

NATIONAL SEED VISION 2013 - 2025

(Seed Sector Development Strategy)

Government of Nepal
Ministry of Agricultural Development
National Seed Board
Seed Quality Control Centre
Hariharbhawan, Lalitpur
Nepal

April, 2013

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Message from the Minister

The use of good quality seeds of high yielding varieties plays the most important role to increase crop production. To ensure the use of good quality seeds, they are required to be available on time and place at reasonable prices. Nepal is lagging behind in conserving diverse genetic resources, utilizing available resources in developing appropriate varieties and producing their seeds, increasing investment for seed infrastructure, and coordinating actors for smooth flow of seeds along the value chain. As a result, Nepalese market is under the domination of global seed business and seed import is continuously rising.

The demand of hybrid seeds is soaring in the Nepalese market due to their high production potential. A large quantity of hybrid seeds is imported annually from abroad to fulfil this demand. In addition, entrepreneurs' access to open pollinated seeds is easier in the international market than the domestic market. Therefore, reducing import is not possible without developing suitable hybrid and open pollinated varieties of different crops according to farmers' choice, and making their seeds available when and where needed. The policies, programmes, and legal environment developed in the past were found ineffective to enhance the dynamism of the Nepalese seed industry, which ensure the supply of seeds according to farmers' choice. In this context, pressing need was felt for the development of a pragmatic and holistic long term vision for the development of Nepal's seed sector.

Realizing the ground reality of safeguarding the national interest of self sufficiency, import substitution, and export promotion of good quality seeds, National Seed Vision (2013 – 2025) has been prepared. This vision is the first official document of its kind, which provides directives to all stakeholders associated with the seed business in Nepal for variety development and maintenance, seed multiplication, seed processing and conditioning, seed marketing, and seed quality control and use. This vision has clearly identified the gaps, opportunities, and strategies to be adopted to achieve the goal and outcomes by 2025 under the proposed seed system in Nepal

The implementation aspect of this vision matters the most in achieving success in the seed sector. Therefore, I earnestly request the concerned stakeholders: donors, government authorities, non- government organizations, private entrepreneurs, seed industrialists, individual scientists, and farmers to put their concerted efforts for the achievement of envisaged outputs of this vision within the stipulated time frame.

I would like to thank everybody, who provided valuable supports and work tirelessly while preparing this document.

Thank you all.

Tek Bahadur Thapa Gharti
Minister
Agricultural Development,
Forests and Soil Conservation

Few Words

Agriculture is the major sector of Nepalese economy. This sector employs around two-third of the Nepalese population and contributes around one-third in the national Gross Domestic Product (GDP). Poverty is rampant and nearly one-fourth of the total population of Nepal live below the poverty line. Majority of this group of people are smallholder farmers. Therefore, the role of the agriculture sector is crucial in national economic development and poverty reduction. However, vulnerability increases in the agriculture sector due to the out-migration of working-aged groups, leaving the responsibility of farming to women, children and old members of families. As a consequence, subsistence farming predominates in production operations, often with traditional methods, and limited use of external inputs, especially improved seeds and mineral fertilisers, resulting low agricultural productivity and untapped market potential of Nepalese agricultural products.

Slow growth of the agriculture sector increases food insecurity, mainly among smallholder farmers and land-less labourers. To address the food security situation and livelihoods concerns of poor and smallholder farmers, increasing crop productivity, commercializing farm businesses and making agricultural products competitive in the domestic as well as international markets are the immediate needs. The use of high quality seeds and that too produced in Nepal to replace the excessive imports plays important role to attain success in agriculture production. Specific interventions, such as the investment in varietal development and maintenance, seed infrastructure, seed production and processing facilities, marketing facilities, and in managing skilled human resources are required to improve crop productivity and facilitate the dissemination of crop varieties and technologies in a wider scale.

The preparation of National Seed Vision (2013 – 2025) aims to fulfill the gap that prevails in the seed sector, and to utilize the vast agro-ecological and biodiversity. Through its implementation in perfect harmony with the Agriculture Development Strategy (ADS), this vision will contribute to produce wide range of crop seeds to be self reliant and safeguard the national interest of substituting imports and promoting exports.

The successful implementation of National Seed Vision (2013 – 2025) is challenging. Being an apex coordinating and facilitating body, Ministry of Agricultural Development (MoAD) will take the lead role of implementing this vision. The mission of MoAD is to guarantee food security through the access of good quality seeds to farmers.

I wish the successful implementation of National Seed Vision (2013 – 2025) and commit full support from the MoAD during its implementation. I would also like to congratulate all those who put their efforts in preparing this document.

Jaya M Khanal
Secretary,
Ministry of Agriculture Development
Singha Durbar, Kathmandu

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Dila Ram Bhandari
Chief, SQCC and Member Secretary, NSB

Table of Contents

Message from the Minister	iii
Few Words	iv
Acknowledgements.....	v
Table of Contents	vi
List of Tables	viii
List of Figures	ix
List of Annexes	x
Acronyms.....	xi
Executive Summary	xiii
1. INTRODUCTION	1
1.1 Background.....	1
1.2 Mission	1
1.3 Seed and its classes	3
1.4 Types of seeds	4
1.5 Seed system in Nepal.....	5
2. OVERVIEW OF SEED SECTOR.....	7
2.1 Seed sector history	7
2.2 Participants in seed sector development.....	8
2.3 Policy environment	12
2.4 Seed development projects	14
2.5 Strengths and opportunities.....	18
2.6 Barriers of seed sector development.....	22
2.7 Gaps and interventions.....	22
3.1 Conceptual framework	25
3.1 Variety development and maintenance	26
3.2 Seed multiplication.....	30
3.3 Seed processing and conditioning.....	35
3.4 Seed marketing.....	37
3.5 Seed use.....	40
3.6 Seed policy issues.....	41
3.7 Public private partnership.....	43
3.8 Conservation and sustainable use of indigenous genetic resources.....	45
3.9 Sensitivity analysis	45
4 SEED VISION OBJECTIVES AND STRATGEIC DIRECTIONS.....	47
5 SEED SECTOR DEVELOPMENT STRATGEY	48

5.1	Strategies and implementation guidelines	48
5.2	Enabling factor, milestones and indicators.....	54
5.3	Activity action matrix.....	60
5.4	Expected results	64
6	IMPACT	65
6.1	Poverty and food security	65
6.3	Biodiversity conservation and climate change	66
6.4	Gender equity and social inclusion	66
7.	MONITORING OF SEED VISION	67
7.1	Monitoring.....	67
7.2	Evaluation	67
7.3	Performance measurement framework	68
8.	CONCLUSION	70

List of Tables

- Table 2.1: Time line of seed sector development in Nepal
- Table 2.2: Role of government agencies in Nepal's seed industry
- Table 2.3: Role of private and non government agencies in Nepal's seed industry
- Table 2.4: Strengths of Nepal's seed sector
- Table 2.5: Opportunities of Nepal's seed sector
- Table 2.6: Barriers and issues in seed sector
- Table 3.1: Resource allocation trend
- Table 3.2: Status of human resources
- Table 3.3: Major organizations working on seed research in various crops
- Table 3.4: Status and projected scientific manpower
- Table 3.5: Number of released varieties in Nepal
- Table 3.6: Number of varieties registered
- Table 3.7: Breeder seed production
- Table 3.8: Foundation seed production
- Table 3.9: Certified/Improved seed production
- Table 3.10: Projected requirement of seed crop area
- Table 3.11: Potential crop varieties for import substitution and export promotion
- Table 3.12: Vegetable seed import, export and availability
- Table 3.13: Human resources for seed production, processing and marketing
- Table 3.14: Estimated area and requirement of hybrid seeds
- Table 3.15: Sensitivity analysis of seed supply and value of crop production in different yield scenario by 2025
- Table 5.1: Proposed strategies for implementing Seed Vision 2013- 2025
- Table 5.2: National level milestones and indicators for seed development strategies
- Table 5.3: Local government, federal and community milestones and indicators for seed development strategies
- Table 5.4: Household level milestones and indicators for seed development strategies
- Table 5.5: Activity action matrix
- Table 6.1: Projected food production increment
- Table 7.1: Monitoring of Seed Vision 2013- 2025
- Table 7.2: Performance measurement framework

List of Figures

Figure 1: Conceptual framework for seed value chain analysis

Figure 2: Seed replacement rates in cereal crops

Figure 2.1: Seed replacement rates in vegetables

Figure 3: Trend of vegetable export, import and availability

Figure 4: Share of public, private and community in cereal seed production

List of Annexes

Annex 1.1: Terms of reference

Annex 1.2: List of organizations and authorities consulted

Annex 2.1: SWOT analysis

Annex 3.1: Organizations responsible for maintaining crop varieties in Nepal

Annex 3.2: Vegetable variety maintenance and seed production pockets / zones

Annex 3.3: Seed replacement rate in food crops and vegetables

Annex 3.4: Crop production and projected seed requirement

Annex 3.5: List of Seed Processing Plants

Annex 3.6: List of Seed Testing Laboratories

Annex 3.7: Yield level of major crops

Annex 3.8: Annual compound growth rate of area, production and yields of crops

Annex 5.1: Logframe - Seed Vision

Acronyms

ABD	Agriculture Botany Division
ADS	Agricultural Development Strategy
AEC	Agro Enterprise Center
AED	Agriculture Extension/ Engineering Directorate
AIC	Agriculture Inputs Corporation
AICC	Agriculture Information and Communication Centre
APP	Agriculture Perspective Plan
APSA	Asia-Pacific Seed Association
ASC	Agricultural Service Centre
ATED	Agricultural Training and Extension Directorate
BIMSTEC	Bay of Bengal Initiative for Multi-Sectoral Trade and Economic Cooperation
BS	Breeder Seed
CADP	Commercial Agriculture Development Project
CARIAD	Centre for Advanced Research in Agricultural Development (UK)
CBO	Community Based Organization
CBSP	Community Based Seed Production
CDD	Crop Development Directorate
CEAPRED	Centre for Environmental and Agricultural Policy Research, Extension and Development
CIDA	Canadian International Development Agency
CIMMYT	International Maize and Wheat Improvement Center
CMIASP	Community Managed Irrigated Agriculture Sector Project
CSB	Community Seed Bank
CSO	Civil Society Organization
CS	Certified Seed
CU	Consumer Union
DADC	District Agriculture Development Committee
DADO	District Agriculture Development Office
DDC	District Development Committee
DFID	Depart for International Development
DISSPRO	District Level Seed Self Sufficiency Programme
DoA	Department of Agriculture
DoLS	Department of Livestock Services
DUS	Distinct, Uniform and Stable
DSSC	District Seed Coordination Committee
FAO	Food and Agriculture Organization of the United Nations
FNCCI	Federation of Nepalese Chambers of Commerce and Industry
FORWARD	Forum for Rural Welfare and Agricultural Reform for Development
FS	Foundation Seed
GoN	Government of Nepal
GMOs	Genetically Modified Organisms
GTZ	German Technical Cooperation
HIMALI	High Mountain Agribusiness and Livelihood Improvement Project
HMRP	Hill Maize Research Project
HR	Human Resource
HVAP	High Value Agriculture Project
IAAS	Institute of Agriculture and Animal Science

IARC	International Agricultural Research Centre
IS	Improved Seed
IRRI	International Rice Research Institute
IPM	Integrated Pest Management
IPR	Intellectual Property Right
ISTA	International Seed Testing Association
I/NGO	International /Non Governmental Organization
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IWRMP	Irrigation and Water Resources Management Project
LIBIRD	Local Initiatives for Biodiversity, Research and Development
LMOs	Living Modified Organisms
MoAD	Ministry of Agricultural Development
MoCI	Ministry of Commerce and Industry
MoF	Ministry of Finance
NA	Not Available
NAP	National Agriculture Policy
NARC	Nepal Agricultural Research Council
NARDF	National Agricultural Research and Development Fund
NGO	Non-governmental Organization
NSB	National Seed Board
NPC	National Planning Commission
NSCL	National Seed Company Limited
OP	Open Pollinated
OECD	Organization for Economic Cooperation and Development
RIU	Research Into Use
PACT	Project for Agriculture Commercialization and Trade
PPB	Participatory Plant Breeding
PPP	Public Private Partnership
PVP	Plant Variety Protection
PVS	Participatory Variety Selection
RARS	Regional Agricultural Research Station
RD	Regional Directorate
RSTL	Regional Seed Testing Laboratory
RISMFP	Raising Incomes of Small and Medium Farmers Project
RS	Regional Station
SAARC	South Asian Association for Regional Cooperation
SEAN	Seed Entrepreneurs' Association of Nepal
SAFTA	South Asian Free Trade Agreement
SDC	Swiss Agency for Development and Cooperation
SMR	Seed Multiplication Ratio
SQCC	Seed Quality Control Centre
SRR	Seed Replacement Rate
SS	Source Seed
SSTD	Seed Science and Technology Division
STCL	Salt Trading Corporation Limited
VSP	Vegetable Seed Project
UPOV	International Union for the Protection of New Varieties of Plants
USAID	United States Agency for International Development
VDC	Village Development Committee
VDD	Vegetable Development Directorate
WTO	World Trade Organization

Executive Summary

Improved crop varieties and quality seeds are the most viable ways of improving agricultural production and food security in a sustainable manner. Realizing the importance of seed system in increasing crop productivity, raising income and generating employment opportunities, the Government of Nepal, NGOs, CBOs, private sectors, donors and research institutions are keen to work in synergy to implement an efficient seed system that ensures the access of quality seed to farmers. A long term vision based on a pragmatic, holistic and proven method was a pressing need for the development of Nepal's seed sector. Seed Sector Development Strategy (Seed Vision 2013 - 2025) is prepared to address the longstanding need in Nepal's seed sector at the request of National Seed Board, Ministry of Agricultural Development (MoAD), with financial assistance from Swiss Agency for Development and Cooperation (SDC). Information was culled from multiple sources (literature review, publications, observations, consultations/feedback and interviews) besides field visits while preparing the Seed Vision.

The seed vision aims at: increasing crop productivity, raising income and generating employment through self sufficiency, import substitution and export promotion of quality seeds. The conceptual framework of the seed vision is based on seed value chain including inputs and outputs of the seed chain components: variety development and maintenance, seed multiplication, seed processing and conditioning, seed marketing and seed use. The seed vision provides strategic orientation and milestone besides a clear vision for a specific output and impacts over a specified period of time. The vision presents key strategies, process and inputs required to meet desired output towards the development of sustainable seed system in Nepal.

Seed vision envisages doubling the number of location specific high yielding competitive varieties to be released by 2025. Improved seed production will be increased threefold through formal system. Strengthened public and private seed laboratories will have a capacity to test and analyse over 40,000 seed samples per annum. Seed production and marketing will be organized through structured and efficient system. Seed replacement rate will be increased at least up to 25 percent for cereal crops and over 90 percent for vegetables. Yield of rice and vegetables will reach 3.8 mt and 19 mt per hectare respectively. Nepal produced high quality seeds amounting to over 750 mt will have an easy access to export market annually. The Seed Vision will contribute significantly in ensuring food security to poor, women and disadvantaged groups. Edible food availability will reach 8 million mt by 2025 equivalent to 200 billion rupees at current price.

In order to achieve stipulated targets, the Seed Vision proposes four strategic and one overarching direction: i) strengthen varietal development, release and maintenance breeding using diverse gene-pool both from local and exotic sources, ii) support public, community and private enterprises in seed multiplication, processing and conditioning through efficient seed quality services iii) enhance marketing skills of seed entrepreneurs and invest in seed related infrastructure iv) promote the use of quality seeds by diversifying farmers' choice including use of local genetic resources and v) create an enabling environment by developing efficient and effective public, community and private seed related organizations with a healthy business culture.

Implementation of the Seed Vision will have a significant impact in ensuring seed security, increasing productivity and raising income through seed self sufficiency, import substitution and export promotion. This will lead to food security, employment generation, biodiversity conservation, climate change adaptation, and gender equity as well as social inclusion.

1. INTRODUCTION

1.1 Background

Globally, over a billion people still continue to live in absolute poverty below one U.S. dollar a day. Twice that number survives on less than two dollars a day. In Nepal, based on international poverty line (purchasing power parity), the percentage of population earning U.S. dollar 1.25/day is 55.1 while the percentage of people making below two dollars a day is 77.6¹. This calls for concerted efforts from all stakeholders to address the poverty issues by providing opportunities to fight hunger, desperation and uncertainty. In order to tackle poverty and food security issues, a long term sustainable economic growth is desired. Its growing recognition and empirical evidences point to the fact that agriculture has a major role to play for a sustainable economic growth. Agriculture is still the largest economic sector in Nepal which contributes 35 percent to the GDP employing two-third of the total population. Increased productivity is the key to agricultural growth and ultimately the food security.

The pressing need of increasing world food production can only be met through proper management and use of high quality seeds including other plant genetic resources (PGRs) required for the development of better-adapted and higher-yielding cultivars. Seed is the most important determinant of agricultural production potential, on which the efficacy of other agriculture inputs is dependent. Seeds of appropriate characters are required to meet the demand of diverse agro-climatic conditions and intensive cropping systems. Empirical evidences show that the use of improved better quality seeds increases crop yield by 20-30 percent². Multiplication of plants by seed and technological use of seed and seed products are among the most important activities of modern society. A majority of human calories come from seeds, especially from cereals, legumes and nuts. Moreover, seeds also provide most cooking oils, many beverages and spices, and some important food additives.

Considering the importance of seeds for agricultural growth and in raising the living standard of Nepalese farm families, the development and transfer of new technologies will be effective only when farmers have access to quality seeds produced and channelled through an efficient seed system. Constant increase in agricultural production and productivity is largely dependent on the development of new and improved varieties of crops supported by an efficient system for timely supply of quality seeds to farmers.

1.2 Mission

Convinced of the fact that seed sector is one of the best options to improve agricultural production and food security in a sustainable way, the Government of Nepal (GoN), Non-governmental organizations (NGOs), community based organizations (CBOs), private sector, donors, and research institutions are keen to work in synergy to develop a seed system that guarantees the access of good quality seed to farmers. For this, a pragmatic, holistic, and evidence based long term vision was felt necessary and urgent for seed sector development in Nepal. Responding to the long yearned need, Seed Sector Development Strategy (Seed Vision)

¹ World Bank (2011). Selected Indicators. World Development Report, 2011. Washington DC.

² Thomson J.R (1979). An Introduction to Seed Technology, London.

is prepared at the request of National Seed Board, Ministry of Agricultural Development (MoAD) and Swiss Agency for Development and Cooperation (SDC).

The Seed Vision aims to increase crop productivity, raise income and generate employment opportunities through self sufficiency, import substitution and export promotion of quality seeds. Seed visioning assignment was implemented for the following reasons: 1) Inadequate location specific varietal choices and limited number of crop varieties as an output of the varietal development and maintenance breeding component 2) Excessive flow of exotic seeds especially the hybrids in vegetables, maize and paddy due to open border and weak regulatory measures 3) Inadequate availability and access to high quality source seeds 3) Low capacity of seed processing and storage 4) Lack of proactive marketing mechanism 5) Low seed replacement rate, and 6) Questionable seed quality. The main purpose of the assignment was: to prepare a workable document on long term vision for seed sector development in Nepal (Seed Vision 2013 - 2025) by reviewing the seed related policies, programmes, and other documents, and by collecting field data. The Terms of Reference provided to prepare this vision is presented in Annex 1.1. The content of the seed sector development strategy was discussed and agreed with National Seed Board Secretariat.

The consultants' team undertook field visits, which encompassed: Rice, Maize, Wheat, Pulse, commodity research programmes, the processing plant and regional laboratory at Hetauda, Institute of Agriculture and Animal Science (IAAS), Forum for Rural Welfare and Agricultural Reform for Development (FORWARD), various private seed companies, seed producer groups (Patihani, Parbatipur and Gitanagar) and cooperatives in Chitwan, Dhanusha and Kavrepalanchowk districts. The consultants discussed thoroughly on seed issues with members of Chitwan Chambers of Commerce and Industry. At the central level, the team had extensive discussions with seed scientists in Seed Science and Technology Division (SSTD), Agriculture Botany Division (ABD), Agronomy Division, Gene Bank, Horticulture Research Division, Seed Entrepreneurs' Association of Nepal (SEAN), Agro Enterprise Center (AEC), Centre for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED), Hill Maize Research Project (HMRP) and National Seed Company Limited (NSCL). The team also met with concerned officials from MoAD and Department of Agriculture (DoA) besides various projects having seed related components. The consultants' team wishes to express its sincere appreciation for the cooperation it received from all concerned authorities and organizations. A list of some of the authorities and experts consulted is given in Annex 1. 2.

The Seed Vision 2013 - 2025 is based on information from various sources such as literature review, publications, observations, consultations, field visits, and interviews with the value chain actors and responsible person of agencies providing support services for seed value chain development. The information collected was analyzed and synthesized in key tables, figures and contents. Finding of the study was shared with stakeholders for conformation, and worthy suggestions received from groups or individuals of both public and private sectors were incorporated. Incompleteness and inconsistency of available information constrained an in-depth analysis of the value chain. Time series available data on key enabling factors for seed sector development were used for projection estimates of major food crops and vegetables. The draft version was reviewed by 17 expert panels from government and private institutions and was further revised based on their comments and suggestions. Seed Vision 2013 - 2025 was

presented and discussed at a national seminar organized by Seed Quality Control Centre (SQCC)/National Seed Board (NSB), CEAPRED, SEAN and HMRP on March 18, 2012. The seminar brought together over 100 participants representing government, IAAS, farmers' organizations, seed companies, agro-vets, International/Non Governmental Organizations (I/NGO)s, donor communities, senior retired experts and policy makers, agriculture related sister organizations of major political parties, and media persons. Recommendations of different thematic groups (policy and law, seed production and marketing, biodiversity and farmers rights; and hybrid and biotechnology) were incorporated in this document as feasible.

