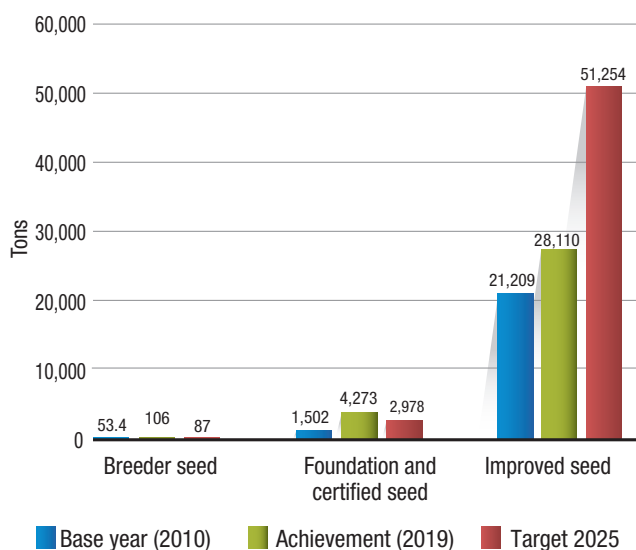


Figure 4. NSV target and achievement on seed sample testing.

seed production target has been over achieved for rice, although there is a poor match between the varieties demanded by the private sector and those available from NARC stations. In 2019, Sukkha series rice varieties accounted for about 50% of total breeder seed production at NARC; but these varieties were not in the top five varieties preferred by seed producer organizations. As a result, some NARC stations had to sell substantial quantities of breeder and foundation seed (57 Mt) as improved seed and distribute it to farmers as minikits.

In 2019, Nepal achieved 54.8% (28,110 Mt) of improved seed production against the targeted 51,254 Mt set up to this year, with rice accounting for 42% (11,706 Mt), wheat 45% (12,550 Mt), maize 10% (2,887 Mt), vegetables 1% (306 Mt) and other crops 2% (661 Mt) of total domestic production. The value of domestic seed production is NPR 1.8 billion. It is estimated that the share of private seed companies is 50%, cooperatives 40% and government seed companies 10% of improved seed production.

Nepal’s seed laws specify that technical audits for purity and quality must be carried out before seed can be certified as improved seed. Thus, most of the seed produced by farmer groups and cooperatives is not counted as improved seed as such auditing is lacking in many locations due to the limited number of seed inspectors and seed testing laboratories. More auditing and testing would increase the volume of improved seed production.

Some seed companies and cooperatives have started producing the seed of recently released, registered and pipeline hybrid maize varieties (Khumal Hybrid 2 and Rampur Hybrid 10), hybrid rice varieties (Hardinath Hybrid 1 and Hardinath Hybrid 3) and tomato varieties

(Sirjana and others) with technical support from NARC's national commodity programs and donor funded projects such as NSAF. A total of 8.9 Mt of hybrid seed was produced in Nepal in 2018/19 comprising:

- 0.97 Mt of rice: (0.12 Mt by NARC and 0.85 Mt by private companies)
- 7.61 Mt of maize (2 Mt by NARC and 5.61 Mt by private companies)
- 0.322 Mt of tomatoes (0.004 Mt by NARC and 0.322 by private companies).

Similarly, a total of 31.42Mt of hybrid seed, including rice (9MT) and maize (24.43MT) seed was produced by different seed company partners in Nepal in 2019/20 (August).

4.3 Seed Processing and Conditioning

The Government of Nepal and donor-funded projects have provided seed infrastructure support to cooperatives, community-based seed producer groups, community seed banks and private entrepreneurs (Gauchan, 2017). This support has built seed stores, threshing floors and seed processing structures and bought tillage and transport equipment.

Accordingly, significant progress has been made in developing processing facilities. In 2010, there were only 20 seed processing plants with a processing capacity of 25 Mt/hr in Nepal, while by 2019, 45 processing plants had been established that could process 112 Mt/hr, which is twice the NSV target for 2025 of 55 Mt/hr. Encouraging progress has been made on improving seed storage facilities, with about 30,000 Mt of storage established and work underway supported by federal and provincial governments to establish more. The aim is to have the capacity to store 50,000 Mt of seed by 2025. However, some of facilities do not function at full capacity year-round due to the low volume of seed produced.

The number of seed laboratories has increased by only 1 to 18 since 2010, while the NSV target is to have 37 seed laboratories by 2025. The limited number of laboratories and its expense hinders the carrying out of seed quality testing. NSV targets a seed testing capacity of 40,000 samples per year by 2025; but only 10,000 samples were tested in 2019 which is 25% of the target (Figure 5).

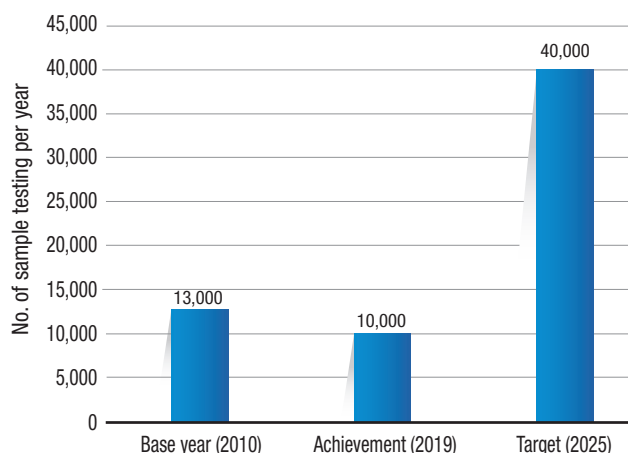


Figure 5. NSV target and achievement on seed sample testing.