The final document prepared by including the recommendations of this National Seminar was submitted to NSB Secretariat. A summary of the main document was prepared in English first and Nepali later to get the final approval of the Government of Nepal. The NSB endorsed these documents and submitted to the MoAD for final approval. The ministry circulated summary documents in Nepali and English to the National Planning Commission (NPC), Ministry of Finance (MoF), Ministry of Commerce and Supplies (MoCS), Ministry of Environment, Science and Technology (MoEST), Ministry of Industry (MoI), Ministry of Land Reform and Management (MoLRM), Ministry of Federal Affairs and Local Development (MoFALD), Ministry of Forest and Soil Conservation (MoFSC), National Seed Company Limited (NSCL), and Nepal Agricultural Research Council for their comments and suggestions. The valid comments and suggestions received from these organizations are incorporated in the main and summary documents. Since the preparation of Seed Vision 2013 - 2025 is a concern of different organizations under the MoAD, relevant line ministries, donor agencies, I/NGOs, and private organizations, the progress made so far in preparing this vision and its main features were presented in the MoAD in 01 February 2013 in presence of the representatives from relevant organizations. The comments and suggestions received from the discussion organized after this presentation and from emails later are incorporated in the main and summary documents of this vision to give them their final shape.

The Seed Vision 2013 - 2025 comprises following chapters. Introduction (chapter 1) part of the report is followed by overview of Nepal's seed sector (chapter 2), seed value chain analysis (chapter 3), the seed vision, objectives and strategic directions (chapter 4), seed sector development strategy (chapter 5), impact (chapter 6) and monitoring (chapter 7). The strategic directions presented in this document are expected to give technical insights for seed sector development in Nepal for at least up to 2025.

1.3 Seed and its classes

Generally, the term seed is used in a broader sense as against its botanic connotation and thus creating confusions at times. As per the Seed Act (1988), seed is defined as "a matured ovule having embryonic plant, food substance and protective cover or seeds or germ which can be used in sowing or planting to produce crops by reproducing in a sexual or asexual mode" and crop refers to kinds such as, food crops, vegetables, cash/industrial crops, flowers and fruits, fodder and forage crops and trees. This report recognizes and is based on the preceding definition of seed.

Quality aspects of seeds are of paramount concern as seed is the vehicle of transferring new technologies and advancements of agricultural science. High quality factors of seed include

genetic purity, trueness to type with high degree of physical purity, uniformity, high germination potential, optimum moisture and vigour, freedom from diseases and pests and noxious weeds. Other factors determining quality of a seed could be seed treatment, storage and packaging. High quality factors apply to a true seed and they may also with little modifications apply as well to other planting materials.

Seed classes officially recognized by the National Seed Board and the designated institutions for the multiplication of major food and vegetable crops are as follows:

Nucleus seed: It is produced by the breeder as a genetically pure parent material.

Breeder seed: It provides the sources for the initial and recurring production of foundation seed and is directly controlled by the originating or sponsoring plant breeder or the research institute/organization. Its production is supervised by a qualified breeder to maintain high genetic purity.

Foundation seed: It is produced from the breeder seed and conforms to the prescribed seed certification standards with white colour tags.

Certified seed: It is produced from the foundation seed and is determined by the seed certification agency. Certified seed II may be the progeny of certified seed I provided this reproduction does not exceed three generation beyond foundation seed stage. Certification tag shall be of blue colour for certified I and green colour for certified II seed class.

Improved seed: It is produced from certified seeds either from CI or CII depending upon seed availability. Basically CII generation is followed in case of wheat seed. Truthful label tags shall be of yellowish colour for improved seed class and producers themselves are responsible for the seed quality. This seed is not certified by the authorised agency.

In case of potato, the seed classes are: breeder (pre-basic), foundation (basic), certified (basic 1 and basic 2) and improved.

Source seed: It is the seed used to produce seeds of the same variety.

1.4 Types of seeds

Food crops seeds: Major food crops whose seeds are multiplied commercially are: Rice, maize, wheat, finger millet, barley, buckwheat, pulses and oil seeds.

Seeds of these food crops are almost similar to the grains at harvest. Therefore, many crop growers are also potential seed producers. This implies that a farmer does not buy food grain seeds but buys a better seed of a variety. Another notable aspect of such crops is that farmers may buy a small quantity of a new variety seed in order to further multiply it over several generations. Both these aspects affect the volume of sales and actual seed replacement rates (SRR). Use of hybrid seeds especially maize and rice is on the rise in Nepal.

Vegetable seeds: Unlike food grains, vegetables are grown for specific consumption purposes such as leaf, flower, pod and root that determine the popularity of a particular crop. Many locally popular vegetables are cross pollinated and recommended isolation distance maybe more than one kilometre. Another important characteristic is that their seed rate is low (except for peas and beans). Most of the vegetable seeds are regarded as high value low volume commodity with specific production requirement. In Nepal, seed replacement rate for vegetable crops was as high as 66 percent in 2009 and hybrid seed use is increasing.

Forage and pasture seeds: Demand for forage seeds has increased recently in order to provide for an increasing need of animal feeds due to growth of dairy and commercial livestock production. The extent of animal feed deficit is estimated to be about 36-40 percent³ in Nepal, and is expected to be fulfilled through increased forage production. Sufficient production of forage and pasture seeds is crucial to increase forage and pasture production, fulfil nutritional requirement of livestock population, and reduce the animal feed consumption. The reducing use of animal feed helps to lower the cost of meat and dairy products as the cost of production of these products is low when livestock production is based on forage and pasture crops.

Cultural crops seeds: Seeds of certain crops or varieties are important from cultural aspects, such as barley, sesame, and anadi rice. Seed multiplication of these crops or varieties is necessary to maintain religious or cultural values.

Other crops seeds: Other important crops are jute, sesame, niger, cotton, tea and coffee, flower, spices and trees seeds.

Other planting materials: Specific parts of potatoes (tubers), ginger (rhizomes), sugarcane (stems) and fruit and forest trees (saplings, cuttings, suckers, grafting) are used as planting materials.

1.5 Seed system in Nepal

Broadly, two types of seed system are recognized in Nepal: informal and formal seed system.

The informal seed system is characterized by farmers producing and preserving their own seeds for subsequent planting. Often, they exchange this small amount of seeds with other farmers as gift, and for both monetary and non monetary value. Most traditional and local land races are product of such selection and maintenance process. In addition, these land races are important genetic resources for modern plant breeding.

The formal seed systems are characterized by a vertically organized production and distribution of tested and released/registered varieties by public and private organizations using agreed quality control mechanism. It comprises different phases of seed cycle: Breeder, Foundation, Certified and Improved seeds. In Nepal, formal seed system comprises seed production by farms and stations of Nepal Agricultural Research Council (NARC) and DoA, contract seed production by National Seed Company Limited(NSCL), Salt Trading Corporation Limited (STCL), Non Governmental Organizations (NGOs) like CEAPRED, LIBIRD Local Initiatives for Biodiversity, Research and Development (LIBIRD), FORWARD, and other seed companies, Community Based Seed Production (CBSP), District Level Seed Self Sufficiency Programme (DISSPRO), and seed imports. Both formal and informal seed systems are not exclusive but are interlinked and can complement each other for continued selection and maintenance of preferred varieties. Although, currently the formal sector accounts for less than 10 percent of seed transaction in Nepal, it plays an important role in deploying new varieties, enforcing seed quality control and regulating marketing mechanisms for both formal and informal seed supply systems. Furthermore, commercialization and involvement of migrant youth in agriculture will

³ MOAC (2001). Proceedings of the Third National Seed Seminar, August 13-14, 2001, page 48, Kathmandu, Nepal

increase the demand of quality seeds resulting in increased share of formal sector in seed supply.

There are some cases where seeds are produced and or marketed outside the formal system of seed cycle and quality assurance mechanism.

2. OVERVIEW OF SEED SECTOR

2.1 Seed sector history

Formal seed production and distribution in Nepal began in late fifties and sixties with the introduction of new varieties of rice like Taichung Native 1, CH 45 and IR 8, wheat Lerma 52 and Lerma Rojo 64⁴, and maize Amarilo de Blanco. Seed production in those days was target oriented and was mainly produced in government farms and stations and seeds were distributed through extension services. With the establishment of Agriculture Inputs Corporation (AIC) in 1974, it started to procure and market limited quantity of seeds to farmers. Organized seed production and distribution started in early seventies when Food and Agriculture Organization of the United Nations (FAO) established a high capacity seed drying, processing and bagging plant at Hetauda for the AIC. During eighties, FAO, German Technical Cooperation (GTZ) and United States Agency for International Development (USAID) further helped to establish seed processing and storage facilities at five AIC regional centres in Terai and 20 mini seed houses in the mid hills⁵. Until 1990, public sector continued to play a key role in production and supply of agricultural seeds in Nepal. A time line on seed sector development in Nepal is presented in Table 2.1.

Table 2.1: Time line of seed sector development in Nepal

Year	Formal seed sector key events
1960	High yielding variety of wheat Lerma 52 released
1962	Establishment of seed testing laboratory under Agronomy Division, Khumaltar
1964	Designated membership of Central Seed Laboratory with International Seed Testing Association (ISTA)
1966	Seed testing laboratory moved to Agriculture Botany Division to work closely with breeders as the division deals with the major crop commodity units identified
1966	Rice variety CH-45 released
1974	Agriculture Input Corporation (AIC) established under Corporation Act 1965
1975	Contract vegetable seed production at farmers' level
1977	Contract cereal seed production at farmers' level
1980	Seed Production and Input Storage Project (SPISP) funded by USAID
1981	Vegetable Seed Production Project (FAO) financed by the government of Switzerland
1982	Seed Technology and Improvement Programme (STIP) initiated
1983	First National Seed Seminar conducted
1984	Central Seed Science and Technology Division established
1985	Import of hybrid seed in vegetables and maize started by private sector
1988	Seed Act enacted
1990	Second Seed Seminar organized
1991	Establishment of Seed Entrepreneurs' Association of Nepal (SEAN)
1993	Koshi Hills Seed and Vegetable Project (KOSEVEG), funded DFID
1997	Seed regulations enacted
1998	Seed Sector Support Project (SSSP) funded by DFID
1999	National Seed Policy approved
2000	Establishment of SEAN Seed Service Centre Limited (SSSC)
2001	Third seed seminar organized

⁴ MOAC (2008). Proceeding of the Fourth Seed Seminar, 19-20 June 2008, Lalitpur, Nepal

⁵ Husain Imtizaj (1990). Review of Nepal's Seed Sector. FAO/DANIDA Regional Trust Fund Project.

2001	Seed Quality Control Centre established
2002	National Seed Company Limited established
2004	Vegetable seed Project initiated with SDC funding
2008	Fourth seed seminar organized. First amendment of Seed Act, 1988
2010	Seed Science & Technology Division revived as central disciplinary division of seed in NARC
2011	Accreditation of CSTL by International Seed Testing Association (ISTA)
2013	Promulgation of Seed Regulation - 2013

Source: Compiled from different sources

Unavailability of adequate good quality seeds at the right time and place stands as the main constraint in improving the economic status of Nepalese farmers. Unfortunately, the barrier persists despite seed development initiatives of the past 50 years. Nepalese agriculture is yet to witness modernization and competitiveness in terms of achieving national goal of food and nutritional security⁶.

2.2 Participants in seed sector development

2.2.1 Government agencies

Government agencies are responsible for a wide range of activities of an effective seed sector. Besides their key role in planning and policy making, the government agencies undertake research, varietal development and maintenance breeding, multiplication, quality control, marketing, seed use and extension for all breeder seeds and most foundation seeds. Table 2.2 briefly summarizes roles of important government agencies related to seed sector development in Nepal.

Table 2.2: Role of government agencies in Nepal's seed industry

Sn	Government agencies	Roles
A	Central Level Agencies (CLA)	
1	Ministry of Agricultural Development (MoAD)	Policy and planning, resource allocation for seed sector, human resource development. Creating enabling environment for public and private sector participation in seed industry. Supporting institutionalization of National Federation of Seed Cooperatives. Providing supports for capacity building of seed cooperatives, etc.
2	National Seed Board (NSB)	National seed programme planning and coordination, policy formulation and support, preparation of balance sheet based on national seed demand and supply. Guide, coordinate and provide leadership to all seed related programmes. Ensuring the supply of source seeds (breeder and foundation seeds) to all seed growers. Release and register new varieties and denotify obsolete varieties. Support seed related agencies in developing needed infrastructure and human resources. Monitoring and regulation of Genetically Modified Organism/ Living Modified Organism (GMO/LMO). Formulating policies for protecting breeders' rights (incentives to breeders). Regular monitoring of impact of seed related regulations and timely amendment. Supporting buffer stock creation and management. Harmonization of seed related policies, regulations, and procedures among SAARC countries.

⁶ Three Year Plan (2011-2013) and Nepal Agriculture and Food Security - Country Investment Plan, 2010

		Regulation of import and export policies, etc.
3	Nepal Agricultural Research Council (NARC)	Strengthening of varietal development and maintenance breeding as per the national requirement. Identification of location specific crops/ varieties based on comparative advantages. Partnership in seed research ⁷ with private sector. Developing inbred lines and supplying to seed companies and NGOs for seed multiplication of national hybrids. Production of breeder and foundation seeds. Research on hybrid seed production technology. Collection, characterization and utilization of indigenous cultivars in crop breeding. Strengthening and operating gene bank effectively. Research and field testing of GMO/LMO. Application of modern techniques including bio-technology in crop breeding.
4	Seed Quality Control Centre (SQCC)	Implementation of seed policies, acts and regulations, acting as NSB secretariat, and providing seed quality control services. Laboratory accreditation with ISTA, APSA, and UPOV. GMO testing, certification and varietal registration. Support to private sector to follow seed quality and internal quality assurance system. Varietal identification (DUS) and conservation including DNA printing. Human resource development, SPS harmonization, coordination with national plant quarantine and quality control services for seed imports and exports. Monitoring the activities of organizations working in the seed sector to ensure the supply of quality seeds in the market.
5	Department of Agriculture and its directorates/ programmes (CDD, VDD, FDD, ABPMDD, PHMD, PPP, AED, etc)	Planning and implementation of seed programmes for self sufficiency import substitution and export promotion. Providing technical support, monitoring district level CBSP and DISSPRO programmes, and supporting seed production and marketing. Support private sector and NGOs in seed production based on internal and export demand. Identify seed zones and pocket areas, and develop appropriate seed production norms for different production zones. Support seed growers to make them competitive. Develop human resources in public and private sectors. Market infrastructure development for seed crops. Support seed growers, especially of remote areas to develop entrepreneurship among them. Seed price collection and dissemination. Conduct seed marketing surveys, seed competitiveness studies and reviews. Provide post harvest support to seed growers with technologies in coordination with NSB. Dissemination of storage and processing technologies, and management of post-harvest pests and diseases. Support seed extension activities through minikits, demonstrations and PVS. Provide support to construct seed storage and processing infrastructure.
6	Department of Livestock Services and its directorates	Identification and zoning of forage seed production pockets. Providing support for source seed production. Preparation of norms and guidelines for forage seed production. Human resource development. Monitoring district level seed production programmes. Facilitating the implementation of seed regulation for forage seed production, marketing and quality control.
7	National Seed Company Limited	Production of foundation and improved seeds. Seed multiplication, procurement, processing, storage and distribution through its dealer networks. Distribute seeds to remote and rural areas where private sector is absent in seed business. Provision of seed storage facilities for buffer stock maintenance at different ecological regions.
8	Trade and Export	Facilitate value chain actors in exporting seed as provisioned in export policy.

⁷ Private sector includes individuals and organizations outside the government such as seed entrepreneurs, seed companies, agrovets, I/NGOs, CBOs and cooperatives, etc

	Promotion Centre (TEPC)	Provide seed trade information to concerned stakeholders.
9	Institute of Agriculture and Animal science (IAAS) and other academic institutions	Develop required human resources in seed related disciplines. Conduct seed research and produce source seeds. Develop course curricula and Learning materials on seed. Conduct trainings and extension programmes. Undertake farm testing of location specific crops/varieties based on comparative advantage. Popularize and promote crops and varieties.
B Regional Level Agencies (RLA)		
1	Regional Agriculture and Livestock Directorates	Identification of seed pockets and zoning. Monitoring seed supply situation in the region. Preparation of regional seed balance sheet based on demand and supply, and in coordination with input dealers, farmers' groups, government agencies, and other private agencies. Facilitating the implementation of seed regulation in the region.
2	Regional Seed Testing Laboratories,	Seed testing and field inspection of seed crops. Monitoring quality of seeds produced in different farms and stations. Quality checks of seeds sold in market by the private sector. Testing reference seed samples, and inspection of seed stores. Provide trainings on seed production and quality control services and help in developing seed resource centres in the regions. Tagging and certification of source seeds.
3	Regional Soil and Plant Protection Laboratories	Testing soils of seed production pockets and providing recommendations. Preparing soil fertility maps. Promote the use of green manure, compost and bio-fertilizers. Surveillance of pests and diseases in identified pockets. Field inspection of seed crops and conduct innovative approaches for pests and disease control at the farmers' levels.
4	Regional Agriculture and Livestock Research Stations	Varietal development and maintenance. Source seed production, multi location varietal trials for farm adaptive research and popularization of new varieties (FAT, PVS, FFT).
C District Level		
1	Agriculture, Livestock development offices and service centres	Analyze seed demand and supply situation and prepare balance sheet for the concerned district. Coordination of seed production and distribution system through District Agriculture Coordination Committee (DACC). Provide technical support for seed production. Update information of seed growers, agro-vets, seed production groups, cooperatives and other seed related agencies. Seed zoning and mapping. Support seed growers to get their seed crops inspected by the technicians of regional seed testing laboratories. Collecting seed samples from stores and from the marketing chain for testing and analysis. Provide technical assistance to seed growers to label their seed accurately. Implement seed regulation and monitor the quality as well as seed supply situation.
2	District and Village Development Committees	Coordinate to balance the demand and supply situation. Help in planning, monitoring, and mobilizing resources for seed production and marketing. Support VDC and ward level resource centres and seed production at local levels to maintain seed quality and conserve biodiversity. Promote VDC level seed bank.

Source: Compiled from different sources

2.2.2 Non-government agencies

Non government agencies including NGOs, seed companies, cooperatives and seed retailers are playing crucial roles in ushering the Nepalese seed industry towards prosperity. Private sector has been the engine of seed industry in Nepal. Private sector now handles more than 90 percent of the formal vegetable seed trade and supplies significant amount of hybrid seeds of maize, rice, vegetables and other crops. Brief roles of important non-government agencies related to seed sector development in Nepal are summarized in Table 2.3.

Table 2.3: Role of private and non government agencies in Nepal's seed industry

Sn	Non-government agencies	Roles
1	Seed Entrepreneurs Association of Nepal (SEAN); Federation of Nepalese Chambers of Commerce and Industry (FNCCI); Agro Enterprise Center (AEC)	Contracting seed production and internal quality control. Educating and building capacity of their members in following quality control measures and seed regulation. Providing feedback to government on existing laws, regulations and procedures. Organizing traders for the supply of quality seed in the market. Representing private seed sector in different committees and task groups. Representing seed entrepreneurs in different national and international forums. Coordinating and lobbying to create enabling environment for seed sector development. Strengthening quality assurance system. Conducting sensitization programmes for seed law enforcement. Involvement in seed business, including seed production of new varieties (research and development): open pollinated as well as hybrids. Organising seed related events like seminars, workshops, meetings at the national and regional level.
2	Seed companies	Seed production, processing, conditioning and marketing including research and development. Contract seed growers for demand based seed production. Follow up the contract with farmers. Participate in seed production and create distribution network for seed supply. Provide or coordinate to provide technical assistance to seed growers for quality seed production.
3	Seed retailers (Agro-vets)	Develop seed procurement plan as per the market demand in the areas of operation. Sell good quality seeds as prescribed by the acts and regulations. Store and maintain quality standard as suggested by law enforcing agencies and promote seed sales.
4	Seed growers (seed producers' groups, cooperatives, and Individual entrepreneurs)	Get registered in DADOs for seed production purpose. Plan in advance and request concerned farm, station or DADO for foundation seed. Signing contracts with seed buyers. Follow appropriate techniques of seed production cleaning and storage to maintain the standard of good quality seeds. Supply seeds to contracted companies and distributors.
5	Non-governmental organizations (NGO), community based organizations (CBO) and civil society organizations (CSO)	Implement programmes to support seed growers for quality seed production, processing and marketing. Social mobilization for promoting the use of quality seeds. Assist communities and government agencies to create favourable environment for quality seed production and use. Support research programmes for variety development and seed production in partnership with Government of Nepal.
6	Financial Institutions (Banks, cooperatives)	Provide short and long term credit to entrepreneurs for the development of seed industry. Provide insurance services for seed production and

	and insurance companies)	marketing.
7	Private academic institutions, universities and seed laboratories	Develop human resources in seed related disciplines and conduct trainings on seed science and technology. Provide seed testing services to seed growers and seed traders.
8	Consulting firms and academic research institutions	Conduct research on seed production, processing and marketing issues and provide suggestions to the government, seed producers, and seed traders for speedy growth of seed industry in Nepal.
9	Seed Users, households	Use good quality seeds. Promote the use of good quality seeds in the area. Check packed date, validity period, germination percentage and other information while buying seeds from the market.

Source: Compiled from different sources

Government and non-government agencies, currently involved and those with high prospects to be involved in implementing seed vision are mentioned in Tables 2.2 and 2.3. These agencies' roles, which are currently in practice and indicative for future, are described in these tables .

2.3 Policy environment

Seed Act, 1988 and its first amendment, 2008: The parliament passed a seed act in 1988 to regulate quality seed production. Preamble of the act clearly mentions that the act is promulgated to maintain the convenience and economic interest of the general public by providing the seeds of quality standards in a well planned system of production, processing and testing of high quality standards in order to increase production of different crops. As per the act, National Seed Board advises the GoN on formulation and execution of national policies on seed to ensure availability of quality seeds through regular production, processing and marketing system. There are some limitations in this act, such as, it has been enforced only in 33 districts, is unable to provide mechanism to fulfil the rising demand of quality seeds including hybrids, and is also unable to address the rights of farmers and plant breeder. First amendment of the Seed Act in 2008 provisioned for licensing of private seed laboratory, authorizing private sector to be involved in quality assurance system and issuance of permission from NSB for seed business. The provisions included in the first amendment of the Seed Act, 1988 will enable concerned agencies and seed suppliers to facilitate farmers in increasing seed replacement rate (SRR). It also established a fee structure and service charges of seed testing and certification.

The Agriculture Perspective Plan: Agricultural policies in Nepal have been shaped by the Agriculture Perspective Plan (APP) since 1995. A growth strategy, APP upholds that acceleration of agricultural growth is the main pillar of growth and poverty reduction in Nepal. The Government approved the APP in 1995 and has been incorporating it in all strategies and planning till now. The APP aims at increasing the agricultural growth from 2.5 per cent to 5 per cent and reducing poverty from 49 percent to 14 per cent over the 20-year plan period. Though the use of quality seeds of improved varieties is widely recognized as fundamental towards ensuring increased crop production and productivity, APP does not address this fact.

Seed Production Guidelines, 1998: Seed production guidelines were developed in 1998 to start commercial seed production programmes in potential districts. District level Seed Self

Sufficiency Programme (DISSPRO) was implemented as per the guidelines in December 1998. DISSPRO is a major contributor of formal seeds supply under the DoA. It is currently implemented in more than 63 districts and is supported by District Agriculture Development Offices. This programme coordinates and provides necessary technical support in producing, processing, storing and distribution of seed. Farmers participating in this programme are given source seeds at 25 percent subsidy besides 100 percent transport subsidy up to their respective service centre and other subsidies like 25 percent on sprayers and metal bins and small grant support for construction of storage structure, threshing floor, and other equipments.

National Seed Policy (NSP) 1999: Government formulated National Seed Policy in 1999 considering seven aspects for the growth of seed industry: 1) Variety development and maintenance 2) Seed multiplication 3) Quality control 4) Increased involvement of private sector 5) Seed supply 6) Institutional strengthening and 7) Biotechnology.

The objectives of NSP are: (i) Availing quality seeds of various crops in required quantity (ii) Promoting export by producing quality seeds (iii) Making seed business effective in existing world trade (iv) Conserving indigenous genetic resources and coordinating with concerned organizations to ensure national rights of the resources. Many provisions in the NSP are progressive, but some require amendment in redefining the terms in line with international treaties, women and disadvantaged group's participation in decision making, and in licensing the private seed laboratories. National Agriculture Policy 2004 has identified the need to amend NSP in order to achieve the food production targets.

National Agriculture Policy (NAP) 2004: The MoAD has adopted the National Agriculture Policy 2004 with the primary goal of improving the livelihoods of people by transforming subsistence agriculture to a commercialized and competitive system. Its objectives are:

- to increase agricultural production and productivity,
- to make Nepal's agriculture competitive in the regional and the global markets, through commercialization and competitiveness; and
- to protect, promote and properly utilize the natural and environmental resources, and biological diversity.

In order to increase production and productivity, the NAP ensures the supply of main production inputs (seeds, fertilizers, and breeds) based on market demand. The policy promotes the use of hybrid seeds and regular monitoring of genetically modified organisms. It talks about the supply of quality inputs. It has provision for accrediting private laboratories. The policy commits to provide special incentives to dalits, oppressed and marginalized farmers and agricultural labourers who own less than a hectare of land with inadequate irrigation facility.

The NAP proposes to establish and strengthen Agriculture Resource Centres (ARC) on the basis of development regions and geographical sub-regions as special technology service centres for: (a) collection, processing, storage and transportation of agricultural produces and (b) production of quality seeds, seedlings, plants and breeds of animals and plants. This policy mentions that these resource centres will be gradually strengthened and transformed into an integrated centre capable of providing services related to soil analysis, seed certification, crop protection and diagnosis of livestock diseases besides training entrepreneurs, businessmen,

cooperative workers and agricultural workers. The ARC has not been established so far. If established at the VDC level, it will provide impetus to seed production at the local level.

Community Seed Bank Guidelines, 2009: The guidelines provide establishment and management of community seed banks where seeds produced in the community are processed, stored and sold locally under the leadership of the concerned community. Surplus seeds are sold outside the community.

Three Year Interim Plan (2010/11-2012/13): The Three Year Interim Plan (TYIP) gives priority to produce good quality seeds by strengthening government-owned and private farms, which produce certified seed and improved breeds of livestock. The plan entails certifying seed and livestock production besides food commodities as per the international standard for export purpose by obtaining accreditation from international seed certification organizations⁸.

National Agro Biodiversity Policy, 2006: National Agro Biodiversity Policy provides overall policy framework for agricultural biodiversity conservation in Nepal. This policy has the provision of acquiring permission from authorized agencies to conduct research on GMOs. The government can also ban imports or conduct research on any GMO with potential risk of altering biodiversity and rendering negative impacts to the environment.

Local Self-Governance Act (LSGA) 1998: The Local Self-Governance Act 1998 authorises the local bodies such as Village Development Committees (VDC), District Development Committees (DDC) and municipalities to formulate and implement policies, programmes and activities related, among others to agriculture and rural development. The implementation of LSGA has hindered the seed business due to the imposition of unnecessary local taxes on seed movements across districts.

Review of past policies indicates that seed was not explicitly prioritised as a key input and carrier of new technology in agriculture. For instance, the APP, the leading policy document, did not include seed as one of the priority inputs. Similarly, the NAP and the current interim plan did not adequately emphasize the importance of seeds. Seed related policies aforementioned also have had implementation problems and lack the components on decentralization of seed research, source seed production and functional partnership for joint venture.

Considering the weaknesses of the past, a close coordination was developed between the team involved in preparing Agricultural Development Strategy (ADS), which would be the main policy document of agricultural development in Nepal after its preparation, and officials of the SQCC. Suggestions given by the team of ADS was given due consideration from the beginning to the end during the preparation of Seed Vision 2013 - 2025. Suggestions were also provided to the team to consider this vision while preparing the Agricultural Development Strategy of Nepal.

2.4 Seed development projects

Seed Production and Inputs Storage Project (SPISP-1980): The project focused on the production and improvement of cereal seeds in the hills and it was implemented by the AIC with the financial assistance from USAID. The project supported the development of a self propelled seed supply system in the hills, where minimum infrastructure like seed cleaning and storage

⁸ GoN (2010). Three Year Interim Plan (TYIP), National Planning Commission, Nepal

facilities were developed. This project provided high amount of subsidy for infrastructure development and their operation throughout the project duration and when the project was terminated farmers could not even manage operational expenses to run the programmes.

Koshi Hills Agriculture Project (Seed Component,1987-1992): The project aimed at developing cereal and vegetable seed production and supply system in Koshi hills and was implemented at the ASC level. The DADO and concerned line agencies in the districts were made responsible for project operation. However, the scheme did not succeed because of the poor financial and technical management of the district level development agencies.

Private Producer Seller Programme (ARPP-1986): This programme, supported by Agriculture Research and Production Project (ARPP), was started in 1985. It aimed at increasing access to quality seeds of new cereal varieties for farmers in the hilly region at affordable prices to achieve self sufficiency in foods by increasing the production of cereal grains. The project had little impact due to the lack of profitable market demand for quality seeds. Furthermore, the quality control mechanism for seeds intended to be followed in the programme was expensive⁹.

Hill Seed Programme (1983): This seed programme was supported by Seed Production and Marketing Project (SPMP) funded by GTZ in Salyan, Pyuthan and Rolpa of Rapti Zone and later in Arghakanchhi and Accham districts. It helped to develop a mechanism for production and marketing of improved cereal seeds locally. There was involvement of DADO, AIC, DoA seed division and GTZ development workers in this programme. The project became successful in introducing new varieties. However, due to heavy investment in operational and infrastructural costs through the project, it lost continuity upon withdrawal of the support from the project¹⁰.

Rural Development Projects (1988-1990): There were some rural development projects like Mechi Hills Programme and Dhading Development Projects, which included seed activities. These activities encouraged seed production of cereals and vegetable crops at the village level for income generation and increased the availability of improved seeds. These projects were successful in raising awareness among farmers for the use of good quality seed, but the activities were short-lived as the government lacked resources amidst other priorities.

AIC Seed Programme: Seed production and distribution in the hills was initiated by the AIC to reduce the pressure on subsidy in transporting seed from Terai to hills. This programme was implemented with the support from SPISP. Though farmers around mini seed houses got new varieties instantly, the programme was proved commercially unviable. Yet, the AIC continued contracting farmers in the Terai for producing seeds and supply them in the hills to fulfil the demand.

Fresh Vegetable and Vegetable Seed Production Project: The project was funded by the Swiss government through FAO as a Technical Cooperation Project from 1979 to 1994. Working with Vegetable Development Division under the DoA, this project introduced a systematic and integrated approach to vegetable seed production and marketing. It opened broad horizon for private sector to be involved in vegetable seed production and marketing. This project left commendable impact in Nepalese vegetable production and marketing.

⁹ MOA, NSB (1990). Proceedings of the Second National Seed Seminar, December 1990, Kathmandu, Nepal

¹⁰ MOA, NSB (2001). Proceedings of the Third National Seed Seminar, December 2001, Kathmandu, Nepal

Vegetable, Fruits and Cash Crops Development Project, (VFC/Rapti - 1984): In 1990s, the seed production and marketing programmes of VFC were successful to scale up the production of vegetable seeds by many folds in Rapti zone. However, due to the negligence in providing good quality foundation seeds and quality control services, Nepal lost radish seed market in Bangladesh. This project failed to collaborate with research and seed chain maintenance system.

Koshi Hills Seed and Vegetable Project (KOSEVEG,1992-1997): This project was designed to develop an effective, sustainable and market oriented seed and vegetable programme for increasing food production and household income. The social mobilization process of the project was notably a successful feature and the creation of local farmers' association was particularly important. The project linked seed growers with national and regional seed traders to give continuity to seed production even after the termination of the project.

Community Based Economic Development Project (CBED,1997-2002): The CBED, funded by the Canadian International Development Agency (CIDA), adopted the demand based vegetable seed production programme linking seed growers with seed traders through regional seed contracting workshops. It was successful to introduce seed production practices in some of the western hill districts of Nepal.

Market Access for Rural Development (MARD-1997-2002): The USAID funded MARD Project supported farmers' groups and cooperatives for vegetable seed production and marketing in Surkhet, Dailekh and Nuwakot districts. Due to poor linkage between government line agencies, the project impact could not last long.

Seed Sector Support Project (SSSP): The SSSP was a successor of the KOSEVEG project and adopted the same approach for seed production and marketing. The approach was based on contractual seed production agreed by seed producer groups and seed buyers during seed planning workshops. This model of seed production and marketing was later replicated in Dadeldhura and Achham districts. The SSSP contributed enhancing the Nepalese seed industry by encouraging private sector in the seed business. It supported in purchasing processing equipments and establishing laboratory for the SEAN Service Centre, Thankot.

Agro Enterprise Center (AEC): The AEC supported SEAN and other institutions in developing their capacities through studies, reviews and organizing different workshops and tours for linking producers with national and international seed companies. It is playing an important role in the collection and dissemination of market information related to seed demand, supply and prices. It also suggests the government on seed related policy issues.

Vegetable Seed Project (VSP): The VSP, funded by SDC and implemented by CEAPRED, was initiated in 2004 in order to benefit poor farmers in remote areas by diversifying their income opportunities through vegetable seed production and marketing. Through its first phase (2004-2006) and second phase (2007-2010), the project significantly contributed in improving food security situation through availing good quality seeds for vegetable production and marketing. The new phase (2011-2014) will address emerging issues in sustainable seed system and plans to contribute to the priorities set in the recent Three Year Plan (2010-2013)¹¹. The project

¹¹ CEAPRED (2010). Vegetable Seed Project Phase III, Project Document, Lalitpur, Nepal

expects building the capacity of groups and cooperatives and encouraging public private partnership among others.

Hill Maize Research Project (HMRP): The Hill Maize Research Project (HMRP) has been implemented by the International Maize and Wheat Improvement Center (CIMMYT) since 1999 with the financial support of SDC in partnership with the National Maize Research Programme (NMRP) of NARC and Crop Development Directorate (CDD) under the DOA. The project focuses on the development and dissemination of improved maize varieties and other technologies through Community Based Seed Production (CBSP) and Participatory Variety Selection (PVS) approaches. It also puts special emphasis on information dissemination to have a wider outreach and to promote the adoption of farmers' selected varieties and technologies to the benefit of women, poor and disadvantaged groups (DAGs) in the mid hills of Nepal.

Research Into Use Programme (RIU): The RIU is implemented under the leadership of FORAWRD, LIBIRD, CEAPRED and Support Foundation in partnership with DOA, NARC, SEAN and Centre for Advanced Research in Agricultural Development (CARIAD), UK in 50 CBSP groups of 20 Terai districts. Since 2001, RIU is supporting seed production of mainly cereals, pulses and oilseeds. The CBSP groups are supported to enhance their managerial and marketing skills as well¹².

Social Safety Nets Project – Additional Financing / Seed sub - component - 2 (SSNP-AF/SS-2, World Bank, 2010-2013): The World Bank has approved the Social Safety Nets Project (SSNP) to be implemented between May 2010 and September 2013 in Nepal. The second component of this project is seed component. The objective of the seed component is to increase the use of certified/improved seeds of cereals by involving concerned stakeholders in seed production and supply, and by creating awareness on the importance of producing and using improved seeds.

Other Projects: Apart from aforementioned projects, there were other programmes or parts of different projects or small initiatives working in different aspects of seeds. Some organizations are still continuing small support to these initiatives (e.g. NARDF, CADP, PACT, IWRMP, CMIASP, HIMALI, HVAP, RISMFP, JICA, etc).

Nepal has been experimental ground for several approaches and models in improving seed production and distribution system. Some of the features of the successful seed production programmes described above are: a) Integrated approach to seed production and marketing b) Private sector involvement in seed business c) Institutionalizing seed producers' groups and their associations d) Linking seed producers with seed traders through contract agreement e) Initiatives taken to increase the export market f) Community based seed production initiatives g) Developing quality assurance system and legal provisions. There were also pitfalls in the past efforts. Some pitfalls observed in the performance of the seed programmes are: a) Expensive operational cost b) Inadequate technical and managerial capacity to implement seed programmes at the district level c) Limited focus on quality and marketing aspects d) Inadequate focus on sustainable seed enterprise development e) Lack of clear seed sector development strategy.

¹² Witcombe J. R., K.P. Devkota and K.D. Joshi (2010). Linking Community - Based Seed Producers to Markets for Sustainable Seed Supply System. *Expl Agric.* Vol. 46 (4), pp. 425–437.

Lessons learned from successes and pitfalls provide guidelines to improve the current seed business. As we move along the path of progress, several opportunities will appear and these needs to be utilized for the benefits of wider farm families.

2.5 Strengths and opportunities

National Seed programme is in fact a package of activities with the common goal of assuring adequate availability of good quality seeds for farmers. Any weak link in the seed chain if allowed will nullify the effectiveness of the whole seed programme.

The major elements of the seed programme are: seed legislation, planning and monitoring, varietal development and maintenance, seed production and management, seed testing and field inspection, quality assurance, seed processing and storage, seed extension, seed marketing and distribution and farmers' rights protection. These elements are broadly grouped into 5 categories for analysis and understanding: Varietal development and maintenance breeding, seed multiplication, seed processing and conditioning, seed marketing, seed quality assurance and seed use. Legal and institutional arrangements, infrastructure, human resources and financial resources are also important.

Legal framework: With the promulgation of seed act, policy and regulations, the whole seed industry stands on solid foundation in Nepal. In compliance with the seed act, the NSB is authorized to advise government on formulation and execution of national policies concerning seeds to ensure the availability of good quality seeds through regular production, processing and marketing.

Institutional framework: Under the guidance and leadership of NSB, there are many institutions contributing to seed sector development both in government and private sectors. These institutions are providing technical and managerial support, which is vital for a scientific and efficient seed production and supply system in Nepal.

Infrastructure: Some physical facilities have been developed for the operation of a good seed system. There are 13 seed testing and analysis laboratories available in public and private sector. The NSCL has 6 seed processing plants and seed storage capacity of up to 8,700 mt including mini houses at 20 locations. Vegetable seed cleaning facilities are available at five locations with packaging facilities, including processing and storage facilities at Khumaltar. SEAN Service Centre has a processing plant in Thankot and two cooperatives in Chitwan district possess two processing plants. Currently, 16 registered seed companies have some physical seed processing facilities. In addition, several mini-processing plants have been established with other seed producing groups and cooperatives under DISSPRO and CBSP programmes.

Human resources: Nepal's seed sector has some qualified and trained human resources for various seed related activities in public and private sectors, but the number of these skilled people is insufficient. In the private sector, these people are employed in nearly 1500 registered seed entrepreneurs and 16 registered seed companies as of 2010.

Strengths of Nepal's seed sector based on SWOT analysis conducted by the seed vision team are presented in Table 2.4. The SWOT analysis reveals that the country has major elements of successful national seed programme. Detail results of SWOT analysis is presented in Annex 2.1.

Table 2.4: Strengths of Nepal's seed sector

Process	Structures	Delivery
Varietal development and maintenance breeding		
<ul style="list-style-type: none"> Well established procedure in key crops (rice, wheat and maize) research. Functional coordination with IARC (IRRI, CIMMYT, etc) for breeding lines Seed multiplication system is established with its components 	<ul style="list-style-type: none"> National commodity research programme for major food crops Research scientists available for major cereal crops. Establishment and operation of gene bank 	<ul style="list-style-type: none"> Fairly good number of varieties released in cereal crops Fairly good quantity of breeder seed available in major cereal crops
Seed multiplication		
<ul style="list-style-type: none"> Varied climatic conditions Established system for seed multiplication (BS-FS-CS-IS) Identified seed production pockets for major vegetables crops Devolved seed multiplication practices Awareness on quality source seed Seed production from contract farmers Preparation of balance sheet by NSB for BS and FS seed distribution 	<ul style="list-style-type: none"> Involvement of public (NSCL), private, NGO, cooperatives, community groups, and seed banks Seed infrastructure including laboratories available in public and private sector Fairly good number of trained seed growers 	<ul style="list-style-type: none"> Increasing trend of quality seed production Increased quality of seeds
Seed processing and conditioning		
<ul style="list-style-type: none"> Seed cleaning and packaging practiced Standard developed for genetic and physical quality Post harvest technologies for seed harvesting available Practice of labelling Initiated 	<ul style="list-style-type: none"> Some facilities available at key location with NSCL (Itahari, Hetauda, Bhairahawa, etc) Storage room operational at VDD Khumaltar Processing and storage facilities in NARC stations and private sectors (seed companies and cooperatives) 	<ul style="list-style-type: none"> Seed distributed in plastic packets (vegetable seeds) and jute bags (food grain seeds) Clean and conditioned seeds in formal sector
Seed marketing		
<ul style="list-style-type: none"> Marketing network of seed dealers (NSCL and private sectors) Umbrella organization of traders for seed marketing (SEAN) Pilot initiative for seed export Encouraging environment for private sector development 	<ul style="list-style-type: none"> Presence of NSB/SQCC for regulatory function Provision of seed inspectors, seed specialist and seed analysts District seed federations initiated in few districts Market infrastructure support from donors and public sector for seed industry 	<ul style="list-style-type: none"> Increased quality seed supplied by private sector
Seed use		
<ul style="list-style-type: none"> Moderate level of awareness on quality seed Seed traders preferring seeds of locally adapted varieties Seed traders contract seed growers for quality seeds 	<ul style="list-style-type: none"> Provision of regulation on consumers' rights protection. Registration of import and export of seeds with NSB and Plant Quarantine Programme. 	<ul style="list-style-type: none"> Practice of delivery in good packages Increasing use of good quality seeds

Several approaches and models practiced in the past have prepared a solid foundation for further seed sector development in the country. Private seed entrepreneurs are also well groomed to accelerate the seed industry. This allows for preparing a development strategy, which leads Nepal towards self sufficiency, import substitution and export promotion of seeds in years to come.

The opportunities presented in Table 2.5 are outcomes of SWOT analyses conducted with concerned stakeholders.

In varietal development and maintenance breeding: use of modern breeding techniques, standardization of breeding practices, coordinated support for decentralized variety development, expanded varietal choice and faster breeding cycle are some opportunities. In seed multiplication: use of varied agro-ecological conditions, increasing competitiveness of seed entrepreneurs, use of trained human resources and infrastructure (road, communications, banks, etc), integration of formal and informal seed system, integration of different seed production initiatives to avoid duplication and private delivery of public seeds are some of the areas of opportunities.