4.4 Seed Marketing

Two types of seed are marketed in Nepal – domestically produced seed, which is mainly open-pollinated varieties, and imported seed, which is mostly hybrid seed. Domestic improved seed is mostly produced by seed companies, farmer groups and cooperatives, which they sell to farmers through agrovets (60%), cooperatives (15%), local governments (15%) and development projects (10%), although the proportion varies by type of crop. The subsidy market supported by local governments and development projects (>60% of sales) dominates OPV maize seed, while almost all hybrid tomato seed is sold through agrovets. In recent years, rice millers have started selling the seed of fine quality rice varieties to their contract producers in order to maintain the quality of their milled rice. However, the inundation of different rice varieties and hybrids in rice producing areas is challenging millers to maintain a steady flow of demanded varieties. The distribution channels of domestically produced improved seed and imported seed are summarized in Figure 6.

Imported seed is legally brought into Nepal by importers accredited by SQCC. In 2019, 45 importers brought seed into Nepal from more than 30 international seed companies. Imported seed is sold to farmers through dealers, wholesalers, agrovets and cooperatives. As per the seed law imported varieties must be registered with SQCC to be sold in Nepal. The number of registered varieties has increased from the 251 varieties, including 231 hybrids, which were registered in 2010, to the 419 varieties (363 hybrids and 56 OPVs) registered in 2019 (Annex 6).

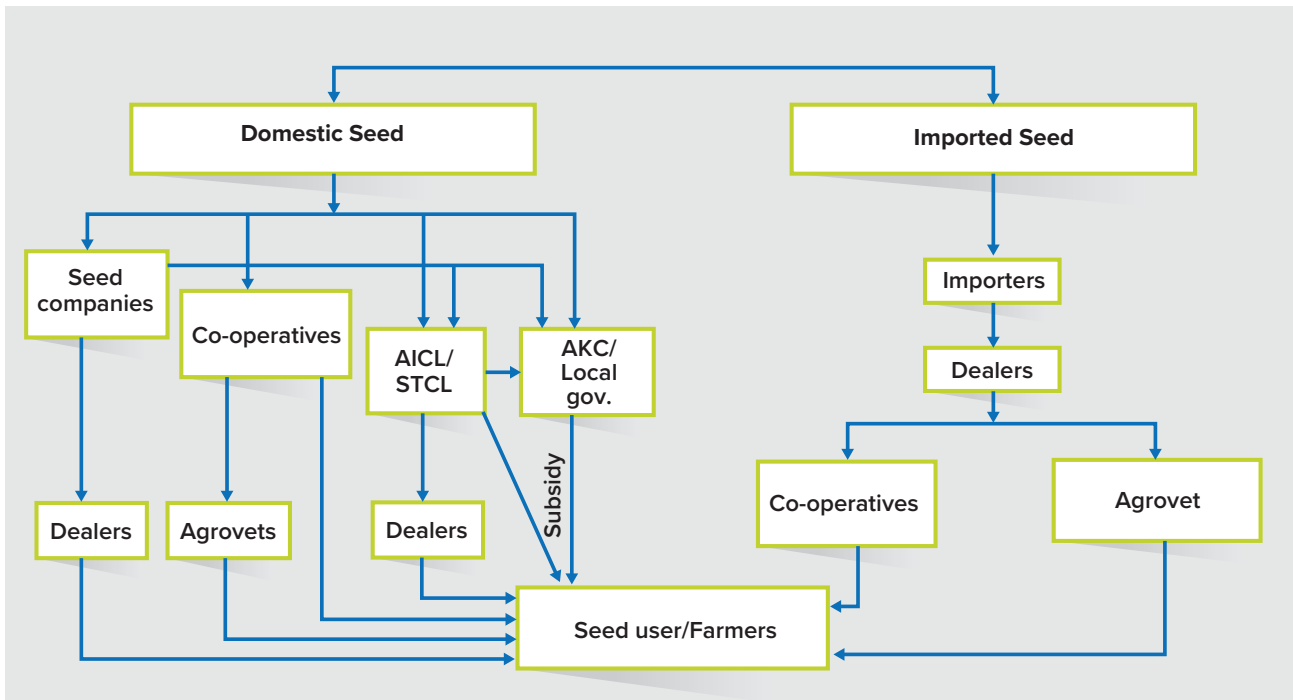


Figure 6: Marketing network for domestic production and imported seed in Nepal.

In 2018/19, 32,360 Mt of seed was sold in Nepal of which 28,110 Mt was domestically produced and 4,250 Mt imported. The share of seeds of major crops in domestic production is discussed above in Section 4.2. The total value of all this seed was US\$ 14.9 million with an average retail price of NPR 64/kg ranging from NPR 50/kg for OP rice seed to NPR 150,000/kg for hybrid tomato seed. Rice, maize and vegetables are the major imported seed with 2,780 Mt of rice, 1,385 Mt of maize and 837 Mt of vegetable seed imported in 2018/2019 with a value of \$12.7 million. The average market wholesale price for imported seed is NPR 360/kg.