In marketing, opportunities exist in enhancing marketing capacities of private sectors, harmonization of export import regulations, use of high quality packaging materials and supply of sufficient quantity of good quality seeds. From seed consumers' perspectives, seed promotion campaign, improving demand forecasting, monitoring seed use, and mechanism for feedback are some of the opportunities.

Table 2.5: Opportunities of Nepal's seed sector

Process	Structures	Delivery
Varietal development and maintenance breeding		
<ul style="list-style-type: none"> • Use of modern crop breeding techniques including fast track shuttle breeding • Strengthening research extension linkages at the national, regional, and local levels • Standardization of breeding practices in vegetable, forage and other crops • Development of standard breeding practices in hybrid research • Continued investment in crop breeding and maintenance including adaptation to climate change • Harmonization of seed research with international and regional organizations. 	<ul style="list-style-type: none"> • Coordinated support for decentralized varietal development and maintenance. • Evolving role of public private partnership in seed research. • Joint venture for hybrid variety development and seed multiplication in collaboration with multinational seed companies • Local and exotic breeding materials of some crops are available, and hybrids recycling is also possible 	<ul style="list-style-type: none"> • Expanding varietal choice • Development and promotion of climate resilient OP and hybrid varieties • Faster breeding cycle using modern techniques
Seed multiplication		

<ul style="list-style-type: none"> • Use of varied agro climatic conditions • Use of modern techniques (shuttle seed multiplication) • Human resources for hybrid seed multiplication • Collaboration with multinational seed companies • Increased private and cooperatives involvement in seed multiplication • Increased employment with expanded seed production. 	<ul style="list-style-type: none"> • Use of infrastructure, communication network and trained human resources • Favourable policy environment • Develop popularization mechanism • Strengthening of formal and informal seed sector 	<ul style="list-style-type: none"> • Integration of formal and informal seed system • Private delivery of public seeds
Seed processing and conditioning		
<ul style="list-style-type: none"> • Ample opportunities for establishment of processing plants • Investment on expanding storage facilities • Financial institution and banks in business development • Development of trained human resources 	<ul style="list-style-type: none"> • Accreditation of seed labs with ISTA • Networking of processing plants and seed laboratories • Public private partnership in seed processing and conditioning • Harmonization of seed quality services with SAARC countries 	<ul style="list-style-type: none"> • Use of high quality packaging materials • Consumer friendly container size • Proper labelling and growing guidelines • Enhanced seed transaction and uptake through uniform regulations
Seed marketing		
<ul style="list-style-type: none"> • Enhancing marketing linkages of seed entrepreneurs • Export of temperate vegetable seeds • Increased policy support and linkage with export market • Investment in marketing infrastructure • Development of human resources in seed marketing 	<ul style="list-style-type: none"> • Development of seed marketing institutions • Support to growing private sector including cooperatives • Massive distribution of good quality seeds resulting in food security • Harmonization of regulations on seed exports and imports • Empowerment of women in seed marketing 	<ul style="list-style-type: none"> • Adequate quantity of quality seed supply based on market demand for domestic and export market
Seed use		
<ul style="list-style-type: none"> • Supporting studies of farmers' choice and use of quality seeds • Implementation of promotion campaign for new high yielding varieties of quality seed • Coordination and preparing updated demand and supply of improved seeds • Improving demand forecasting of improved seeds • Monitoring seed use in market by seed inspectors 	<ul style="list-style-type: none"> • Mechanism for feedback collection from users to seed research and multiplication process • Supporting district and national seed related institutions for preparing balance sheet of improved seeds supply • Improving packaging, storage and seed handling in the retailer chain 	<ul style="list-style-type: none"> • Varietal choice in required quantity • Adequate information on seed available in the market • Development of expertise among seed growers

2.6 Barriers of seed sector development

Stakeholders' analysis conducted in Dhanusha, Chitwan and Kavre districts revealed that Nepal's seed sector faces some barriers. The key barriers and issues observed in the seed sector are presented in Table 2.6.

Table 2.6: Barriers and Issues in Seed sector (Stakeholder Analysis)

Component	Barriers	Issues
Varietal Development and Maintenance Breeding	Inadequate varietal choice and limited number of breeding lines	<ul style="list-style-type: none"> • Slow varietal replacement due to limited number of farmers' preferred varieties • Inadequate varietal maintenance • Low investment in demand driven plant breeding • Low motivation for breeders to produce competitive varieties • Limited number of qualified breeders • Unclear vision for developing hybrids • Low participation of private sector in plant breeding • Inadequate use of crop genetic resources • Poor mechanism for receiving research feedback
Seed Multiplication	Inadequate production of source seeds Inadequate high quality seed production	<ul style="list-style-type: none"> • Public sector dominance in source seed production • Inadequate seed planning and monitoring • Multiplication steps not adequately maintained • Absence of decentralized source seed multiplication system and appropriate seed zones and pockets • Low competitiveness of seed production • Low seed replacement rate • Inadequate incentive package for seed growers • Lack of awareness on adaptation of regulatory mechanism on seed production
Seed Processing and conditioning	Low capacity for seed processing and storage	<ul style="list-style-type: none"> • Processing plants and storage capacity in public sector (farms and NSCL) are underutilised. • Low capacity for processing/conditioning in private sectors. • Low investment in seed infrastructure • Poor seed processing procedures and quality measurement
Seed Marketing	Lack of proactive marketing mechanisms Poor availability of quality products	<ul style="list-style-type: none"> • Inadequate seed dealers, channels and networks • Lack of promotion and advertisement campaigns • Excessive flow of exotic hybrids and other crop seeds (maize, vegetables and forage crops) • Absence of /improper labelling and inappropriate size of seed containers • Unaffordable pricing of seed packets • High competition with imported seeds • Limited seed quality services
Seed use	Inappropriateness of varieties Lack of awareness Low quality seeds	<ul style="list-style-type: none"> • Poor performance of varieties (yield, quality, adaptability) • Improper packaging and labelling • Consumer rights not ensured • Weak extension education

The identified barriers and issues form the basis for detail value chain analysis and for developing seed vision strategy.

2.7 Gaps and interventions

Gaps and suggested interventions identified along the value chain for the development of seed sector through the analysis of stakeholders are summarized below.

a) Varietal Development and Maintenance Breeding

Gaps	Suggested interventions
<ul style="list-style-type: none">• Absence of comprehensive variety maintenance plan and procedure for different ecological regions• Limited effort for breeding climate resilient and high yielding varieties• Inadequate functional arrangement for vegetable and underutilized crops breeding• Insufficient seed stock of new promising lines before release/registration• Insufficient motivation of breeders to produce varieties based on farmers' changing needs• No concrete policy on hybrid research• Lack of R&D component in private sector• Poor linkage with international research institutions/universities mainly on horticulture, NTFPs and other underutilized crops• Inadequate coordination with research and academia• Inadequate breeders for vegetables, cash and forage crops• Limited capacity to use modern techniques of plant breeding including biotechnology	<ul style="list-style-type: none">• Designate farms, stations, zones and pockets for variety maintenance and biodiversity conservation• Clarify and assign lead role and supporting roles for crop breeding and maintenance• Provide adequate support for hybrid varietal research and seed production through national research programmes and private sector participation• Explore and develop organizational incentives for breeders, based on output indicators• Develop policies on hybrid research in public and private sectors including PPP in all crops• Strengthen human resource capacity on breeding in public and private sectors• Develop/strengthen and use linkage with international institutions/academia• Develop human resources on modern plant breeding techniques (molecular breeding, biotechnology, etc)

b) Seed Multiplication

Gaps	Suggested interventions
<ul style="list-style-type: none">• Inefficient production planning and poor follow up of seed balance sheet• Mismatch between source seed demand and supply• Seed policies not implemented properly• Seed production zones and pockets not adequately followed• Poor incentives for developing private seed enterprises• Inadequate capacity of seed growers• High cost of production for seed crops• Noncompliance with contract seed production system• Absence/limited seed crop insurance mechanisms• Incentive package for seed growers	<ul style="list-style-type: none">• Participatory production planning for source seed with rationale FS distribution policy• Decentralize seed production with proper guidelines• Appropriate storage of left over seed for carrying over to next year (buffer stock management)• Emphasize foundation seed production of new and highly demanded crops and varieties in public and private sectors• Mechanize seed production• Strengthen formal seed production system in partnership with private sector (PPP) for rural employment generation• Provide adequate support to community based seed production system for local seed requirements.• Improve and harmonize seed policies and regulation.

c) Seed processing and conditioning

Gaps	Suggested interventions
<ul style="list-style-type: none">• No clear policy for buffer stock management• Insufficient knowledge and skills for processing and conditioning• Noncompliance to seed quality assurance system and processing procedure• Limited human resource capacity on post harvest handling of seeds• Quality packaging techniques not followed• Old equipments, processing plants and techniques used	<ul style="list-style-type: none">• Development of policies and programmes on buffer stock management and seed processing• Public private partnership in processing, conditioning and establishing seed conditioning units• Develop HR capacity in processing and conditioning• Apply seed regulations including quality assurance throughout the country• Increase investment in seed infrastructure (road and communication from public sector and processing and storage by private sector in a friendly manner).• Use of mobile processing plants in the hilly areas

d) Seed marketing

Gaps	Suggested interventions
<ul style="list-style-type: none">• Inadequate seed dealers, channels and networks	<ul style="list-style-type: none">• Create awareness on seed quality (packaging and

- primarily in hills and mountains
- Lack of seed marketing intelligence
- Ineffective market demand forecast
- Absence of seed certification schemes for organically produced seeds
- Customs hassle for seed export
- Lack of seed market extension both in private and public sector
- Lack of technology for seed transportation and handling
- Inadequate window of popularization for new varieties

- labelling)
- Equip seed forecast and intelligence mechanism
- Harmonize seed export and import regulations
- Investigate hassles and sort out through appropriate channels
- Strengthen HR capacity for seed market extension
- Strengthen seed handling in retailer chain
- Develop seed handling and transportation mechanism
- Support in seed packaging and labelling for rural employment generation

e) Seed use

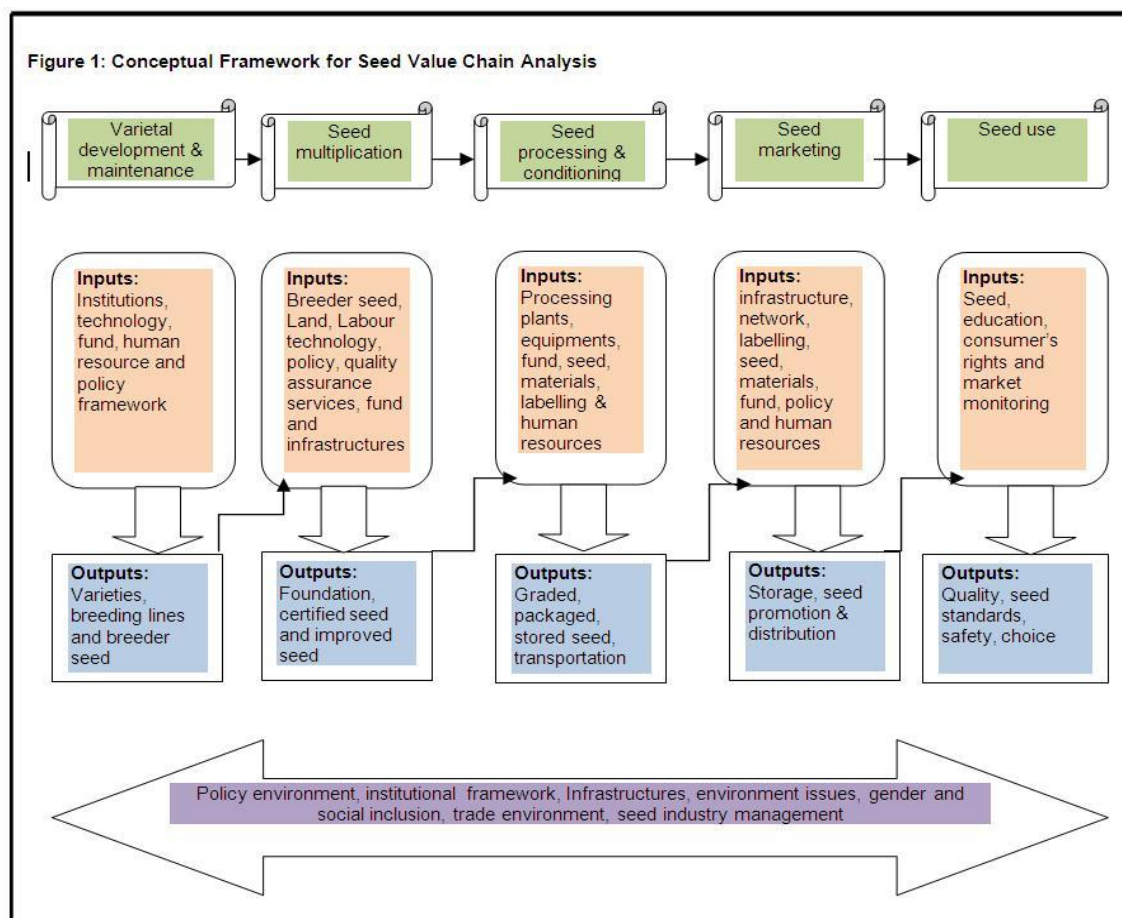
Gaps	Suggested interventions
<ul style="list-style-type: none"> • Absence of seed and new varieties promotion and campaigns • Poor seed quality awareness • Limited knowledge on consumers rights • Limited monitoring of seed use • Poor access to quality seeds • Poor knowledge on seed use • Lack of post seed sale services • Low coverage of formal seed system (<10%) 	<ul style="list-style-type: none"> • Promote seed campaigns and promotional measures such as FAT, PVS, minikits, demonstration • Educate consumers on good seed quality • Enhance consumers knowledge on their rights to quality seed • Develop compensation mechanism for poor quality seed supply • Conduct regular seed use survey every five year • Develop post seed sale services in public and private sectors

The gaps and interventions suggested are respondents' qualitative perceptions and are used as a basis for value chain analysis and seed sector development strategy.

3. SEED VALUE CHAIN ANALYSIS

3.1 Conceptual framework

The conceptual framework of the seed vision is based on seed value chain with inputs and outputs of the seed chain component (Figure 1). In order to maintain the prescribed seed multiplication steps, it is essential to analyze different phases of seed production along the chain. Varietal development and maintenance, seed multiplication, seed processing and conditioning, seed marketing and seed use are the key activities of this chain. Quality Control, policy environment, institutional framework, infrastructure, environmental issues, gender and social inclusion, trade environment and monitoring (seed industry management) are crosscutting themes of the chain.



The analysis of issues, findings and lessons learned from the past experience are discussed along the value chain. Projection for the development of competitive seed sector in 2025 is based on conclusions and assumptions with moderate growth scenario¹³.

¹³ Moderate growth scenario is when crop productivity growth rate is modest with the proposed investment under seed vision strategies.

3.1 Variety development and maintenance

Variety development, release, registration and maintenance are the key components of the seed value chain and seed vision framework. Development, maintenance and deployment of new location specific high yielding competitive varieties are prerequisites for bringing accelerated technological change and the means to increasing agricultural production and income. However, the current level of investment in terms of research fund and human resources for variety development and their maintenance is very low, and the availability of required organizational and institutional framework is weak. Investment analysis of resource pattern in agricultural research in the NARC is meagre and variety development and maintenance component receive less than one third (27%) of the research fund¹⁴ (Table 3.1).

Table 3.1: Resource allocation trend (in '000' NPR)

SN	Budget allocation	2008/9	2009/10	2010/11	Average
1	Operational budget in crop and horticulture research	97,456	91,113	272,537	153,702
2	Budget in plant breeding including variety maintenance	26,723	22,595	75,599	41,639
3	Allocated share of budget in plant breeding including variety maintenance (%)	27.42	24.8	27.7	27.09

Similarly, the share of researchers in plant breeding and variety maintenance is about one-tenth (11%) of the total available human resources on crop and horticulture sectors in NARC (Table 3.2). This is apparently low to implement the seed vision strategy.

Table 3.2: Status of human resources

SN	Crop and horticulture	Scientists	Technical officers	Total
1	Total number of researchers in crop and horticulture	121	179	300
2	Number of researchers in plant breeding and variety maintenance	25	7	32
3	Percentage of researchers in plant breeding and variety maintenance	21	4	10.6

Very few public, NGOs and private sector organizations are involved in seed research and development in various crops (food, cash, vegetables, spices, forage, and tree) in Nepal (Table 3.3). The main organizations involved in variety maintenance and source seed production by specific crops and varieties are presented in Annex 3.1. Nepal Agricultural Research Council is the main organization involved in varietal development and maintenance work and has national crop research programmes for major cereals, legumes, oilseeds, hill crops and potato. There are no national research programmes under the NARC for vegetables, fruit, forages and

¹⁴ Compiled from NARC budget and expenditure database

NTFPs. Nonetheless, some of the NGOs (e.g. LIBIRD) are at the forefront in variety development in food crops, particularly in participatory crop improvement in Nepal¹⁵.

Table 3.3: Major organizations working on seed research in various crops

SN	Organizations	Food crops	Vegetables	Cash and industrial crops	Forage crops	Spices and herbs	Trees and flowers
1	NARC	X	X	X	X	X	X
2	DoA/DoLS	X	X	X	X	X	X
3	MOFSC					X	X
4	NAST					X	
5	NSCL	X					
6	LIBIRD	X					
7	FORWARD	X		X			
8	CEAPRED		X				
9	SEAN		X				
10	Academia and Others	X	X		X	X	X

Trained human resources are limited on plant breeding and variety maintenance for most of the important crops. Seed vision envisages: a) Initiation of breeding programmes for crops b) Hybrid seed research c) Development of location specific varieties to address the changing climate and nutritional needs and d) Use of modern plant breeding techniques. Realizing the crucial role of trained scientific personnel, Seed Vision has proposed to increase the number of trained crop breeders from 32 in 2010 to 93 in 2025 both for public and private sectors (Table 3.4).

Table 3.4: Status and projected scientific manpower

SN	Crops	Status ¹	Projection		
		2010	2015	2020	2025
1	Rice	9	10	12	15
2	Wheat	4	6	8	10
3	Maize	5	7	10	15
4	Barley/ millet	2	3	4	5
5	Oilseeds	1	4	5	6
6	Legumes	2	4	6	8
7	Potato	1	3	5	8
8	Vegetables	4	6	8	10
9	Forage	1	2	3	4
10	Industrial /cash crops	2	4	5	6
11	Seed technology	2	3	5	6
	Total	32	52	71	93
¹ NARC, 2010					

¹⁵ Joshi, K. D., B. R. Sthapit, M., Subedi, and J.R. Witcombe (2002). Participatory plant breeding in rice in Nepal. In *Farmers, Scientists and Plant Breeding: Integrating Knowledge and Practice*, 239–267 (Ed. D. A. Cleveland and D. Soleri), Wallingford, UK: CABI.

Variety release and registration

At present, There are limited number of farmer preferred improved varieties developed, released and maintained, in spite of the fact that increasing number of hybrids and improved varieties are being demanded and imported, particularly in the case of vegetables, rice and maize. Analysis revealed that the current rate of variety release in many crops has been low except for major cereals. This indicates that no single improved vegetable variety has been released (which constitutes 40 of the crops) post 1995 and the same applies for industrial crops post 2005 despite the fact that a fairly good number of varieties were developed and released previously. Considering this slow release of new varieties, there is a need to increase the release of competitive varieties rapidly to provide diverse choices of farmers. The variety release and registration process needs to be faster and user friendly, but should follow the minimum requirement of distinctness, uniformity and stability. By 2025, the cumulative number of crop varieties released needs to be doubled, from 232 in 2010 to 423 in 2025 (Table 3.5) following the implementation of the proposed seed vision strategy.

Table 3.5: Number of released varieties in Nepal

SN	Crops	Status			Projection		
		2001	2005	2010	2015	2020	2025
1	Rice	44	49	60	75	90	100
2	Maize	15	17	23	28	35	40
3	Wheat	27	28	30	35	40	45
4	Millet	3	3	3	4	10	15
5	Barley	6	6	6	8	12	15
6	Lentil	7	8	10	12	15	18
7	Other pulses	18	20	25	29	35	40
8	Oilseed	12	16	16	20	25	30
9	Vegetables	40	40	40	50	60	70
10	Potato	6	6	8	12	16	20
11	Forage	0	2	2	4	7	10
12	Industrial crops	7	9	9	12	15	20
	Total	185	204	232	289	360	423

Source: MOAC, 2010 and NSB, 2010

Variety registration is one of the means to provide the mechanism in meeting the need and choices of improved varieties and hybrids for farmers. Though there has been a surge in registering hybrids basically after 2008, the registration of promising open pollinated improved crop varieties is much limited and is confined to vegetables (Table 3.6). Moreover, the trend is non-existent among farmer-preferred promising local land races.

All varieties, both domestic and imported, that are floated in the market for sale and distribution of seeds as well as planting materials are registered under the Seed Act. NSB prescribes minimum standards as well as guidelines for registration of seeds and planting materials. Import of parental lines of newly developed varieties will be encouraged in future.

Table 3.6: Number of varieties registered

SN	Crops	Varieties		Total
		Open pollinated	F1 (Hybrid)	Varieties
1	Rice	0	3	3
2	Maize	0	9	9
3	Vegetables	20	219	239
	Total	20	231	251

Source: SQCC, 2010

Hybrid variety development

Hybridization is a technique to create variability with increased vigour (heterosis) in variety development. It is obvious that hybrids have high yielding ability by 15-25 percent as against open pollinated varieties¹⁶. For this reason, there is an increasing trend of using hybrids among farmers. The first hybrid variety in Nepal was officially released in maize (Gaurav) in 2004. However, it was not successful due to non synchronization nature of inbred lines¹⁷. A hybrid variety of tomato (Srijana) was registered in 2010. A large number of hybrids in vegetables are gaining popularity among farmers in Nepal. Recently, hybrids in maize and rice are also increasingly becoming popular among farmers in Terai and lower hills. Many of them are imported. As of 2010, 231 hybrids are registered for cultivation in Nepal (Table 3.6).

Research in hybrid development is being initiated in maize and vegetables by National Maize Research Programme and Horticultural Research Division, NARC respectively. Despite the high demand for hybrids, research in hybrid variety development is limited due to the lack of trained human resources, infrastructure and investment from both the public and private sectors. In order to reduce the import of hybrids, public sectors' research institutions, such as NARC, should have Hybrid Research Unit (HRU) under National Commodity Programmes and Divisions with adequate fund and human resources. For this, special action plan needs to be developed and initiated without further delays. National hybridization programme increases employment opportunities in rural areas as a high labour force is required for hand pollination and maintenance of parental lines. By 2025, it is envisaged that 40 hybrids comprising, 20 in vegetables, 12 in maize and 8 in rice will be developed and promoted to meet the growing domestic demand and also as an import substitution measure. In addition, 20 hybrids comprising 10 in vegetables, 5 in maize and 5 in rice are expected to be developed and promoted by private sector.

Variety maintenance

Variety maintenance is an important component of quality source seed production. Maintenance of crop varieties in their original ecological domain is essential to produce good quality source seed and retain original genetic vigour and unique characteristics of the varieties. However, there is limited use and compliance of zoning concept in maintenance of varieties so far. Variety maintenance chart for food crops and vegetables released by NSB has been prepared based on agro ecological zones, domains of the research centres and farms, original genetic vigour and

¹⁶ Virmani S S, M. Hossain, and T. Bayarsaihan (2006). Policy support needs of hybrids rice technology in Asia (eds), IRRI, Los Banos.

¹⁷ Personal communication with SEAN Seed Service Centre and SQCC.

unique characteristics of the variety and provision for alternative seed source (Annex 3.1 and 3.2). The team recommends to follow-up the variety maintenance programmes as per the chart. In future, as more and more varieties will be released and/or de-notified, maintenance chart has to be regularly updated and adapted accordingly. Present status of breeder seed production and its projection in seed vision is discussed in seed multiplication section since breeder seed is an output of the variety development chain, which is also an input for the seed multiplication chain.

International linkages and collaboration

At present, the linkages and collaboration of national commodity programmes with international institutions and private R & D organizations are limited. Except for major food crops (rice, maize, wheat, legume, potato), virtually there are no linkages and international support for developing new varieties in vegetables, fruits, forages and cash crops. Development and strengthening link is essential for increased germplasm exchange and sharing of information and technology. Similarly, linkages between domestic plant breeding programmes and national gene bank are weak. As a result, flow of new germplasm, modern technological information and the use of diverse genetic resources available locally are limited. It is suggested that operational guidelines for gene bank need to be developed and implemented.

The Seed Vision framework assumes that incremental output by 2025 will come primarily from investment in inputs (fund, human resources and organizational development) for this sector that will bring sustained changes through the development and maintenance of large number of high yielding competitive farmer-preferred varieties and planting materials. The Seed Vision also assumes that there will be a substantial increase in investment on inputs (e.g. research funds). Also, there will be an increase in the number of trained scientists, deployed with the right institutional framework and organizations in place. Focus will be on strengthening the existing crop breeding and variety maintenance programmes including hybrid breeding in major food crops and other commodities.

3.2 Seed multiplication

Various organizations both in public and private sectors are involved in seed multiplication. National Seed Company Limited (NSCL) is the main public organization involved in seed multiplication of cereal crops. Public sector has been playing dominant role in cereal seed multiplication, while role of private sector remains higher in vegetable seeds. Recently some private seed companies are also involved in cereal seed production. In seed multiplication, the role of private sector and community sector is increasing. District Level Seed Self Sufficiency Programme (DISSPRO), Commercial Seed Multiplication Programme and Community Seed Bank (CSB) as well as many Community Based Seed Production (CBSP) programmes of the government and donor funded projects (e.g. HMRP, VSP, and RIU) are also involved in multiplying seeds of food and vegetable crops.

Current production of breeder and foundation seeds in cereals is sufficient to meet the projected seed replacement rate in major cereals (rice, maize and wheat) and potato, if seeds are produced as per the recommended seed multiplication steps (BS-FS-CS-IS) using standard seed multiplication rate (SMR). However, source seeds produced currently in the country do not provide adequate choices of preferred varieties to the diverse group of farmers in different

ecological domains and socioeconomic settings. In addition, source seeds are misused due to inadequate planning and unregulated seed distribution, lack of incentives for source seed production/marketing, and farmers' immature perception on quality seeds.

Present status and projection of breeder seed production

Fifty two mt of breeder seed of selected food crops and vegetables was produced in 2009 (Table 3.7). This amount is adequate to fulfil the present total breeder seed requirements. However, breeder seeds of all farmers preferred varieties are not currently available. The requirement of breeder seed is based on the required amount of foundation seeds derived from crop production estimates using backward calculation¹⁸. The requirement of breeder seed will increase to 88 mt by 2025 with emphasis on the quality and varietal choice.

Table 3.7: Breeder seed production

SN	Crops	Production status (mt)				Projected requirement (mt)		
		2001	2005	2009	2010	2015	2020	2025
1	Rice	5.50	11.00	8	8.56	6.6	8.96	11
2	Maize	10.27	1.00	3	3.00	0.63	0.9	1.46
3	Wheat	23.13	24.5	27	28	32.39	45.35	57.14
4	Millet	NA	NA	0.015	0.015	0.031	0.038	0.063
5	Barley	NA	NA	NA	NA	0.43	0.87	1.56
6	Lentil	0.04	0.03	0.33	0.33	0.65	1.15	2.48
7	Oilseed	NA	NA	0.01	0.01	0.03	0.05	0.07
8	Vegetables	0.315	0.382	0.5	0.55	0.878	0.955	1.204
9	Potato	13	13	13	13	13	13	13
	Total	52.26	49.91	51.86	53.47	54.64	71.27	87.98

Source: NARC Annual Reports

Present status and projection of foundation seed production

The production of foundation seeds of food and vegetable crops was 1471 mt in 2009 (Table 3.8). The quantity of foundation seeds produced in this year was sufficient to attain the seed replacement rate of 2010 through improved seed production. However, there are some issues to be addressed:

- Lack of sufficient quantity of foundation seeds of different types of crops and their varieties to meet farmers' demand.
- Foundation seeds are being utilized directly for improved seed production rather producing certified seeds.
- Foundation seeds are used directly for food grain production or consumed as food since poor farmers cannot hold it for the next season.

¹⁸ **In backward calculation**, requirement of BS is calculated based on the required quantity of foundation seeds. Requirement of foundation seed is estimated based on the requirement of certified/improved seeds following three stages of seed cycle (BS-FS-CS-IS) and seed multiplication ratio (SMR). Certified/ Improved seeds are calculated based on crop area and production targets set by estimated seed replacement rates.

Table 3.8: Foundation seed production

SN	Crops	Production status (mt)				Projected requirement (mt)		
		2001	2005	2009	2010	2015	2020	2025
1	Rice	358	410	307	307	230	314	389
2	Maize	202	110	65	65	37.53	54.00	87.60
3	Wheat	139	150	220	250	582.95	816.25	1,028.50
4	Millet	NA	NA	NA	0.90	2.04	2.45	4.07
5	Barley	NA	NA	NA	0.03	5.20	10.40	18.67
6	Lentil	0.9	0.73	8.20	8.20	16.13	28.80	62.06
7	Oilseeds	NA	NA	0.81	0.81	1.71	2.83	4.26
8	Vegetables	12.58	15.28	22	22	35.12	38.18	48.14
9	Potato	216	517	848	848	1,066	1,285	1,376
	Total	699	670	1,471	1,502	1,977	2,552	2,978

Source: SQCC, NARC, CDD/DOA, and NSCL

Seed Vision envisages that high yielding competitive varieties preferred by farmers will be available as a result of enhanced capacity of research in public and private spheres. Foundation seed production is based on required amount of certified/ improved seeds derived from crop production estimates. In 2025, the projected requirement of the foundation seeds will be 2,978 mt.

Present status and projection of certified/ improved seed production

The status of certified/improved seed production of food and vegetable crops by formal sector was 32,352 mt in 2009 (Table 3.9). To meet the target of seed replacement rate of above mentioned crops, 92,527 mt of improved seeds is estimated to be required by 2025. The amount of seed is projected on the basis of food estimates (6.8 million mt) for the projected population of 36.5 million in 2025.

Table 3.9: Certified/Improved seed production

Sn	Crops	Production Status (mt)				Projected requirement (mt)		
		2001	2005	2009	2010	2015	2020	2025
1	Rice	542	4,142	6,788	8,470	11,490	15,690	19,450
2	Maize	163	565	1,147	1,592	2627	3,780	6,132
3	Wheat	2,878	5,796	8,245	9,680	11,659	16,325	20,570
4	Millet	-	-	53	63	153	184	305
5	Barley	-	-	0	0.5	78	156	280
6	Lentil	27	22	230	246	484	864	1,862
7	Oilseeds	-	-	52	57	120	198	298
8	Vegetables	629	764	1,009	1,100	1,756	1,909	2,407
9	Potato	2,161	7,241	14,827	16,111	25,577	37,265	41,273
	Total	3,583	10,503	32,352	37,320	53,944	76,371	92,527

Source: SQCC, NARC, CDD/DOA and NSCL.

Present status and projection of seed crop area

Seed planning in terms of seed crop area (ha) for the implementation of Seed Vision is presented in Table 3.10. The area available for improved seed multiplication in 2009 with public (NSCL) and private sectors is 13,241 ha. The requirement of total seed crop area is estimated to be 26,801 ha in 2025. The projection is made on the basis of crop area required to produce estimated amount of food for increasing population.

Table 3.10: Projected requirement of seed crop area

Crop	Area requirement for Seed Crop (ha)				
	Status		Projection		
	2009	2010	2015	2020	2025
Paddy	3,560	4,059	5,087	6,248	6,368
Maize	832	1,069	1,608	2,035	2,833
Wheat	5,532	5,999	6,545	8,300	9,472
Millet	68	80	185	204	292
Barley	0	1	71	131	217
Lentil	408	431	796	1,300	2,537
Oilseed	35	111	218	333	454
Potato	1,559	1,657	2,334	2,994	2,883
Vegetable	1,247	1,117	1,566	1,506	1,745
Total	13,241	14,524	18,410	23,051	26,801

Source: Authors estimation

Present status and projection of seed replacement rate

It is evident that in order to achieve the food production target, a major effort is required to increase the seed replacement rate of various crops. In 2009, seed replacement rate of rice, maize and wheat was: 9 percent, 7 percent, and 9 percent, respectively indicating that over 90 percent of the required seed of major cereals was supplied by the informal sector (Annex 3.3). Here, seed replacement rate (SRR) is calculated on the basis of seeds produced by formal sector over gross seed requirement and does not take into account the informal hybrid and other seeds used by farmers. With increasing production and use of hybrids through formal sector, the contribution of hybrid seeds to SRR is expected to reach around 10 percent in 2025.

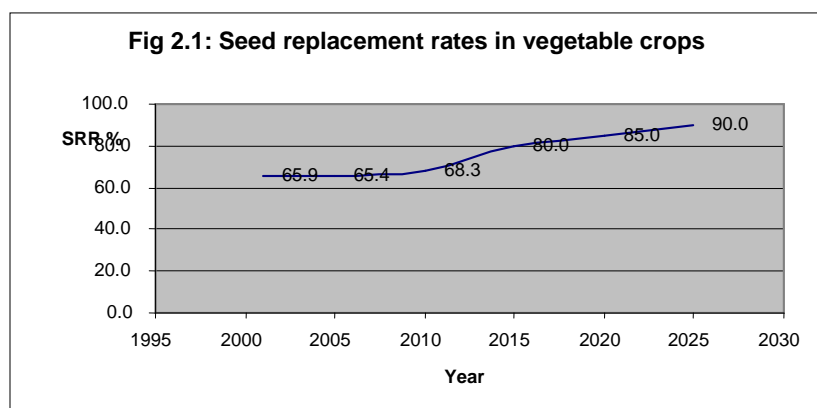
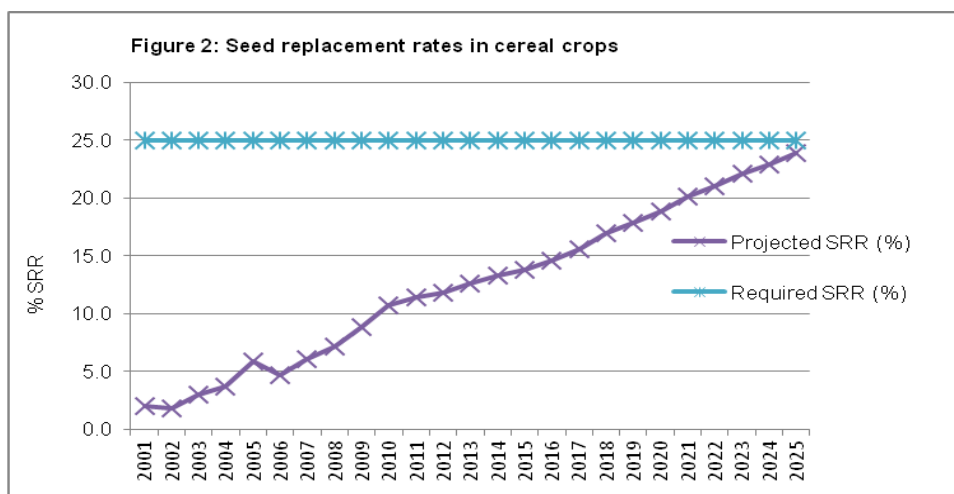
When a variety fails to perform according to its characters, only the replacement of old seeds by certified or improved seeds of the same variety will not be sufficient. In such cases, the old variety needs to be replaced by a new one, which is suitable to grow in similar agro-ecological condition.

By 2025, seed replacement rate is expected to reach about 25 percent for cereals (Figure 2). By the same year, seed replacement rate for vegetables is expected to reach 90 percent from current SRR of 66 percent (Figure 2.1). For self pollinated crops recommend replacement rate is 25 percent. Likewise, for cross pollinated crops, the replacement rate is 33 percent and for hybrids it is 100 percent¹⁹. Use of improved quality seeds at the farm level was a recent initiative with the launching of DISSPRO by DoA and CBSP through many donor funded projects. A favourable policy shift towards the involvement of private sector in source seed production and multiplication also has a contribution to increase the use of good quality seeds for crop production.

Seed production technologies for field crops and vegetables have been developed and recommended by the NARC²⁰. However, specific technologies required for producing good quality seeds are limited.

¹⁹ GOI (2010). National Seed Plan, New Delhi India

²⁰ NARC Annual Report (2010)



Normally, seed growers obtain required fund for seed production from local lending institutions like banks, saving and credit institutions and local money lenders. Private sector also provides source seeds and some agricultural inputs either on credits or as an advance to be deducted during seed purchase. Since large scale funding from public and private sectors has not been done for seed multiplication, Seed Vision envisages that credit required for seed growers/seed companies will be made available from credit institutions in the form of soft loans subsidized by the government. In remote areas, additional incentives may be required to encourage farmers for producing good quality seeds. Large scale investment from public and private sectors is also required to expand the business activities after the production of seeds. A separate government programme needs to address the requirement of infrastructure like road, communication and electricity for the identified commercial seed production pockets and zones. Seed production of temperate crops (wheat and vegetables) need to be focused in production pockets and zones of western regions (west, mid-west, and far-west) because of low rainfall and humidity during seed maturity period.

Currently, farmers do not have choice for seeds of different varieties, at right time, right place and in sufficient quantity in affordable prices largely due to the lack of adherence to seed multiplication steps. Seed Vision envisages that good quality seeds of high yielding competitive varieties preferred by farmers will be produced in sufficient quantity and availed in right time and right place on affordable prices. In case of major cereals, preference will be given to develop more than one variety for the same agro-ecological region and produce seeds in sufficient quantity so that farmers can choose to grow one among them. Variety development, release, and seed production of such competitive varieties will make easy for variety replacement, if a particular variety fails to resist insect pests, diseases, or other unfavourable conditions.

In order to produce and multiply sufficient quantity of seeds for domestic self-sufficiency, import substitution and export promotion, seeds of preferred varieties of crops will be produced in recommended agro-climatic and production zones as envisaged in Annex 3.2 for vegetables. The current status, projected improved seed requirement, and crop area of major crops is presented in Annex 3.4. The Seed Vision suggests developing seed sector plan and producing seeds under common seed production guidelines, and enhancing the capacity of institutions to follow the recommended scientific steps of seed production in public and private spheres. Emphasis needs to be given to multiply sufficient quantity of good quality seeds within the rules and regulations as prescribed by current legislative and policy framework. Present contract seed production system needs to be reviewed for its effective implementation and for keeping producers under legal binding.

3.3 Seed processing and conditioning

Public sector organisations, like NSCL, VDD, and NARC installed processing plants in the early 1980s through various donor funded projects for field and vegetable crops to support source seed production and multiplication. However, the types of available infrastructure are old, inefficient (using old techniques) and hence need updating. National Seed Company Limited (NSCL) has well developed seed processing and conditioning structure at Hetauda, Jhumka (Sunsari), Bahairawa, Janakpur, Nepalganj and Dhangadhi. Recently, some private seed companies and community based organizations / cooperatives have also installed processing and conditioning structures through donor funded projects and public support. Manpower trainings have also been conducted to operate these processing plants. However, the available information suggests that the current level of human resources (trained seed quality control specialists, seed technicians, and seed inspectors) and seed infrastructure are inadequate to meet the projected needs of seed sector development. Also, the investment for the development of seed infrastructure is meagre due to the lack of focus on seed sector development and commercialization of agriculture.

Substantial investment is required on seed infrastructure to make seed industry competitive and meet the supply needs at various ecological regions, domains and market centres. In order to increase the supply of good quality seeds, small scale seed processing and conditioning plants owned by cooperatives and farmers' groups in remote and rural areas need to be supported and promoted both from public and private sectors. Mobile seed processing plants will also be useful in remote hilly areas of Nepal.

The current seed storage capacity is estimated to be about 11,000 mt (8,700 mt with NSCL²¹ and 2,300 mt with private and other public agencies) in Nepal. This capacity meets half of the current seed storage requirement excluding potatoes. By 2025, around 50,000 mt of seeds needs to be stored for six months in well equipped storage structures. That means the storing capacity of both the public and private sectors needs to be doubled to meet 50 percent of the projected seed storage requirement. There are 20 processing plants operational at present in both public and private sectors (Annex 3.5) with a cumulative processing capacity of about 20-25 mt/hr²². By the current estimate, the cumulative processing capacity of existing processing plants needs to increase by over two folds (55 mt/hr) to meet the requirement of 50,000 mt of processed seeds excluding potatoes by 2025. This calls for a substantial increase in investment on processing plants from both the public and private sectors. Seed processing locations need to be determined based on production and marketing zones.

Altogether, there are 17 seed laboratories established in different parts of the country (Annex 3.6). Out of these laboratories, 13 were functional till 2009 and two of them were owned by the private sector. Assuming that each laboratory can test 1000 samples per annum, 13 laboratories tested and analyzed 13,000 samples of about 17,000 mt of improved seeds in 2009. Based on this calculation, the capacity of existing laboratories needs to be increased by at least three times in 2025. Seed vision proposes to establish at least 20 additional seed laboratories in public and private sectors. Seed laboratories in private sector should be encouraged to get accreditation from central seed testing laboratory (CSTL) to promote devolved and quality seed testing services for farmers.

Seed buffer stock

Buffer stock is a system where source and improved seed reserves are maintained for future uncertainties. Seed production programmes could be affected by weather conditions, diseases, pest problems or natural calamities, which may reduce the production of targeted quantity of seeds. Buffer stock is also essential in cases when demand for seeds of a particular variety is not precisely estimated, or when an unexpected demand surge occurs for a new variety. It proves handy when the government comes up with ad hoc special programmes at a particular location and season. National buffer stock also contributes a minimum of one percent of common varieties to Regional Seed Bank of the SAARC countries²³. About 10 - 20 percent of the total seed requirement of a particular commodity excluding potato is recommended to be maintained as a buffer stock, which comes to be 10,000 mt in Nepal²⁴. The storage structure for buffer seed stock needs to be developed at regional and local levels both in public and private sectors.

²¹ NSB (2008), Proceeding of the 4th Seed Seminar and SQCC, (2064/65), annual progress report.

²² Ibid.

²³ SAARC (2011). Meeting minutes of the Inter-government experts to finalize regional seed bank and material transfer framework, 15-16 February, 2011, Dhaka.

²⁴ Rai, M. and J. Robinson (2007). Promotion of Vegetable Seed for Poverty Reduction in Deprived Areas of Nepal, Project Review Report, CEAPRED.