In addition to formal imports, a sizeable quantity of cereal crops seed is imported 'informally'. SEAN estimates that about 8,000 Mt of OPV rice varieties worth \$0.4 million were imported informally from India in 2018/2019, including Sona Masuli, Ranjit Masuli, Sawa Masuli and Sarju 52 varieties. Small quantities of wheat long duration varieties such as HD 2967 are imported informally into the mid and far-western Terai. It is estimated that that at least 1,000 Mt of rice and the same quantity of maize are imported informally each year (Chhote Lal Prasad, Vice President SEAN, February 2019).

NSV targets the export of 750 Mt vegetable seed per year by 2025 (Figure 7). The NSV's 2010 baseline figures for seed imports was 240 Mt and for seed exports was 160 Mt. The NSV calls for reducing seed imports to 30 Mt and increasing exports to

about 600 Mt per year by 2025 (Figure 7). The achievement to 2019 shows that to achieve the NSV target, imports should be reduced by 31% and exports increased by 99.8%. In 2018/19, Nepal exported only 500 kg carrot and 200 kg bitter gourd seeds to Bangladesh through two seed companies CGNS and Sean Seed Service Centre Ltd (SQCC, 2020). Currently, about 80% of vegetable seed sold in Nepal is imported. It will therefore be very difficult to meet this target considering the slow progress made towards variety development and vegetable seed production.

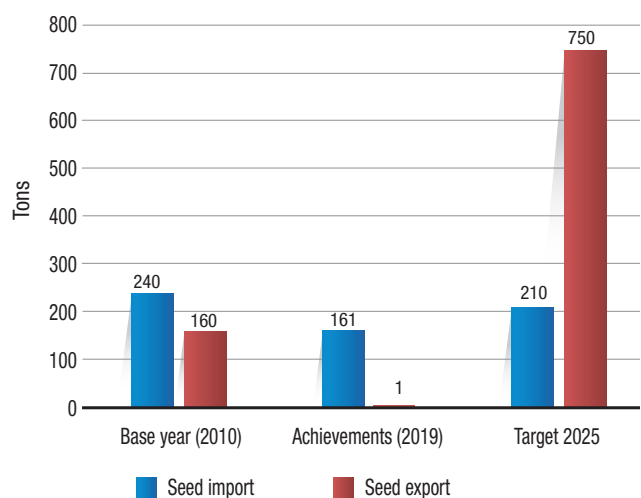


Figure 7. Nepal vegetable seed imports and exports and NSV target.

Nepal has started exporting seeds of some cereal crops, including rice (Radha 4) from Banke, and wheat (NL 297, Vijaya, Gautam) from Banke, Rupandehi, Dhanusha and Morang districts informally to India. In 2019, it was estimated that Nepali seed companies sold at least 2,000 Mt of wheat seed and 500 Mt of rice seed to Indian farmers and entrepreneurs (Personal Communication, Chhote Lal, Vice President SEAN, Feb 2019).

NSV calls for increasing the role of private seed companies and reducing the engagement of government institutions and cooperatives in marketing seed. It targets the setting up of four large seed companies with research and development facilities but does not define large seed companies. As per international standards, large seed companies should have their own varieties and research and development (R&D) programs. However, Nepal has no such companies. Such companies could emerge in Nepal by strengthening the R&D and market development capacity of private seed companies, and by creating a more conducive environment for private investment in the seed business. The NSV targets for small and medium seed companies is 40 and up to 2018/19 only 25 such seed companies have been established. So, the number of seed companies' indicator is unlikely to be achieved.

4.5 Seed Use

The Government of Nepal aims to increase crop yields by increasing the seed replacement rate (SRR). The SRR is the main indicator of the use of quality seeds by farmers as it measures the area of crop sown with improved seed amidst the total cropped area. However, Nepal's SRR is far behind other south Asian countries. The NSV targets an SRR of 25% for self-pollinated crops, 33% for cross-pollinated crops and 90% for vegetables in 2025. In 2019, the SRR was estimated to be 17% for the major cereals and 75% for vegetable (Figure 8). The target for vegetable has already been achieved mainly due to the use of imported hybrid seed.

In 2019, the SRR of rice was 18.4%, wheat 15.4% and maize 15.2%. Up to mid-2019, the share of hybrids in total SRR was only about 3% for cereals. This poor progress in increasing the SRR is mainly due to seed companies and cooperatives, continuing to mainly produce the seed of old varieties and their traditional marketing that lacks attractive branding and innovations. Seed promotional activities such as participatory variety selection, on-farm

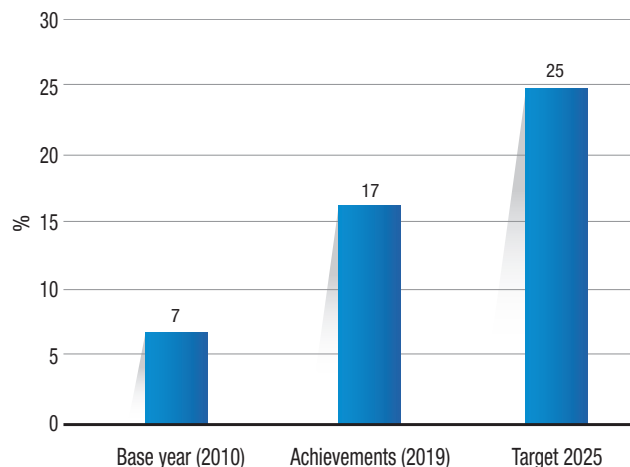


Figure 8: Status of achievement of NSV SRR target.

demonstrations, farmers' acceptance tests, minikit distribution and pre-released seed multiplication are being adopted by NARC stations on a small scale. Seed companies and cooperatives hesitate to invest in market promotion of the public domain varieties as potential profits from this could accrue to others.

The 17% SRR indicates that 83% of seed used by farmers comes from informal sources, mainly farm-saved seed and seed exchanged with relatives and neighbors. Nepal has made good progress on improving the SRR as it has increased from 7% in 2010 to 17% in 2019. This trend indicates that the SRR target can be achieved if seed produced by farmer groups and cooperatives is brought under the formal seed system by running seed certification campaigns. The main challenges to achieving the target are the limited number of seed laboratories, seed certifiers and inspectors and the scattered seed production. Only 18 of NSV's envisioned 37 seed laboratories had been established by 2019 with many of them at private seed companies which are not fully operational due to lack of trained personnel. Although SQCC has licensed more than 90 private sector crop and seed inspectors, the lack of a proper incentive mechanism is the major constraint for their mobilization. However, the big concern with this indicator is how to increase farmers' access to newly released crop varieties because the genetic gains from old varieties are low due to the higher susceptibility of old varieties to biotic and abiotic stresses.

STAKEHOLDER PERCEPTIONS ON MAJOR GAPS IN NSV IMPLEMENTATION

The NSV is the main strategic document that guides stakeholders on the development of Nepal's seed sector. For this, stakeholders should understand the scope of the NSV, and the concerned entities should roll out strategies to address stakeholder issues to achieve NSV's overall goals. Table 1 in Chapter 2 presents NSV's indicators and key strategies across seed value chain functions. This chapter summarizes the perceptions of eight types of stakeholders on NSV implementation gaps in seed value chain functions in the past six years and how to improve the situation.

Federal government policy makers: MoALD policy makers believe that inadequate investment and the lack of a dedicated coordination unit are the major causes of the low achievement of NSV's targets. They perceive that Nepal could meet all NSV targets except for the vegetable seed export and hybrid development targets. The NSV called for investing NPR 827 million during the NSV period on the development of the seed value chain (Annex 8) with 41% of this from the private sector. Some donor funded projects have invested about NPR 661 million, principally to upgrade seed storage buildings and processing machinery. These stakeholders say that concrete actions and activities are needed to make progress on vegetable seed exports, the provision of long-term soft loan to seed companies for R&D, the development of national level seed market centers, and the holding of national seed buffer stocks.

Provincial and local government policy makers: The provincial MoLMACs, agricultural knowledge centers (AKCs) and local governments feel they face difficulties to focus their seed-related activities in line with NSV targets such as variety development, and registration due to the lack of policies to guide provincial and local seed systems. It is anticipated that the revised Seed Act (2020) will provide opportunities to design local seed policies. To meet the requirement for quality seeds, provincial governments through AKCs have started training and providing output-based incentive for source seed production to seed companies, cooperatives and farmer groups. Local government seed-related activities focus on improved seed and grain production through subsidy schemes towards

filling the gaps in improved seed production and use. However, many local governments' insufficient agricultural technicians makes it difficult for them to implement and monitor seed production support activities.

NARC scientists: NARC scientists feel it is difficult to meet both the hybrid and OPV variety NSV development targets considering the limited number of scientific staff at NARC stations (Annex 9), and the high turnover and transfer of scientists, especially plant breeders. According to them at least three crop specific breeders are required at each commodity program, who should not be transferred for at least five years to achieve concrete outputs. They opined that the operational budget for variety development and maintenance at NARC stations has been almost stagnant since the start of NSV in 2013 (see Annexes 7.1 to 7.3). In 2015/2016, the government allocated only 3.29% of its national budget to agriculture while the investment in agriculture research accounted for only 0.25% of agriculture budget (Timsina et al., 2019). Moreover, the commodity programs (rice, wheat, maize) receive less than 20% of NARC's budget. This means that the annual program cost of each commodity research organization is below \$50,000 and development and maintenance is only 16% to 20% of this. NARC scientists argued that the provision of adequate budget would enable the attainment of NSV variety development targets of developing four hybrid rice varieties and developing OP varieties. And the National Maize Research Programme is likely to release five hybrid maize using material received from the Heat Tolerant Maize for Asia (HTMA) and NSAF projects. Moreover, infrastructural facilities such as control greenhouses (phytotrons), molecular labs and assured irrigation supplies are yet to be developed at NARC stations to enhance the efficiency and effectiveness of breeding programs.

Academics: University professionals feel that the government has not considered their partnership in NSV implementation and no financial resource are provided to their departments nor is there any coordination between the Agriculture University and NSV related programs. Though the main objective of the university is formal education, some professionals and students are engaged in research

that could contribute to NSV goals. They argue that the Agriculture and Forestry University, Rampur, Chitwan, has unused land which could be used for variety development and early generation seed production in contractual arrangements with private seed companies; but an appropriate partnership modality needs to be developed and approved by the government. Also, university professionals feel that professors and students could support seed companies and cooperatives to strengthen their skills on plant breeding, seed production and seed business management given an appropriate partnership modality, resources and benefit sharing mechanism.