3.4 Seed marketing

Cereal seed marketing is mostly carried out by public sector organizations, like NSCL and STCL in Nepal. These organizations distribute seeds across the country through their dealers' network. Distribution of cereal seeds in hills and mountains is poor due to high cost of production, huge transportation cost, and small demand. Many private seed companies and cooperatives are also involved in cereal seed marketing these days. Vegetable seed is mostly marketed by traders and agro-vets. Over 1, 854 seed entrepreneurs and 829 trained seed traders were registered with National Seed Board till 2010 and involved in marketing.²⁵ The trend of registering seed entrepreneurs is continuously rising.

Seed marketing is not a prioritized activity in overall seed system. Systematic marketing of seeds with proper grading, standard packaging and labelling is limited to vegetables and few cash crops. Marketing of good quality seeds are constrained due to the absence of seed marketing campaigns and adequate quality control services such as field inspection, certification, branding and labelling. Marketing of organically produced seeds is constrained in absence of seed certification schemes.

Seed Vision recognizes the worth of rapid marketing and the spread of seeds of high yielding competitive varieties. Availability of high quality seeds through an improved distribution system and efficient marketing will be ensured to facilitate greater security of seed supply. Therefore, this vision proposes developing and strengthening seed networks, seed dealers and seed supply channels in public and private sectors. Marketing of seeds of any variety will be permitted for sowing and planting only if the variety is registered with the National Seed Board.

Self sufficiency, import substitution and export promotion

Based on the seed production experience of past 30 years, seeds of different varieties of crops can be successfully multiplied and marketed in Nepal. Some cereals (rice, maize, and wheat), legumes (beans, soybeans, lentil, and blackgrams), and vegetables (radish, rayo, beans, cauliflowers, peas, lady's finger, cress, coriander, chillies, etc.) can be promoted for self-sufficiency. In terms of import substitution, special focus should be given to crops, like radish, onion, garlic, broccoli, peas, cowpeas, pigeon peas, tomatoes, cucumber, lady's finger, carrots, potatoes, bottle gourds, squashes, and watermelons. For export promotion, emphasis should be given to produce seeds of wheat, lentil, radish, peas, beans, onion, tomatoes, cauliflowers and cucumbers. Potential crop varieties identified for import substitution and export promotion are summarized in Table 3.11.

²⁵ SQCC (2011). Seed entrepreneurs' registration document

Table 3.11: Potential crop varieties for import substitution and export promotion

Crops	Varieties	Import substitution /export promotion
Rice	Khumal-4, Shambamashuri-Sub1, Jethobudho, Sunaulosugandha	Import substitution
Lentil	Shishir, Shimrik	Export promotion
Tomatoes	Srijana hybrid, Lapsigede	Import substitution
Radishes	Mino-Early, 40 days, Tokinashi, Pyuthane, Rocky -45 (Bangladeshi variety)	Import substitution and export promotion
Broccoli	Green Sprouting and Calabrese	Import substitution
Peas	Arkel, Sikkim, Azad, etc.	Import substitution and export promotion
Cowpeas	Prakash, Akash, Khumal Tane, some selected lines of Chinese origin	Import substitution
Onion	Red Creole, Agrifound Dark Red	Import substitution and export promotion
Garlic	Chinese and local	Import substitution
Carrots	Nantes and Newkuroda	Import substitution and export promotion
Egg plants	Nurki, Sarlahi Green, Pokhara Lurke	Import substitution
Cucumbers	Bhaktapur local and Kusule	Import substitution and export promotion
Squashes	Gray Jukini	Import substitution
Beans	Trishuli, Four season, Contender, some new lines from China,	Export promotion
Mung beans	Pusabaisakhi, Kalyan, Pratiksha	Import substitution
Pigeon peas	Bageswori and Rampur-1	Import substitution
Potatoes	Khumal Laxmi, Kufri Jyoti and Khumal Rato	Import substitution

A large proportion of improved seeds particularly hybrids in vegetables are being imported, particularly from Japan, India, Thailand, Korea and China. In 2009-2010, Nepal imported 238 mt of vegetable seeds (Table 3.12).

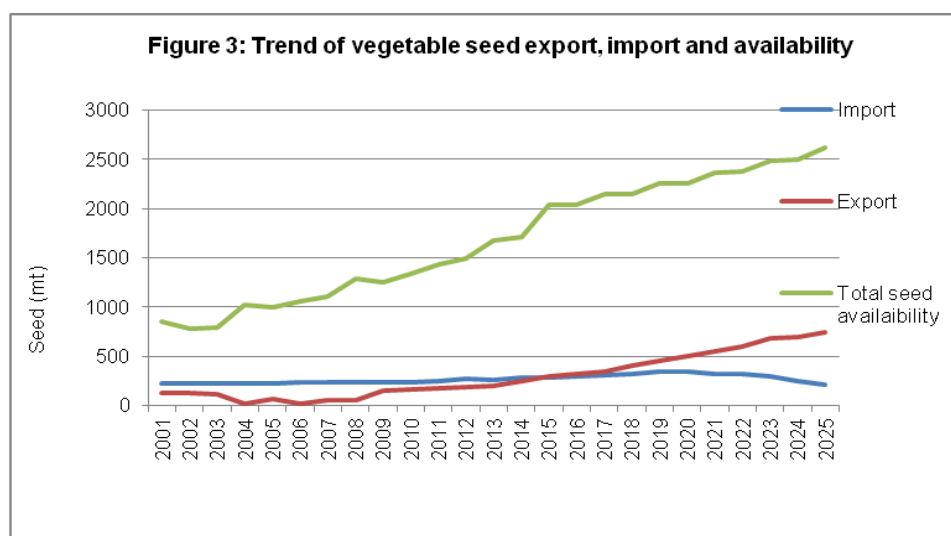
Table 3.12: Vegetable seed import, export and availability

Vegetable seed	Status (mt)				Projection (mt)		
	2001	2005	2009	2010	2015	2020	2025
Seed Import	220 (26)	230 (23)	238 (19)	240 (18)	280 (14)	350 (15)	210 (8)
Seed Export	124 (15)	71 (7)	150 (12)	160 (12)	300 (15)	500 (22)	750 (29)
Seed Prod required	629 (74)	764 (77)	1009 (81)	1100 (82)	1756 (86)	1909 (85)	2407 (92)
Availability for domestic use	849 (100)	994 (100)	1247 (100)	1340 (100)	2036 (100)	2259 (100)	2617 (100)

Note: The figures on export and import are compiled from sources including proceedings of the third and fourth seed seminar (2001, 2008) and Foreign Trade Statistics, Fiscal year 2065/66, GoN. Percentage in parentheses.

About one-fifth (19 percent) of vegetable seeds was imported in 2009. This will be reduced to eight percent by 2025 by developing domestic hybrids. However, competitive international hybrid varieties will still have import access in the country. The share of export is expected to increase from the current 12 percent to 29 percent by 2025. The volume of export constitutes the seeds of mainly open pollinated crops.

Seed vision envisages an increasing trend of vegetable seed availability, moderate rate of export and a slight decline on imports as shown in Figure 3.



Inadequate production of good quality seeds augmented by factors: lengthy custom clearance procedures, absence of internationally accredited quarantine laboratory, and the lack of facilities, such as storage at border points stand as major hurdles on the export of vegetable seeds.

Human resources for seed production, processing and marketing

As per the current estimates, the number of trained human resources in various seed related disciplines, such as production agronomists, seed analysts and inspectors, plant operators /engineers, seed extension and marketing specialists in public and private sectors is 71 (Table 3.13). Total number of various specialists required to support the activities proposed in Seed Vision strategy is projected to increase by three folds i.e. to 210 by 2025. The projection is based on seed crop area, seed quantity and institutional capacity in both public and private sectors.

Table 3.13: Human resources for seed production, processing and marketing

Specialists	Status*	Projection		
	2010	2015	2020	2025
Seed production agronomists	30	40	60	75
Seed analysts and inspectors	15	20	25	30
Plant operators/ engineers	20	25	30	35
Seed marketing specialists	2	10	20	30
Seed extension officers	4	10	30	40
Total	71	105	165	210

*Authors' estimates, 2011

3.5 Seed use

Quality seed use at the farm level is a good indicator of seed sector development and a key input for agricultural development. Due to inadequate seed use education, resource allocation, and human resource development, the use of good quality seeds at the farm level is reduced. Seed sector lacks mechanisms for the collection of information on seed use and conduction of seed survey. The data published by the MoAD provides annual coverage of area by improved varieties of three major food crops (rice, maize, wheat), but not the actual annual use of improved seeds at the farm level.

Furthermore, the current estimation of seed replacement rate in Nepal is based on seed production and sales data instead of field survey data. Hence, empirical information on seed replacement rate actually at the field level and variety replacement data is currently unavailable. However, the available evidence and observation indicate that the use of good quality seeds at the farm level is very low due to limited access and poor knowledge of farmers.

The use of hybrid seeds is common in maize, rice, and vegetables mostly in market accessible areas of Terai and river valleys. Crop area under hybrid seeds in maize and rice was estimated to be 10 percent and 2 percent, respectively in 2010. Hybrid vegetable seeds are used in 60 percent area of the commercial production pockets. The current status and projected area under hybrid seeds is presented in Table 3.14.

Table 3.14: Estimated area and requirement of hybrid seeds

Crops	Status		Projection					
	2010		2015		2020		2025	
	Crop Area (ha)	Seed reqd. (mt)	Crop Area (ha)	Seed reqd. (mt)	Crop Area (ha)	Seed reqd. (mt)	Crop Area (ha)	Seed reqd. (mt)
Maize	85,000	1275	120,000	1,800	180,000	2,700	250,000	3,750
Rice	32,000	640	50,000	1,000	100,000	2,000	150,000	3,000
Vegetables	30,000	30	40,000	40	70,000	70	90,000	90

Source: Authors' estimates based on production norms of India, 2010.

The demand of hybrid seeds is met by imports as of today. Cereal crops (maize and rice) usually enter Nepal through informal channel via Nepal-India boarder. Hybrid vegetable seeds are imported from Thailand, China, Korea, Japan, and India. Currently, some 30 foreign companies are supplying seeds of the crops, like rice, maize, and vegetables to Nepal.

Public and private extension programmes and activities for creating farm level awareness and marketing campaigns on the use of good quality seeds are lacking. Furthermore, monitoring the flow of seeds of newly developed promising varieties in the market is nonexistent. In order to increase farmers' awareness on the use of good quality seeds, there is a need to promote seed use education and /campaigns massively. Seed campaigns educate farmers on their rights to access good quality seeds. National Seed Board needs to monitor seed use regularly in order to know the status of good quality seeds, hybrid seeds, and low quality seeds prevalent in the markets.

3.6 Seed policy issues

Existing Seed Act (1988), Seed Regulations (2013) and Seed Policy (1999) are relatively liberal towards the seed sector development in Nepal. However, some issues and constraints need to be addressed in the future with regards to implementation of existing and proposed seed regulations. Seed policy (1999) and Seed Act (1988) and its Amendment (2008) provided impetus for the growth of private sector in seed production. Consequently role of private sector in seed multiplication and distribution is increasing. Policies to promote the private seed sector should lavish attention to consumer education so that farmers are able to protect their interests and can express their demands.

Intellectual Property Rights (IPR) is a mechanism to protect rights of those (for example, farmers, scientists, and companies) holding genetic resources. Recently promulgated Seed Regulation – 2013 protects the rights of farmers and plant breeders, and includes provisions to provide incentives for their contribution in increasing food production. Intellectual Property Rights provides incentives for developing new varieties and commercializing seed production and distribution. This can provide a basis for market segmentation which may be useful to increase investment. However, the introduction of IPR tends to reduce farmer to farmer seed exchange practice by limiting seed promotion among farmers having poor resource. As a member of World Trade Organization (WTO), Nepal is obliged to follow the Trade Related Intellectual Property Rights (TRIPS) agreement²⁶. Therefore, Nepal should develop its own plant variety protection mechanism at the national level, either through patents or through “an effective *sui generis* system” or both (article 27.3 b).

The existing seed policy document does not adequately address issues on modern plant breeding techniques, including biotechnology and GMO. Existing facilities are scattered and human resources are not adequate to work on modern plant breeding techniques. Policies for additional investment on strengthening existing facilities and in establishing National Agriculture Biotechnology Centre need to be formulated. There is also a need to formulate clear-cut guidelines on GMO and GMO seeds. Government subsidy and grants are suggested for every function of the value chain.

Revised seed policies, act, and regulations have been prepared through series of consultative workshops and a proposal is submitted to the government for a revision. Revised proposal addresses current issues and constraints on seed sector. It may require further review and consultation, for which NSB should take the lead. The Seed Vision team proposes to upgrade the role of NSB for inter-ministerial coordination (e.g. for forestry and agricultural seeds). The team also recommends increasing private sector participation (private breeders, importers, exporters, private seed laboratories, seed associations, NGOs working in seed sector, and seed companies) in NSB and other seed related committees.

Prevailing seed policies are unable to address the emerging issues, such as the demand of quality seeds including hybrids, implementation of genuine labelling system for quality assurance, implementing effective law enforcement procedures, and addressing farmers' and plant breeders' rights.

²⁶ The purpose of the TRIPS agreement is to promote the effective and adequate protection of IPRs as a means to reduce the distortions and impediments in international seed trade.

First amendment of the Seed Act in 2008 provisioned for licensing of private seed laboratories, authority to private sector to involve in quality assurance system, permission from NSB to undertake seed business, fee and service charges for seed testing and certification. However, these provisions could not be implemented effectively in absence of full implementation of seed regulations. In the changing dynamics of seed sector, it is pertinent to practically implement the Seed Act provisions in all districts of the country, align seed quality assurance services with growing community and private seed industries, and support the envisaged goal of seed self sufficiency, import substitution and export promotion. Quality assurance services need to be regulated/provided to all components of seed multiplication steps (BS-FS-CS-IS) for all crops.

Inclusion of women and socially excluded groups along the seed value chains is crucial. The Seed Vision promotes inclusive and equitable development that ensures full and active participation of women and disadvantaged groups. The policy revision suggested under the seed vision will facilitate awareness activities on gender and social inclusion and support the empowerment of women and disadvantaged groups.

With the development of road and communication infrastructure in hills and mountains, farmers will be attracted towards fresh vegetable production instead of producing seeds of long duration crops. In this scenario, seed growers need to be supported with low cost better technologies such as mechanization, high yielding and short duration crop varieties, seed insurance, credit besides market supports. All these measures will on the one hand reduce the cost of production and on the other hand allow seed growers to continue seed production along with fresh vegetable production.

Harmonisation of policies, acts and regulations

Harmonisation of policies, acts and regulations is required to facilitate seed trade, enhance access of new seed varieties to farmers, and for compliance with standard rules and procedures of WTO and regional agreements with SAARC and other regimes (e.g. SAFTA, BIMSTEC). Harmonisation of seed policies and trade rules help to facilitate foreign direct investment in seed industries. Harmonisation of the policies for variety development and release will enhance the promotion and adoption of new competitive varieties released in one country to another. For example, newly developed climate resilient varieties and hybrids developed in neighbouring border states of India could be promoted and adopted faster in Nepal and vice versa. Harmonisation of trade related policies, rules and regulations will help to mitigate current constraints and hassles in seed trade at border points. For this, the scope of NSB needs to be widened with balanced representations from public, private and cooperative sectors including Ministry of Forests and Soil Conservation, Ministry of Trade and Commerce, and Ministry of Law and Justice.

Asia-Pacific Seed Association (APSA) has initiated harmonization process of seed regulations at the regional level in Asia. APSA has selected 10 crops, which include maize, rice, sunflower, cabbage, cauliflower, cucumber, eggplant, hot pepper, tomato and watermelon, for harmonization. Initially six countries (India, Indonesia, Philippines, Thailand, Vietnam and China) participated in harmonization process. In 2005, seven countries from Asia (Pakistan, Bangladesh, Sri Lanka, Malaysia, Cambodia and Laos) joined the harmonization process. Nepal so far has not fully participated in the harmonization process yet.

International Seed Testing Association (ISTA)²⁷ accredited CSTL of the SQCC as its member laboratory in December 2011. This accreditation allows CSTL issuing the Orange International Seed Lot Certificates, and will be a basis for ensuring the trade of quality seeds by developing standard seed testing methods in Nepal.

3.7 Public private partnership

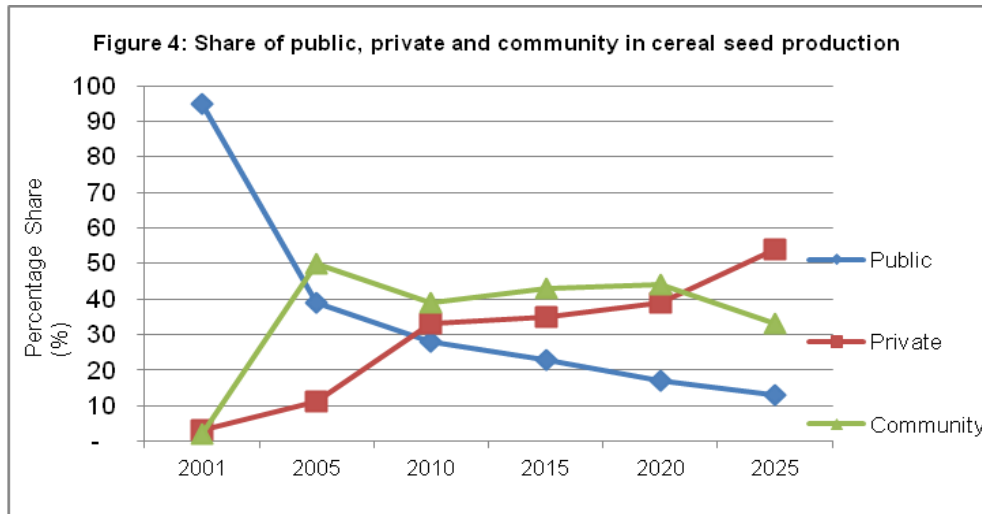
Private sector is known for its efficiency and pro-activeness, while public sector has comparative advantage in terms of its broader social role of a welfare state. Both public and private sectors are characterized by their strengths and limitations. Strengths of both public and private sectors can be capitalized for a competitive business. In Public Private Partnership (PPP), the role of public sector is mostly facilitating and supportive from broader policy perspective. Public private partnership is successful in areas involving long term investment with higher degree of risks. Competitive seed sector development with a long-term vision can be an important investment area for both public and private sectors. However, some financial rules and regulations stand as impediments for joint investment and sharing of facilities by public and private sectors. Concerned ministries need to sort out and resolve such barriers. As of today, public, private and community sectors enjoy almost equal share in aggregate cereal seed production. The role of public sector is relatively high in wheat seeds while the share of community sector is high in rice and maize. Though the private sector (mainly seed companies) has a fair degree of share in producing seeds of all these three crops, but the share of this sector is far high in vegetable seeds.

The role of public sector was gradually decreasing, private sector was increasing, and community sector was increased sharply in the initial years and then remained somehow constant later in cereal seed production in the past decade (2001 – 2010). The share of private sector in cereal seed production reaches above 30 percent in 2010 from 3 percent in 2001 (Figure 4). This is a good indication for the development of seed sector as envisaged in this vision.

Seed Vision expects that the role of public sector in seed multiplication will diminish with a rapid proliferation of the private and community sectors. Share of private sector in seed supply will increase steadily assuming a dominant role towards the end of 2020s. Upon the implementation of Seed Vision community sector will grow faster at the initial stage and will lead in the next few years (until 2020). However, its role shall decline gradually as a result of the transformation of community groups into private companies. This will further increase the share of private sector in seed production.

Public private partnership model needs to be developed and implemented to fully utilize the existing processing plants in both public and the private sectors. This model will help to fully operate the underutilized structure owned by the public sector. For example, the VDD possesses a processing plant and an air conditioned seed store operating partially. Similarly,

²⁷ The International Seed Testing Association was founded in 1924 during the 4th International Seed Testing Congress held in Cambridge, United Kingdom. Currently its membership consists of about 176 member laboratories, 48 personal members and 22 associate members, from 74 countries around the world. The primary purpose of the Association is to develop, adopt and publish standard procedures for sampling and testing seeds, and to promote uniform application of these procedures for evaluation of seeds moving in international trade (<http://www.fabinet.up.ac.za/seeds/science/ISTA>).



seed processing plants and storage structure of NSCL and processing plant in Khairenitar, community seed processing facilities at Lumle and Horticulture Station, Sarlahi are not fully utilized. These facilities can be brought under operation in the PPP model.

Processing plants installed recently by private and community sectors also need to be brought to full operation by strengthening the partnership between public and private sectors. All stages of value chain: variety development, seed multiplication, processing and conditioning and marketing through PPP offer investment opportunities.

Seed Vision proposes public sector to develop inbred lines and hand over them to private seed companies adopting appropriate procedures and guidelines for further multiplication. This could be one of the models for public private partnership on hybrid research. Proposition is that the government should support to establish some viable and strong seed companies by availing required land on lease. It should also provide funding to the companies as grants and subsidies and also exempt tax and customs for seed equipments and machineries as well as skilled manpower for a fixed period.

Taking into account the role of seed sector in agricultural development, and the results of value chain analysis, seed development strategy should focus on: 1) Strengthening varietal development and maintenance breeding component 2) Creating enabling environment for all stakeholders' participation in seed multiplication, processing and conditioning through an established competitive seed industry in eco-friendly manner 3) Enhancing marketing skills of seed entrepreneurs and investing in seed related infrastructure 4) Promoting the use of good quality seeds for seed security and crop productivity improvement through seed regulation and marketing extension, and 5) Supporting the development of efficient and effective seed related organizations (NGOs, seed companies, cooperatives and GoN institutions and academic institutions) with business culture through appropriate monitoring and evaluation system.