Seed companies: Seed companies that work only on OPVs argued that seed marketing is the big concern for maize varieties due to inconsistent government subsidies by local governments. Some local governments provide 100% subsidy while others give only 25% subsidy on seed. Furthermore, the amount of subsidized seed is only decided on at peak planting season time, making it difficult for seed companies to forecast the demand for seed. Some local governments have the policy of purchasing improved seed for the subsidy market from local groups and cooperatives. For rice, the seed marketing window is smaller due to the increasing imports of registered and unregistered hybrids through formal and informal channels from India and China. These seed companies are interested in developing their domestic hybrid production capacity but said they had inadequate skills on hybrid seed production and maintaining parental lines. They added that seed companies would invest more in hybrid variety development and seed production if the support was provided:

- variety patenting and exclusive licenses
- technical expertise, even on a cost sharing basis
- the ownership of parental lines of competitive hybrids
- financial packages (100% insurance) for seed crops and subsidized loans.

The seed companies indicated they hesitated to make big investments in hybrid development due to their poor technical competency and risk factors. They however said that their technical competence and market intelligence has increased considerably through their partnership with CIMMYT while working market-ready maize lines provided by CIMMYT for production of hybrids in the country. This recent development will allow the private sector to meet the NSV target to develop five maize

hybrids. However, the retention of competent technical staff at seed companies is a big challenge.

Seed cooperatives and farmer groups: The NSV envisions the active role of farmer groups and cooperatives on improved seed production and marketing, especially in marginal areas where private seed company businesses are unprofitable. Farmer groups and cooperatives argue that there is an increased risk in marketing OPVs of rice and wheat seed due to imported hybrids and inconsistent and unpredictable subsidy policies of provincial and local governments. This results in ups and down in their seed production and sales trends. And farmer groups and cooperatives lack experience on hybrid seed production and mostly produce improved OPV seed using source seed from NARC centers and seed companies.

Seed users: Commercial farmers said they need higher yielding and more disease tolerant crop varieties. They prefer fine to medium fine varieties and hybrids of rice. The reasons for emphasizing hybrid rice are due to higher profitability as a result of higher yield and comparable grain price to OPVs. In recent years, millers have started treating hybrid rice grains as medium fine quality rice. For maize, commercial farmers focus on high yielding and yellow kernel hybrids as the output market (feed mills) demand yellow maize. Subsistence farmers in marginal hill areas are more concerned to preserve local landraces and OP varieties. They said that more focus should be given towards the conservation, use and promotion of local varieties. Seed sector development and promotion must cater to the demand of users to make quality seed available across the country's markets and ecoregions.

Rice millers: Most rice millers are not aware of the varieties developed by the national research system and sold by seed companies. For rice, they categorize varieties into coarse, medium and fine varieties. They said that there is increasing demand for fine quality rice from supermarkets and dealers in urban areas while Nepali farmers mainly grow coarse varieties. There is thus an increasing tendency for millers to import rice from India and sell it to under their own brand names. Towards reducing imports and increasing the production and use of domestically produced varieties, the demand from end markets must be met to promote a demand-driven seed system.

The Way Forward

Good progress has been to 2019/20 under NSV on source seed production and establishing seed processing facilities. But critical limitations exist in several important areas that hinder progress including, but not limited to, varietal research and development, the market development of new varieties, the capacity of public and private sector actors in hybrid variety development, and the export of vegetable seed. In addition, with the recent state restructuring, which was not considered when NSV was formulated, there is lack of clarity on roles and responsibilities with regard to NSV implementation at provincial and local government levels. Stakeholders perceive that the lack of a seed vision coordination cell, limited investment, limited number of trained human resource such as breeders and seed technologists, limit the implementation of NSV. These gaps should be addressed by assigning accountable coordinating bodies at provincial and local government levels to guide stakeholders to address lacking areas. Based on stakeholders' perceptions it is suggested to implement the following recommendations across the five components of the seed value chain over the remaining period of NSV to 2025.

Variety development and maintenance

- Establish a hybrid research and private sector coordination cell at NARC headquarters under the Directorate of Planning and Coordination or Crops and Horticulture Research in association with representatives from MoALD, SQCC, DoA, DoLS, and private actors with special responsibility to roll out the seed vision targets
- Create hybrid research units and identify hybrid research teams at the National Maize Research Program, Rampur, the National Rice Research Program, Hardinath, and the National Horticulture Research Center, Khumaltar and the National Plant Breeding and Genetics Research Center, Khumaltar
- Prepare a variety release and registration time frame to meet the NSV targets from national commodity programs, directorate of research from seven provinces and central national research centers.
- Adopt fast track breeding and variety release and registration procedures.
- Develop a mechanism to mobilize public sector breeders from NARC stations and agriculture universities to build the capacity of private seed companies on hybrid variety development.
- Develop guidelines for patenting hybrid varieties, which could attract private sector investment in hybrid variety development and maintenance.
- Engage consumers and industries in variety development and the selection process to incorporate client-oriented traits in the variety development process.
- Capacitate public and private institutions (farmer groups, cooperatives, companies) for the registration of local land races in a fast track process.
- Develop mechanisms for easy access to useful genetic resources
- Register superior maize hybrids identified by the NSAF project and request inbred lines from CIMMYT for multiplication in Nepal.
- Provide licenses to private agencies for variety development, maintenance and seed production.

Seed multiplication

- Establish an online data base of breeder, foundation, certified and improved seeds.
- Develop a technical auditing system in the seed production process to ensure the maintenance of the seed cycle from breeder seed to foundation seed to certified seed on to improved seed.
- Develop a mechanism for human resource development and its hiring for hybrid seed production in the public and private sectors.
- Start pre-release seed multiplication programs, especially for bio-fortified wheat, lentils, maize to strengthen nutritional security in the country

- Develop output-based incentives (based on sales volumes) for the early generation seed production of OPVs and hybrids.
- Capacitate seed inspectors to use digital tools for seed quality certification and build an effective field mobilization plan for seed crop inspection.
- Encourage private sector companies to adopt truthful labelling systems for seed production and quality maintenance.
- Implement seed crop insurance schemes to minimize the potential risks in seed multiplication.
- Implement soft loan and agriculture lending schemes in seed production to minimize production costs.

Seed processing and conditioning

- Review and upgrade the capacity of seed laboratories.
- Upgrade the capacity of seed storage, seed processing and packaging.
- Ensure seed quality and avoid varietal admixture during seed processing and packaging.
- Develop business models for underused machines and facilities.
- Enhance linkages between machinery service providers and seed producers, especially for seed dryers, and cob shellers.

Seed marketing

- Build the capacity of seed companies, cooperatives and groups about market intelligence including attractive packaging and branding.
- Strengthen collaboration between seed companies, cooperatives and local governments to market improved seed in marginal areas and amongst disadvantaged communities.
- Strengthen the digitally enabled seed information system.
- Introduce a smart subsidy scheme to minimize market distortion from seed subsidies.

Seed use

- Raise the awareness of seed users about the importance of using quality seed, and the digital seed information system.
- Promote large scale on farm demonstrations for new varieties popularizations
- Involve AKCs, agrovets and model farmers for seed extension and adoption initiatives
- Link extension services such as agricultural finance, crop insurance and minimum support price for seed users.

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ANNEXES

ANNEX 1: MILESTONES IN THE NEPALESE SEED SECTOR

- 1960: Introduction of high yielding wheat varieties Lerma, Rho
- 1962: National seed testing laboratory established under Agronomy Division at Khumaltar in the Kathmandu Valley.
- 1972: First major crop commodity program (for rice) started.
- 1974: Establishment of the Agriculture Inputs Corporation Ltd (AICL) fostered the start of commercial seed production.
- 1975: The start of contract vegetable seed production between farmers and seed entrepreneurs, which was followed by several seed-related projects.
- 1985: The introduction of vegetable and maize hybrid seed by private seed companies.
- 1988: The Seed Act (1988) provided the legislative framework.
- 1991: Formation of the Seed Entrepreneurs' Association Nepal (SEAN).
- 1997: Seed Regulations (1977) was developed to regulate the Seed Act (1988).
- 2001: Establishment of the Seed Quality Control Centre (SQCC).
- 2002: Establishment of the National Seed Company Limited (NSCL).
- 2010: Revival of the Seed Science and Technology Division as the central disciplinary division for seed development under the Nepal Agricultural Research Council (NARC).
- 2013: New Seed Regulations (2013) introduced.
- 2013: Finalization and beginning of implementation of the National Seed Vision (2013–2025).
- 2015: Beginning of the Agricultural Development Strategy (2015–2035), which included the National Seed Vision under its program.
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ANNEX 2: THE ROLES OF ORGANIZATIONS INVOLVED IN IMPLEMENTING THE NATIONAL SEED VISION

	Organizations	Roles
Federal government		
1.	Ministry of Agriculture and Livestock Development	Policy, planning, and resource allocation for the seed sector. Human resource development and creating an enabling environment
2.	National Seed Board	Guidance, coordination and leadership to all seed related programs, policy support and advise to government and varieties release and registration
3.	Seed Quality Control Centre	National seed board secretariat. Implements seed policies and provides regulatory and quality control services
4.	Nepal Agriculture research Council (NARC)	Agriculture research, variety development and maintenance, germplasm conservation, source seed production (breeders', foundation), and seed research partnership with private sector companies.
5	Department of Agriculture	Planning, technical support, and coordination to NSB and SQCC
6	Department of Livestock Services	Planning, technical support, and coordination to NSB and SQCC
7	Agriculture Seed Laboratory	Laboratory testing of seed samples and technical support to seed entrepreneurs
8	Prime Minister Agriculture Modernization Project	Supports the commercialization of agriculture including seed production and marketing in collaboration with farmers' groups, cooperatives, companies, agrovets and local governments
9	Seed Entrepreneurs' Association of Nepal	Represents the private sector in seed policy dialogue and NSB
	The Agriculture and Forestry University, Rampur, Chitwan	Development of human resource, training
	Agriculture Input Company Ltd.	Provide improved seed of food security crops as per the government mandate
Provincial Government (provisioned)		
1.	Ministries of land management, agriculture and cooperatives (MoLMACs)	Policy, planning, and resource allocation for the seed sector.
2.	Provincial seed boards	Guidance, coordination and leadership to provincial seed-related programs, policy support and advise to MoLMACs, recommendation of varieties for release and registration to NSB
3.	Provincial seed laboratories	Implements seed policy and provides regulatory and quality control services
4.	Regional agriculture research station (NARC)	Agriculture research, variety development and maintenance, germplasm conservation, source seed production (breeders, foundation), partnership in seed research with private sector
5	Directorates of agriculture and fisheries development/livestock services	Planning, technical support, coordination to provincial seed boards and seed laboratories
6	Directorates of agriculture extension and livestock and fisheries	Coordination and capacity building of local governments to implement agriculture and livestock-related activities
7	Agriculture knowledge centers, veterinary hospitals and livestock knowledge centers	Technical support for seed producers, processors and seed entrepreneurs, Coordination with provincial seed laboratories
Local level		
1	Local government agriculture units	Design and implement programs for improved seed production and distribution in collaboration with groups, cooperatives, companies, agriculture knowledge centers, PMAMP, agrovets and NARC research stations.