3.8 Conservation and sustainable use of indigenous genetic resources

At present, over 90 percent of the seed is supplied by informal sector, which includes local seed savings, exchange, and local purchase. However, it is observed that many land races and indigenous genetic resources are on the verge of extinction. These precious genetic resources are very much crucial for the development of climate resilient high yielding competitive varieties in future. In addition, conservation and management of diversity can also help in local seed security and in enhancing livelihoods of resource crunched farmers in marginal areas²⁸, particularly in the hills and mountains, where formal seed system does not function well. Appropriate programmes, institutional linkages, and policies need to be worked out explicitly in order to strengthen the capacity of farmers and other stakeholders for the conservation and sustainable use of these precious genetic materials. Special attention is required to be given in using these valuable resources for sustained crop improvement and in meeting local seed security²⁹. Therefore, the rights of farmers and local communities need to be protected for equitable access and a fair share of benefits. Farmer rights to save, use, exchange, share or sell farm produce of all varieties will be protected. Farmers shall not be entitled to sell branded seed of a protected variety under the brand name.

The proposed Plant Variety Protection and Farmers' Rights Bill (2005) will guarantee a balance of rights between farmers and breeders. It will promote investment in plant breeding, research, and technology transfer particularly from the private sector. Moreover, it aims to protect the rights of farmers and that of a community on genetic resources, which will promote farm seed saving and local seed exchange in the community. Such a genuine form of *sui generis* system could help Nepal in working out balanced IPR systems that are more appropriate for its own needs and priority.

3.9 Sensitivity analysis

Sensitivity analysis of seed crops was carried out in order to observe changes on the yielding level of seed, seed production and also to assess crop value of selected key food crops and vegetables when yield growth rate of these crops changes under different conditions (low, moderate and high growth scenario) of the country (Table 3.15). High yield level is assumed given a strong political will and commitment to fully implement Seed Vision backed by political stability and favourable economic scenario. Moderate yield level is expected when Seed Vision strategies are implemented within a certain level of political and economic stability. Low yield level might occur where Seed Vision is not implemented. Projection for yield increment is estimated based on the projected yield level of the selected crops, scientific assessment of technological progress of specific crops, and potential future yield and targeted yield achievements of the crops (Annex 3.7 and Annex 3.8). The total value of production was analysed using statistical tool (T test). When compared with the base scenario (2009), all growth

²⁸ Gauchan, D., B. Sthapit and D. Jarvis. Editors (2003). Agrobiodiversity Conservation On-farm: Nepal's Contribution to a Scientific Basis for National Policy Recommendation. International Plant Genetic Resource Institute (IPGRI), Rome, Italy.

²⁹ Sthapit, B.R., M.P. Upadhyay, P.K. Shrestha, and D.I. Jarvis Editors (2005). On-farm Conservation of Agricultural Biodiversity in Nepal. Volume I and II: Proceedings of the Second National Workshop, 25–27 August 2004, Nagarkot, Nepal. International Plant Genetic Resources Institute, Rome, Italy.

scenarios were found notably significant. Taking base scenario as 100, relative index for low, moderate and high scenarios were found as 144, 164 and 186 respectively. Moderate scenario of yield growth was used for the purpose of Seed Vision, which is highly likely to occur granted that the suggested seed strategies are fully implemented.

Table 3.15: Sensitivity analysis of seed supply and value of crop production in different yield scenario by 2025

crops	Base line (2009)	Low growth	Moderate growth	High growth
Rice				
Seed yield (mt/ha)	1.90	2.31	2.66	2.94
Improved seed prod (mt)	6,768	16,870	19,450	21,449
Seed replacement rate (%)	9.14	21.01	24.25	27.00
Crop production (mt)	4,023,823	5,293,919	6,103,552	6,730,869
Value of crop production (000 Rs)	60,357,345	79,408,784	91,553,282	100,963,032,
Maize				
Seed yield (mt/ha)	1.38	1.95	2.16	2.34
Improved seed prod (mt)	1,146.00	5,529.00	6,132.00	6,624.00
Seed replacement rate (%)	6.5	28.46	31.57	34.00
Crop production (mt)	1,855,184	2,916,134	3,234,159	3,493,764
Value of crop production (000 Rs)	22,262,208,	34,993,602,	38,809,906,	41,925,168,
Wheat				
Seed yield (mt/ha)	1.49	1.89	2.17	2.45
Improved seed prod (mt)	8,244	17,902	20,570	23,214
Seed replacement rate (%)	9.40	20.00	22.53	25.00
Crop production (mt)	1,556,539	2,054,423	2,360,580	2,663,972
Value of crop production (000 Rs)	28,017,702,	36,979,621,	42,490,448,	47,951,496,
Lentil				
Seed yield (mt/ha)	0.57	0.66	0.73	0.84
Improved seed prod (mt)	231	1,685	1,862	2,224
Seed replacement rate (%)	3.08	19.95	22.04	25.14
Crop production (mt)	151,758	200,4517	221,456	252,624
Value of crop production (000 Rs)	7,587,900,	10,022,593,	11,072,800,	12,631,216,
Vegetables				
Seed yield (mt/ha)	1.00	1.42	1.50	1.60
Improved seed prod (mt)	1,009	2,478	2,407	2,793
Seed replacement rate (%)	66.30	85.25	90.00	96.05
Crop production (mt)	3,003,821	4,736,750	5,404,431	6,398,335
Value of crop production (000 Rs)	60,076,420,	94,734,993,	108,088,621,	127,966,697,
Total values of production (000 RS.)	178,301,575	256,139,595	292,015,058	331,437,612
Relative Index	100*	144**	164**	186**
* = significant at 5 % level and ** indicates significant at 1 % level				

4 SEED VISION OBJECTIVES AND STRATEGIC DIRECTIONS

Vision: Quality Seed for the well-being of farming families.

Mission: Produce and manage the supply of quality seeds to all farmers through a sustainable and competitive seed system.

Goal: To increase crop productivity, raise income, and generate employment opportunities through self sufficiency, import substitution and export promotion of quality seeds.

General objectives of the Seed Vision are:

1. To enhance farmers' access to sufficient quantity of quality seeds and other planting materials.
2. To increase seed replacement rate through increased production and supply of quality seeds.
3. To promote local seed security through conservation and sustainable use of agro biodiversity.
4. To create an enabling environment for developing, producing and marketing quality seeds of improved varieties of agricultural crops.

Strategic directions

Following strategies will be adopted to attain the objectives mentioned above:

1. Promote use of quality seeds by expanding farmers' choice including use of local genetic resources.
2. Support public, community and private enterprises in source seed production, seed multiplication, processing and conditioning through efficient seed quality services.
3. Strengthen varietal development, release, and maintenance breeding using diverse gene pool both from local and exotic sources at different agro-ecological zones of the country.
4. Enhance marketing skills of seed entrepreneurs and invest in seed related infrastructure.
5. Create enabling environment for developing efficient and effective public, community and private seed related organizations with business culture.

The Seed Vision 2013 - 2025 provides strategic orientation and vision besides being a milestone for specific outputs and impacts over a specified period of time. The vision presents key enabling factors and implementation guidelines required to meet the expected results towards the development of a sustainable seed system in Nepal.

5 SEED SECTOR DEVELOPMENT STRATEGY

There has been a growing recognition and empirical evidences signifying that agriculture has a major role to play for sustainable economic growth³⁰. Agriculture is the important sector of the economy promising a sustainable growth. Raising productivity is the key to agricultural growth thereby reducing food insecurity. Agriculture provides a broad base to the national economy. About seventy percent of the households constitute agricultural holdings in Nepal. These households derive nearly half of the income from agricultural sources consisting of farm income and agricultural wages. National growth based on agriculture holds high potential to have relatively wider impact on poverty reduction and inclusiveness³¹. However, the present yield of most of the crops is far below the Asian standards. New crop varieties and good quality seeds are the most viable options to improve agricultural production and food security in a sustainable manner. Therefore, a pragmatic, holistic, and evidence based medium term vision strategy is proposed for the development of seed sector in Nepal. This sectoral development strategy (Seed Vision 2013 - 2025) will adopt an integrated approach encompassing both public and private sectors for varietal development, seed multiplication, seed marketing and use through seed value chain. The strategy envisages a competitive development of seed sector with an increasing involvement of private sector. A log frame prepared for the Seed Vision is summarized in Annex 5.1. The outcome of the Seed Vision strategy will be increased production as well as distribution of good quality seeds. The outcome level achievement will be measured by two main indicators:

- Percentage of yield increased through the use of newly developed and released varieties of major food, vegetable and cash crops.
- Percentage of increased income and employment through quality seed use.

The outcome will contribute to achieve the goal of improving the well being of farming families through competitive seed sector development in Nepal.

5.1 Strategies and implementation guidelines

As stated in Section 4, there are five main strategies in this vision. Each strategy will have three sub-strategies at the national and lower levels (federal/ regional/district or community, household, and individual) as presented in Table 5.1.

Table 5.1: Proposed strategies for implementing Seed Vision 2013 - 2025

SN	Strategy
100	Strategy 1: Promote use of quality seeds by expanding farmers' choice including use of local genetic resources and agro-climatic regions.
110	Strategy 1.1: Improve policies and practices on reducing the use of low quality seeds.
120	Strategy 1.2: Develop and support a participatory process for quality seed use planning.
130	Strategy 1.3: Enhance the capacity of households in using locally available genetic resources and in buying seeds from reliable private sectors.

³⁰ DFID (2003) Agriculture and Poverty: unlocking the poor, A DFID policy paper.

³¹ World Bank (2008). Agricultural for development. World Development Report. The World Bank, Washington DC. USA.

200	Strategy 2: Support public, community and private enterprises in source seed production, seed multiplication, processing and conditioning through efficient seed quality services.
210	Strategy 2.1: Improve system for source seed production, seed multiplication steps (BS-FS-CS-IS) with active participation from private sector and government collaboration.
220	Strategy 2.2: Support in implementing devolved seed production system including quality assurance.
230	Strategy 2.3: Strengthen the capacity of farmers, households and cooperatives for local level seed saving, multiplication and storage.
300	Strategy 3: Strengthen varietal development, release, and maintenance breeding using diverse gene pool both from local and exotic sources for different agro-ecological zones of the country.
310	Strategy 3.1: Strengthen commodity research programmes in variety development and maintenance breeding both in public and private sectors.
320	Strategy 3.2: Support regional and local governments and private institutions in the development, maintenance and release of location-specific crop varieties.
330	Strategy 3.3: Enhance access of new seeds and information to households and individual through participatory breeding and use of local genetic resources.
400	Strategy 4: Enhance marketing skills of seed entrepreneurs and invest in seed related infrastructure.
410	Strategy 4.1 Develop and strengthen seed networks, seed dealers and seed supply channels in public and private sectors.
420	Strategy 4.2: Support local institutions ³² to plan, produce and market quality seeds.
430	Strategy 4.3: Support people using knowledge and skills on good quality seed use.
500	Strategy 5: Create enabling environment for developing efficient and effective public, community and private seed related organizations with business culture.
510	Strategy 5.1: Develop a system and or support NSB (widen its scope) on seed related information collection, processing and dissemination.
520	Strategy 5.2: Promote seed entrepreneurs and community groups to make their small and microenterprises competitive.
530	Strategy 5.3: Enhance linkage and coordination among different seed sector stakeholders and facilitate public-private partnership in promoting competitive seed business.

AMN - Activity Matrix Number

Proposed seed sector development strategy is based on existing organizational structure and practices. The structure and practices may require reviews as we move ahead through “learning by doing.” In order to make seed systems effective, the following key implementation guidelines or recommendations are suggested as per the strategies mentioned above.

Varietal development and maintenance breeding

- *Investment and institutional strengthening:* Increase investment in public and private sectors to conduct research for variety development and maintenance breeding including hybrids. Develop and strengthen human resource in modern plant breeding including participatory plant breeding (PPB). Create essential infrastructure (research laboratory, storage, threshing, and processing equipments) for source seed production. Establish research stations in private sector.

³² Local institution refers to locally elected bodies, CBOs, NGO, seed cooperatives, seed companies, seed enterprises, etc.

- *Incentives to plant breeders:* Explore and develop incentive scheme for breeders and farmers. Finalize and enact Plant Variety Protection Act to provide incentives to private sector and individual scientists in plant breeding. Facilitate individuals, NGOs, seed companies and cooperatives to develop and promote location specific varieties.
- *Genetic improvement and variety maintenance:* Implement genetic improvement activities based on comparative advantage of important cereals, pulses, oil seeds, industrial crops, vegetables, fruits, medicinal plants and forage crops, in partnership with private sector. Designate farms stations (under NARC, DoA, and DoLS) and pockets for maintenance of released varieties and biodiversity conservation. For pre-released varieties, explore and assign - breeder, public and private institutions and communities - for varietal adaptation, improvement and maintenance. Establish broader genetic base and biodiversity of crops and varieties using local land races, exotic germplasm and their wild relatives for developing climate resilient and nutrition rich varieties.
- *Hybrid and modern plant breeding research:* Support in developing technologies to adopt modern plant breeding techniques including genetic engineering, tissue culture, and biotechnology for the production of high quality seeds and planting materials. Support private and public research institutions to develop hybrids in order to reduce dependency on foreign seed companies. NARC should have a separate hybrid research units under each National Commodity Programme and division with adequate fund and human resources. It should come up with a long term vision in this regards, to be implemented without delays.
- *National and international linkage:* Develop, strengthen and use linkages with national and international institutions and academia. Strengthen capacity of National Agriculture Genetic Resource Centre (gene bank). Promote linkage between national gene banks, regional and international seed banks and community seed banks for exchange of materials and information for biodiversity conservation.
- *Capacity building:* Strengthen and support local governments and communities to develop mechanism for monitoring seed research and provide feedback to crop breeders. Enhance scientific capacity for varietal development and maintenance including hybrid breeding at all levels, in both public and private sectors.
- *Policy Issues:* Develop policy guidelines for hybrid research and partnership modality with private sector. Simplify varietal approval and registration process for local land races as well as farmers developed varieties. Revisit the growing domain of registered/released varieties, develop policies in strengthening public and private farms and stations as resource centres for source seed production. Formulate policy guidelines in developing human resources by providing grants and scholarships to those committed to work devotedly on particular crops breeding for at least 5 years.

Seed multiplication

- Community based seed production: Decentralize participatory seed production planning (DISSPRO, CBSP and CSB) with the proper guidelines and support of NARC outreach

sites, DoA and DoLS resource/service centres. Support community based seed producer groups and co-operatives in quality seed production, processing and marketing - linking them with research, extension and market. Strengthen community based seed production groups to promote them into cooperatives and seed companies through institutional development including governance. Promote use of promising local genetic resources in community seed banks and community based seed production stations.

- *Private sector seed production:* Support private seed companies for - infrastructure development, fund and required human resources to produce hybrid seeds of selected crops in Nepal. Develop resource sharing modalities for public private partnership for seed multiplication including hybrids. Strengthen the capacity of private sector for hybrid seed multiplication using inbred lines both from public and private sectors. Provide private sector with fund and other required resources and supports for - networking, regular planning, implementation and monitoring of seed programmes through regular interactions among public, private and communities to foster development of healthy growth of seed industry. Establish seed multiplication farms.
- *Public sector support to seed production:* Identify and map seed production zones and pockets. Intensify the existing zones and expand to new areas. Integrate community seed bank and district level seed production initiatives e.g. DISSPRO, CBSP and CSMP and into regular district level seed programmes and institutionalize the best practices. Support local seed production in remote areas like Karnali zone on government farms or even on leased farms and discourage transporting of seeds from Terai and mid hills. Emphasize private sector's lead in Terai and market accessible areas and community sector (farmer groups and cooperatives) in rural and remote areas particularly in hills and mountainous regions.
- *Custom seed production:* International seed companies are entitled to grow and multiply their seed (stock, foundation) in specified area of Nepal. The concerned seed company is responsible for production, purchasing and marketing of the seed. Such a venture shall benefit Nepali farmers and also the country through revenue.
- *Quality control support:* Promote the use of quality seeds at all levels. Instruct national, regional, district and village level institutions to follow the SQCC balance sheet. Monitor all types of seeds (breeder, foundation, certified, and improved seeds) and provide tagging and certification services for breeder and foundation seeds. Implement mandatory genuine labelling practice for improved seeds. Conduct trainings on seed production, technology, quality control, post harvest handling, marketing and seed use. Strengthen institutional and physical capacity of RSTL and GMO laboratories. Strengthen private laboratories. To facilitate export and meet quality assurance standard seed certification procedures shall be adopted in conformity with OECD.
- Monitor and support in delivering seed testing services.
- *Policy issues:* Formulate and enforce Contract Farming Law binding both producers and buyers to follow the agreed terms and conditions including price, quality and quantity of

seed. Formulate or amend acts and regulations to protect the rights of seed producers in quality control operations and also protect the rights of the farmers. Develop and facilitate seed crop insurance schemes. Harmonize rules and regulations for free movement of seeds across districts and production zones. Create policy environment for foreign direct investment and joint venture in seed business including tax incentives.

Seed processing and conditioning

- *Investment on seed processing:* Modernisation of seed processing facilities will be encouraged through the adaptation of modern equipment and latest techniques. Increase investment in seed infrastructure (storage, processing, packaging, and grading) and seed testing laboratories in different regions and domains both for public and private sectors. In remote areas (hills and mountains), provide support in developing seed collection centre with mobile processing units for local seed production and distribution. To store seeds at farm level scientific storage facilities will be popularized and technique of scientific storage of seed will be promoted.
- *Capacity building:* Develop and train human resources in private and public sectors (plant engineers and seed technologists among others) on post harvest technology and seed infrastructure.
- *Public private partnership:* Develop guidelines for PPP for effective utilization of underused seed processing plants and storage facilities. Handover underutilized mini houses (constructed by SPISP project during 1980s) to local seed production groups, cooperatives and private seed companies.
- *Policy Issues:* Subsidize and provide long term soft loan and grants to private sector for the establishment and operation of processing plants in different regions and domains based on volume and scale of production coordinating with financial institutions.

Seed marketing

- *Seed network:* Develop and strengthen seed network of dealers, and seed supply channels in public and private sectors. Develop and network district level seed committee to regional and national level as functional mechanism for planning and coordination.
- *Seed marketing infrastructure:* Develop national seed market centres equipped with seed yards, seed godown and storage facilities. Facilitate seed auctioning through appropriate institutional framework. Develop regional market centres based on volume and scale of production.
- *Enhancement of marketing skills:* Develop institutional base for seasonal forecast on demand and supply of quality seeds. Support local institutions to plan and market quality seed. Train seed entrepreneurs in enhancing their business developing marketing skills and knowledge.
- *Seed extension and market promotion:* Promote seed of new varieties through extension programmes, e.g. demonstrations, PVS, seed minikits, etc. Support market campaigns for promoting local seed distribution through seed fairs, exhibitions, and tours as well through print and electronic media.

- *Seed export promotion:* Support seed production of identified varieties in selected pockets for export. Provide incentives to seed exporters for custom seed production through one window policy.
- *Capacity building:* Strengthen the capacity of local institutions (NGO, CBO, Cooperatives, DDC and VDC) to market, monitor, analyze and disseminate information on current and future demand for good quality seeds. Promote skills of seed entrepreneurs to make their small and medium micro enterprises competitive.
- *Policy issues:* Devise plans and policies to protect the rights of farmers and communities in specific geographical domain. Facilitate free movement of seeds and planting materials in its recommended domain through exemption of taxes.

Seed use

- *Seed campaigns:* Support increasing awareness on quality seed use through seed extension and campaign via FM radio and other media. Develop training materials and manuals on - seeds production and marketing, and disseminate those for wider use. Invest on popularization of newly released varieties.
- *Market monitoring in retailer chain:* Conduct a regular monitoring of seed quality along retailer chains. Reward retailers involved in the promotion of locally produced quality seeds.
- *Consumer rights:* Educate seed users to protect their rights and on their access to quality seeds.
- *Policy Issues:* Provide subsidy on quality seed targeted to poor, women, disadvantaged and vulnerable households for home gardens, and semi commercial seed users (for domestic consumption and semi commercial use). Prepare seed vulnerability map periodically. Provide subsidy to domestically developed new OP and hybrid varieties for a prompt popularization. Enhance the capacity of seed growers to produce and store quality seeds.

Planning, coordination, monitoring and regulation

- *Planning, coordination and monitoring:* Review and restructure NSB to make national seed system functional, competitive and sustainable. Coordinate and regulate seed programmes implemented by different agencies streamlining production and marketing in order to avoid duplication of activities and resources. Ensure smooth coordination between selected authorities designated by the National Seed Board for quality seed production and marketing. These authorities include different institutions under the Ministry of Agricultural Development, National Planning Commission Secretariat, Ministry of Finance, Ministry of Commerce and Supplies, Ministry of Industry, Ministry of Land Reform and Management, Ministry of Federal Affairs and Local Development, Ministry of Environment, Science, and Technology, and Ministry of Forest and Soil Conservation. Strengthen National level seed planning and monitoring sub-committee comprising of representatives from ministry, departments, NARC, SQCC, SEAN, seed related NGOs and scientists and seed growers. Focus community seed programmes in remote and mountainous regions and promote private led seed production in accessible commercial production pockets. Make district development committee responsible for

district level seed planning, resource mobilization including VDC/DDC local agriculture development funds, implementation and monitoring. Promote annual experience sharing and learning workshops involving stakeholders at all levels.