ANNEX 3. LIST OF PROJECTS IMPLEMENTED DURING NSV IMPLEMENTATION

Project name	Short form	Implemented period	Donor Agency	Focus
Hill Maize Research Program	HMRP	2002-2014	USAID and Swiss Agency for Development and Cooperation (SDC)	Variety development, seed production, maize technology dissemination & local capacity building
Poverty Alleviation through Agriculture Commercialization and Trade	PACT	2009–2018	World Bank	Improve the competitiveness of smallholder farmers and the agribusiness sector in selected commodity value chains in 25 districts
Nepal High Mountain Agribusiness and Livelihood Improvement	HIMALI	2011 and on-going	Asian Development Bank	Business literacy and small grants for local enterprises
Irrigation and Water Resource Management Project	IWRMP	2008-2018	World Bank	Irrigation support to farmers
Raising Incomes of Small and Medium Farmers Project	RISMFP-FP	2011-2017	Asian Development Bank	Support for the production, post-harvest and value chain development of high value commodities
Kisankalagi Unnat Biu-Bijan Karyakram (Improved Seed for Farmers)	KUBK	2014–2019	International Fund for Agricultural Development (IFAD)	Variety testing and seed system development in the hills, and linking farmers' groups and cooperatives with seed companies for marketing seed
Knowledge Based Sustainable Agriculture and Nutrition	KISAN-	2013-2022	USAID	Dissemination of technologies related to seed and crop management
Nepal Seed and Fertilizer Project	NSAF	2016-2021	USAID	Strengthen seed companies, cooperatives and NARC stations for the synergistic and competitive seed system
Cereal System Initiative for South Asia	CSISA	2009-2022	USAID	Capacitate seed companies for the production and marketing of newly released and pipeline wheat, mung bean, rice, maize and lentil varieties
High Value Agriculture Project	HVAP	2010-2017	IFAD	Integrate the rural poor, especially women and marginal groups in high value agriculture and Non-Timber Forestry Products (NTFPs)/Medicinal and Aromatic Plants (MAPs) value chains and markets, and improve income, employment opportunities and ability to respond to market demand and opportunities based on marketing agreements with private agribusiness.
Heat Tolerant Maize for Asia	HTMA	2012-2020	USAID	Capacitate national seed system actors for testing, development and seed production of high yielding and stress tolerant hybrid maize

ANNEX 4: SUPPORT BY THREE PROJECTS TOWARDS NSV TARGETS

	Project	No. of sub projects	Total investment (NPR million)	Beneficiary households	Total seed production (Mt)	Processing plant with buildings	Support to private seed companies	Storage capacity (Mt)
1	KUBK	499	349.8	25,829	4,934	31	3	2,000
2	HVAP	15	243	450	27.2			
3	RISMFP	20	74.3	961	5,356	14	6	1,200
Total		534	667	27,240	10,317.2	45	9	3,200

ANNEX 5: NSV CROP-WISE TARGETS

Annex 5.1: NSV crop-wise variety targets and progress to 2019

Crop	Baseline	Targets for 2025	Additional varieties to be released	Progress to June 2020		Remarks
				Total released	Progress (%)	
Rice	60	100	40	82	55	17 denotified
Maize	23	40	17	36	76	7 denotified
Wheat	30	45	15	44	93	13 denotified
Millet	3	15	12	5	42	
Barley	6	15	9	0	0	
Lentil	10	18	8	14	50	
Other pulse	25	40	15	4	27	3 denotified
Oilseed	16	30	14	21	36	1 denotified
Vegetables	40	70	30	45	17	
Potato	8	20	12	11	27	
Forage	2	10	8	15	100	
Industrial crops	9	20	11	3	27	
Total	232	423	191	279	Average (46)	41 denotified

Annex 5.2: NSV crop-wise breeder seed production targets and progress to 2019

S.N.	Crops	Base year	Projected requirement			Progress
		2010	2015	2020	2025	2019
1	Rice	8.56	6.6	8.96	11	27.91
2	Maize	3	0.63	0.9	1.46	1.35
3	Wheat	28	32.39	45.35	57.14	72.73
4	Millet	0.015	0.031	0.038	0.063	0.26
5	Barley	NA	0.43	0.87	1.56	0.25
6	Lentil	0.33	0.65	1.15	2.48	1.11
7	Oilseed	0.01	0.03	0.05	0.07	2.31
8	Vegetables	0.55	0.878	0.955	1.204	0.11
9	Potato	13	13	13	13	NA
10	Buckwheat	-				0.33
	Total	53.47	54.64	71.27	87.98	106.36

Annex 5.3: NSV crop-wise foundation seed production targets and progress to 2019

S.N.	Crops	Base year	Projected requirement			Progress
		2010	2015	2020	2025	2019 NARC
1	Rice	307	230	314	389	2314
2	Maize	65	38	54	88	145
3	Wheat	250	583	816	1029	2332
4	Millet	1	2	2	4	2
5	Barley	0	5	10	19	NA
6	Lentil	8	16	29	62	2
7	Oilseed	1	2	3	4	6
8	Vegetables	22	35	38	48	1
9	Potato	848	1066	1285	1376	23
10	Jute	-			-	
11	Sugarcane	-			-	85
12	Ginger & Turmeric	-			-	5
13	Forage seed	-			-	7
	Total	1,502	1,977	2,552	2,978	4,273

Annex 5.4: NSV crop-wise improved seed production targets and progress to 2019

Sn	Crops	Projected requirements				Progress
		2010	2015	2020	2025	2019
1	Rice	8,470	11,490	15,690	19,450	11,706
2	Maize	1,592	2,627	3,780	6,132	2,887
3	Wheat	9,680	11,659	16,325	20,570	12,550
4	Vegetables	1,100	1,756	1,909	2,407	306
5	Other	309.5	715	1,204	2,447	661
6	Total	37,320	53,944	76,371	92,527	28,110

ANNEX 6: NUMBER OF REGISTERED CROP VARIETIES IN NEPAL

Crops	National varieties	Baseline 2010		Status of imported varieties June 2020			Notes
	Registered	F1 hybrids	Total varieties	OP	F1 hybrids	Total	
Rice	7	3	3	7	58	65	6 F1 denotified
Maize	1	9	9	0	56	56	7 F1 denotified
Wheat	1	-	-	-	-	-	-
Vegetables	1	219	239	49	249	298	6 OP and 52 F1 denotified
Potato	5	-	-	-	-	-	
Total	15	231	251	56	363	419	6 OPVs and 65 F1 denotified

ANNEX 7: RESOURCES ALLOCATED BY NATIONAL COMMODITY PROGRAMS FOR DEVELOPING VARIETIES

Annex 7.1: Resources allocated by National Rice Research Program for developing varieties

Year	Total budget (NPR '000)	Variety dev. budget (NPR '000)	Variety development projects	No. breeders	No. varieties developed
2013/14	53,260	2,813	8	4	0
2014/15	59,740	2,568	8	4	5
2015/16	51,613	2,443	8	4	0
2016/17	67,634	2,792	8	4	1
2017/18	76,055	3,953	8	3	3
2018/19	60,738	4,295	8	3	3
Total	369,040	18,864	393		12

Annex 7.2: Resources allocated by National Wheat Research Program for developing varieties

Year	Total budget (NPR '000)	Variety dev. budget (NPR '000)	Variety development projects	No. breeders	No. varieties developed
2013/14	48,365	3,228	1	4	0
2014/15	57,810	3,513	3	4	0
2015/16	51,504	3,510	2	5	2
2016/17	57,006	3,292	2	4	2
2017/18	69,037	3,613	3	4	0
2018/19	65,062	3,246	3	3	6
Total	348,784	20,402			10
Average		3,400 (5.85%)			

Annex 7.3. Resources allocated by National Maize Research Program for developing varieties

Year	Total budget (NPR '000)	Variety dev. budget (NPR '000)	Variety development projects	No. of breeders	No. varieties developed
2013/14	53,853	5,145	9	5	0
2014/15	57,993	5,250	9	4	2
2015/16	77,734	6,404	2	4	3
2016/17	58,940	5,039	3	5	2
2017/18	80,599	5,402	2	7	3
2018/19	74,210	4,575	2	4	
Total	403,329	31,815			10

Annex 8: Estimated Annual Budgets of the Five Components of Nepal's Seed Value Chain

	Components	Targeted NSV Budget (million NPR)	2013 (million NPR)	2019 (million NPR)
1	Variety development and maintenance	161	75	90
2	Seed multiplication	110	80	76
3	Seed processing and conditioning	267	267	267
4	Seed marketing	177	-	-
5	Seed quality assurance and use	112	34	42
	Total	827	456	475

ANNEX 9: PROJECTED REQUIREMENT OF SCIENTIFIC STAFF (PLANT BREEDER, NUMBER) DURING THE NSV PERIOD AND PROGRESS TO 2019

	Crops	Base year	NSV projected requirement			Progress
		2010	2015	2020	2025	2019
1	Rice	9	10	12	15	2
2	Wheat	4	6	8	10	3
3	Maize	5	7	10	15	3
4	Barley and millet	2	3	4	5	2
5	Oilseeds	1	4	5	6	1
6	Legumes	2	4	6	8	3
7	Potato	1	3	5	8	2
8	Vegetables	4	6	8	10	1
9	Forage	1	2	3	4	0
10	Industrial and cash crops	2	4	5	6	0
11	Seed technology	2	3	5	6	3
	Total	32	52	71	93	20



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