- *National seed information database:* Develop a system and or support NSB on seed related information collection, processing and dissemination. Conduct review and studies on problems encountered in seed sector development as to take informed policy decisions. Conduct regular national seed survey every five years.
- *Regulation of seed programmes:* Upgrade regional seed laboratories to regional seed quality control centres under National Seed Quality Control Centre. Regulate seed act and regulations through seed crop inspectors and seed testing services. Harmonize seed policies, regulations and standards across SAARC countries and beyond. Harmonize Seed Act, 1988 and Plant Protection Act, 2008 in coordination with National plant quarantine programme and custom department. Create enabling policy environment for joint venture of national companies with international seed companies. Develop policies for seed crop insurance and arrange buffer stocks for emergency and crop failures. Develop framework for conserving indigenous resources and protect the rights of farmers and community. Develop policy guidelines on import and export of hybrid seeds. Coordinate, facilitate and regulate seed programmes at various levels including quality control involving private sectors in seed business. Develop policy guidelines for research, development and use of GMOs. Regulate general use of GMOs in Nepal.
- *Capacity building:* Strengthen human resource (seed specialists) in all districts and production pockets. Establish a mechanism to provide national awards for extraordinary seed traders, seed entrepreneurs and seed scientists.

5.2 Enabling factor, milestones and indicators

Enabling factors contributing to the achievement of outputs in each component of the value chain are identified, milestone for enabling factors established and indicators of the milestones proposed. Furthermore, these enabling factors, milestones and indicators have been worked out for national (Table 5.2), district/ community (Table 5.3) and household levels (Table 5.4).

Table 5.2 : National level milestones and indicators for seed development strategies			
Enabling Factors	Milestones	Indicators	Definition of Indicators
Varietal development and maintenance breeding			
Commodity research programmes in variety development, and maintenance breeding	National Research programmes covers key food crops, cash/industrial crops, vegetables, forage, herbs, flowers and tree crops.	<ul style="list-style-type: none"> No. of farmer preferred general and hybrid varieties developed and released. Percentage of resource allocated to plant breeding and varieties maintenance. No. of crops/ varieties, developed through PVS both in public and private sectors. 	Preferred varieties are of high yielding, wide adaptability and stress tolerance with good quality attributes. Resource include both financial and human.
Seed research issues in national plans and policies including forthcoming ADS.	New policies and plans include seed research issues.	<ul style="list-style-type: none"> No of new national plan and policies with seed research issues included. 	Policies and plans of NPC, MoAC, and NARC.
Private sectors supported through technology, infrastructure and enabling policies	Increasing capacity of private sectors in variety development and maintenance.	<ul style="list-style-type: none"> No of general and hybrids varieties developed and promoted by private sector. Increased private sector investment in variety development and maintenance breeding. 	Private sector includes seed companies, individuals, NGOs and Cooperatives.
Grermplasm exchange, plant breeding research and technology transfer.	Increased access and use of international plant breeding materials.	<ul style="list-style-type: none"> No of collaboration with international institutions (public and private) involved in plant breeding. 	International institutions includes IARC, Universities and Multinational companies (MNC)
Scientific capacity in modern plant breeding techniques.	Use of modern techniques in variety development and maintenance.	<ul style="list-style-type: none"> No of research scientists. No of research publication in plant breeding. 	Research scientist includes personnel with at least post graduate degree and involved in plant breeding both in public and private sectors.
Linking national gene bank with crop breeding and on-farm conservation.	Linkage of plant breeders and farmers with national gene bank improved.	<ul style="list-style-type: none"> No of accessions used by breeders and farmers by crops. 	Accession registers maintained at national and community levels.
Seed multiplication, processing and conditioning			
Maintenance of Seed multiplication steps	Increased seed replacement rate (SRR).	<ul style="list-style-type: none"> Rate of seed multiplication in prescribed steps (BS-FS-CS-IS) 	The multiplication rate includes ratios from BS-FS-CS-IS.
Mechanisms of seed planning.	Seed policies and plans involve joint meetings between public and private sectors.	<ul style="list-style-type: none"> No. of seed planning workshop organized with private sectors Demand and supply balance sheet prepared and monitored at least annually. 	Balance sheet for BS-FS-CS-IS prepared separately.
Devolved seed production system	Involvement of wide spectrum of private sectors in source seed production.	<ul style="list-style-type: none"> Increased share (%) of seed produced by private sectors. Increased number of private sectors involved in source seed production 	Source seed includes both breeder and foundation seed.
Public and private investment in seed infrastructure	Strengthening of National seed infrastructure	<ul style="list-style-type: none"> Increased investment in processing and conditioning infrastructure No. and capacity of processing plants and storage structures. 	Capacity of the processing plant refers to process the seed in mt. Storage capacity refers to conditioned capacity to store safely at least for one season.
Public private collaboration	Strengthening Public Private Partnership	<ul style="list-style-type: none"> No. of collaboration established for variety development, seed multiplication, processing, conditioning and marketing 	Collaboration increases investment in seed sector.
Capacity building of seed specialists and	Enhanced capacity achieved	<ul style="list-style-type: none"> Increased number of trained seed specialists and seed entrepreneurs 	Includes both in public and private sectors.

entrepreneurs			
Integration of seed production into new national policies & strategies.	New policies and plans include seed multiplication and marketing issues.	• No. of new national plan and policies with seed multiplication issues included.	Policies and plans of NPC, MoAD, DoA, DoLS, and NARC.
Seed marketing			
Seed networks, seed dealers and seed supply channels.	Multi-stakeholders involved in seed supply.	• No. of wide variety of channels established and maintained.	Multi-stakeholders include seed companies, individuals, NGOs and Cooperatives, Agrovets, etc.
Prompt popularization of new seed varieties.	New varieties popularized.	• Rate of popularization (number/year).	Rate of popularization includes varieties by regions, and types.
Seed export promotion.	Nepal produced seeds promoted in foreign countries both by public and private agencies.	• No of foreign seed companies with established business link by countries. • No. of seed fairs organized.	Formal link between Nepal and foreign seed agencies.
Collection, monitoring and dissemination of market information.	Market information on seed collected, analyzed and disseminated.	• Inclusion of market information on seed in electronic and print media. • Quantity of seed exported.	Market information includes quality, quantity, price, areas of production and yield potential.
Foreign and domestic private sector investment in seed business.	Investment diversified.	• Share of foreign investment in seed business increased.	Share includes the investment by foreign and domestic private sectors.
Modality for protecting farmers' rights.	Indigenous germplasms, local varieties and local knowledge protected.	• Plant Variety Protection Act to be revised and endorsed by the government. • Framework for protecting farmers' rights prepared discussed and implemented.	Farmers' rights understood as per International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA).
Quality seed use			
Reducing the use of low quality seed.	Use of low quality seeds reduced.	• Increasing percentage of area covered by seeds from formal sector.	BS-FS-CS-IS from formal sector (public, private companies, cooperatives, DISSPRO and CBSP) are: truthfully labelled, certified and quality maintained.
Mechanisms to recognize specific vulnerability of poor, women and disadvantaged groups to quality seed use.	Support poor, women and vulnerable groups in using good quality seeds.	• Resource allocated for promoting quality seed among poor, women and vulnerable groups. • No. of poor, women, vulnerable groups using government subsidized quality seeds.	Subsidized quality seed packets available for home gardens , and semi commercial use by women, disadvantaged and vulnerable households.
Mechanisms to promote quality seed use campaign.	Seed promotion campaign supported.	• Resource allocated for promoting seed campaigns and advertisements.	The resource includes allocation to both public and private institutions and communication media
Regular national seed survey.	The national survey conducted once in three years.	• No. of survey results published.	The survey conducted in consultation with concerned national commodity programmes.
Consumers rights to get quality seed.	Farmers aware of consumer rights.	• No. of cases filed under Consumer Act, 1997.	Reward and punishment for selling quality and substandard seed.
Monitoring seed market	National Seed Board conducts monitoring at national level and by qualified authorities from NSB.	• No. of traders selling substandard seed reported and action taken.	Punishment as defined by the law.
Seed handling in retailer	Seed retailing improved.	• Resource allocated and training provided for	Regular training to retailers.

chain		supporting seed handling in retailer chain.	
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Table 5.3 : Local government, federal and community milestone and indicators for seed development strategies			
Enabling factors	Milestones	Indicators	Definition of indicators
Varietal development and maintenance breeding			
Development, maintenance and release of location-specific crop varieties.	Regional research programmes covers food crops, vegetables, forage, flowers and tree crops.	<ul style="list-style-type: none"> No. of farmer preferred varieties developed and released. Percentage of resource allocated to plant breeding and variety maintenance. 	Preferred varieties are of high yielding, wide adaptability and stress tolerance with good quality attributes. Resource include both financial and human.
Facilitation in developing new plan and policy guidelines for breeding better and climate resilient varieties.	Climate resilient varieties developed and adapted.	<ul style="list-style-type: none"> No. of plans and policy guidelines with better climate resilient varieties breeding. 	Climate resilient refers to stress tolerance (heat, drought, flooding, etc).
Developing mechanism for monitoring the seed research and providing feedback to crop breeders.	Operational mechanism for feedback.	<ul style="list-style-type: none"> Established mechanism for monitoring seed research. No. of monitoring reports published. 	Monitoring cases with documentation.
Capacity in modern plant breeding techniques.	Use of modern techniques in variety development and maintenance.	<ul style="list-style-type: none"> No. of research scientists with modern breeding skills. No of research publications on plant breeding. 	Research scientists include personnel with at least post graduate degree and involved in plant breeding both in public and private sectors.
Seed multiplication, processing and conditioning			
Seed production of locally important crops varieties.	Formal sector seed production share increased.	<ul style="list-style-type: none"> Area (ha) and quantity (mt) of seed produced by crops and varieties. 	Includes seed production of foundation, source, certified and improved seeds.
Investment in seed infrastructure.	Processing and conditioning capacity enhanced.	<ul style="list-style-type: none"> Resource (amount) invested in seed infrastructure by public and private sectors. 	Seed infrastructure refers to demo farms, processing plant, laboratories and storage.
Contract seed production and insurance mechanisms.	Contract seed production procedures and terms comply.	<ul style="list-style-type: none"> No. of cases of contract breaching. Seed insurance mechanism developed. 	Breaching as explained in Contract Act, 2056.
Capacity building of seed specialists and entrepreneurs.	Enhanced capacity achieved.	<ul style="list-style-type: none"> Increased number of trained seed specialists and seed entrepreneurs. 	Seed specialist from public and private sectors.
Implementing devolved seed production system.	Involvement of wide spectrum of private sectors in source seed production.	<ul style="list-style-type: none"> Increased share (%) of seed produced by private sector including cooperatives. Increased number of private sectors involved in seed production. 	Source seed includes breeder, foundation, and certified seeds.
Seed marketing			
Plan and market quality seeds.	Local government is aware of seed planning and distribution.	<ul style="list-style-type: none"> No. of planning meetings/workshops conducted. Production and distribution plan prepared. 	Local government and line agencies include seed production and distribution plans.
Linkage with national and foreign seed companies to promote seed marketing.	Locally produced seeds promoted in commercial production pockets.	<ul style="list-style-type: none"> No. of local seed companies with established business link with national and foreign seed companies. No. of seed related extension events organized. 	Seeds from both public and private agencies included. Commercial pockets include production for market.
Farmers' rights in specific geographical domain	Indigenous germplasms and local knowledge protected.	<ul style="list-style-type: none"> National framework for protecting farmers' rights prepared. 	Farmers' rights understood as per ITPGRFA
Support popularization of new	New varieties popularized/promoted.	<ul style="list-style-type: none"> Rate of seed promotion/popularization 	Rate of popularization/promotion including

varieties in its domain.		(number/year)	varieties by locations and types.
Monitoring seed market.	Local government conducts monitoring in its domain.	<ul style="list-style-type: none"> No of traders selling substandard seeds reported and action taken. 	Bad quality seed includes low germination and low varietal purity.
Seed use			
Participatory process for seed use planning.	Wide spectrum of stakeholders involved.	<ul style="list-style-type: none"> No. of joint seed planning events organized. 	Joint planning meetings include production and marketing workshops..
Women and marginalized groups participate in local seed use planning processes.	Needs of women and marginalized groups attended.	<ul style="list-style-type: none"> Percentage of women and marginalized groups involved in seed use planning. 	Marginalized groups as defined by GoN.
Access to and control over local government resources for seed and planting material.	Local government is aware on the importance of access and control over quality seed use.	<ul style="list-style-type: none"> No. of beneficiaries accessing local government resources for seed use disaggregated by sex and socio economic groups. 	Resources allocated for seed promotion and campaigning included.
Regular assessment of seed use.	Local government is aware of quality seed use.	<ul style="list-style-type: none"> Assessment documented and disseminated. 	Regular assessment of crops and varieties in seasonal basis (winter and summer).
Monitor seed use in local market.	Local government conducts seed use monitoring in its domain.	<ul style="list-style-type: none"> No. of traders selling substandard seeds reported and action taken. 	Substandard seed includes low germination and low varietal purity.

Table 5.4 : Household level milestones and indicators for seed development strategies			
Enabling factors	Milestones	Indicators	Definition of Indicators
Varietal development and maintenance breeding			
Access of new varieties and information to households and individuals.	Farmers' access to new varieties & seed increased.	<ul style="list-style-type: none"> Percentage of households planting seed produced through conventional and Participatory Variety Selection (PVS) methods. 	PVS method includes participation of farmers and other clients in variety selection.
Climate resilient varieties.	Climate resilient varieties selected and adapted by farmers.	<ul style="list-style-type: none"> No. of climate resilient varieties adapted. 	Climate resilient refers to stress tolerance (heat, drought, flooding, etc).
Breeding and maintenance of farmer preferred crop varieties.	Farmers' capacity on crop breeding and maintenance improved.	<ul style="list-style-type: none"> No. of farmer preferred varieties selected and maintained by crops. No. of farmers with crop breeding skills. 	Cooperating farmers in FFT and PVS.
Mechanism for information flow and feedback.	Mechanism established.	<ul style="list-style-type: none"> No. of electronic and print media used for information flow 	Electronic media includes FM radio and television.
Seed multiplication			
Seed saving, multiplication and storage capacity.	Capacity to save, multiply and store with scientific methods.	<ul style="list-style-type: none"> No. of seed savers and growers. 	No. of farmers trained in seed saving and growing recorded.
Diversified sources of quality seeds.	Source diversified.	<ul style="list-style-type: none"> Number of sources diversified. 	Sources include seed companies, CBSP, NSCL and neighbours.
Risk management of unavailability of seeds.	Farmers have better knowledge of seed planning and management.	<ul style="list-style-type: none"> Increased number of household managing risk. 	Includes HH with proper seed planning and stock keeping.
Seed marketing			
Social and economic safety nets	Social and economic safety nets established.	<ul style="list-style-type: none"> No. of households with CBO membership including savings and credit organizations. 	CBOs provide financial services and safety nets to its members.
Access to seasonal forecasts of demand and supply	Use of seasonal demand and supply information.	<ul style="list-style-type: none"> No. of households having knowledge of seasonal seed demands and supply in local domain. 	Seed demand and supply of villages and communities considered.
Knowledge and skills to use good quality seeds	Knowledge and skills enhanced.	<ul style="list-style-type: none"> No. of farmers with enhanced knowledge and skills. 	Enhanced knowledge and skills on seed marketing counted.
Access to seed requirement information	Information used for production planning.	<ul style="list-style-type: none"> No. of HH with pre-planned seed requirement and production planning. 	Pre-planning helps to plant the crops on time.
Access to public sector seeds marketed by private sector	Public Private Partnership (PPP) promoted.	<ul style="list-style-type: none"> No. of PPP activities conducted. 	PPP includes collaborative actions with resource sharing.
Seed use			
Capacity for financial resources	Financial capacity enhanced.	<ul style="list-style-type: none"> No. of households buying seed from private sector. 	Private sectors include seed companies, NGOs, agro-vets, cooperatives, DISSPRO and CBSP.
Support equal rights and access to information, skills, services on seed use	Information, skills and services accessed by men, women and marginalized groups and equal rights utilized.	<ul style="list-style-type: none"> No. of men, women and marginalized groups having access to information, skills, services on seed use. No. of men, women and marginalized groups exercising their rights. 	Rights defined as per draft PVP Act (2005) of Nepal.
Production and use of good seed for food security.	Production and use of quality seed increased.	<ul style="list-style-type: none"> No. of households using quality seed. 	Quality seed refers to seeds with high purity & germination.

5.3 Activity action matrix

The activity action matrix for short (S), medium (M) and long-term (L) period with the estimated costs and role of implementing organizations is presented in Table 5.5.

Table 5.5: Activity action matrix

SN	Major activities proposed for implementing Seed Vision 2013 - 2025	Tentative cost (million rupees) per annum			Terms (S/M/L)	Responsibility
		Total	Government Sector	Private Sector		
100	S1: Promote quality seed use for seed security and crop productivity improvement through seed marketing extension.					
110	<i>S 1.1: Improve policies and practices on reducing the use of low quality seeds.</i>					
111	Develop government mechanisms to recognize specific vulnerability of poor, women and disadvantaged groups to quality seed use.	5	5		S	MoAD, NSB
112	Allocation of resource and develop mechanisms to promote quality seed use campaign.	25	20	5	S	MoAD, DADO, DOLS, Private
113	Conduct regular national seed survey.	4	4		S M L	NSB, DoA, DoLS
114	Protect consumers' rights to obtain quality seed.	2.5	1.5	1	S M	NSB, CU
115	Monitor seed market.	10	10		S M L	NSB, ABPMDD
116	Support seed handling in retailer chain.	45	15	30	S M	ABPMD, Private
120	<i>S1.2: Develop and support a participatory process for seed use planning.</i>					
121	Support women and marginalized groups to participate in local seed use planning processes.	15	10	5	S	DADO, DLSO, DDC, NGOs/CBOs
122	Involve private sector in formulating plans and policies and control over critical resources for seed and planting material.	10	5	5	S	DDC, DADO, DLSO, NGOs/CBOs Private
123	Conduct regular assessment of seed use.	25	25		S M L	NSB, DADO, DoLS
124	Monitor seed use in local market.	15	10	5	S M L	DADO, DoLS, Private
130	<i>S1.3: Enhance household's capacity for financial resources to buy seeds from private sectors.</i>					
131	Support rights and enhance access of women and marginalized groups to information, skills and services for seed use.	10	6	4	S M L	DADO, DLSO, DDC, NGOs/CBOs
132	Produce and use quality seed for food and nutritional security.	10		10	S	HH, Farmers
200	S2: Create enabling environment for all stakeholders' participation in seed multiplication, processing and conditioning through an established competitive seed system.					

210	<i>S2.1: Improve system for seed multiplication steps (BS-FS-CS/IS) with private sectors' active participation.</i>					
211	Develop mechanisms of adequate seed planning for source and other seeds.	1	1		S M	NSB/MoAD
212	Facilitate implementation of devolved seed production system.	5	3	2	S M L	NSB, DoA, Private
213	Invest in seed infrastructure at public and private sector.	10	2	8	S M L	DoA, Private
214	Enhance collaboration with domestic and multinational seed companies for seed multiplication and buffer stocks.	5	0.5	4.5	S M L	MoAD, DoA, Private
215	Capacity building of seed specialists and entrepreneurs.	10	6	4	S M L	NARC, DoA, AETD, DoLS, NGOs, CBOs, Private
216	Integrate seed production and development into new national policies & strategies -e.g. ADS.	1	1		S M L	MoAD/NSB
220	<i>S2.2: Support in implementing devolved seed production system.</i>					
221	Support public, CBSP, private and cooperatives on seed production of locally important crops and varieties.	15	6	9	S	DoA, NARC, DDC/RD/, NGOs, CBOs, Cooperatives
222	Increase investment in local level seed infrastructure including laboratories in public and private sectors.	50	40	10	S M	RSTL, RS, NSCL, Private sector
223	Develop and facilitate rules and regulations for contract seed production and insurance mechanisms.	1	1		S	RSL, DADO, DLSO
224	Legally protect the rights of seed producers & consumers.	5	2	3	SML	DADO, DLSO, VDC, DDC, private sectors, NGOs CBOs, Private
230	<i>S 2.3: Strengthen households and farmers' capacity for local level seed saving, multiplication and storage.</i>					
231	Households having diversified sources of quality seeds. Encourage farmers to multiply store and save the better seeds.	5	2	3	S	DADO, DLSO, VDC, DDC, NGOs
232	Manage risk of seed deficiency/unavailability by proper seed planning and maintain bufferstock.	2.5	1.5	1	S M L	DADO, DLSO, VDC, DDC, NGO
300	S3: Varietal development and maintenance breeding component					
310	<i>S3.1: Strengthen national commodity research programmes in variety development and maintenance breeding</i>					
311	Emphasize seed and variety research issues in national plans and policies including forthcoming ADS.	0.5	0.5		S M	NSB/MoAD
312	Support private sectors through technology, infrastructure and enabling policies.	10	5	5	S M L	NSB, DOA, NARC, Private sectors, Academia
313	Develop and strengthen partnership with national and international crop research institutions and private companies for germplasm source, plant breeding research and technology transfer.	5	2.5	2.5	S M L	NARC, Private

314	Enhance scientific capacity in hybrid and modern plant breeding techniques.	80	48	32	S M L	NARC, DoA , NGOs, Academia and Private sector
315	Promote the use of crop genetic resources through the linkage with plant breeding and insitu biodiversity conservation programmes.	5	5		S M L	DOA, NARC, Academia
320	<i>S3.2: Support regional and local governments in the development, maintenance and release of location-specific crop varieties</i>					
321	Facilitate in the development of local plan and policies in breeding better and climate resilient varieties.	5	3.5	1.5	M L	DDC/RD/RS, NGOs,Private
322	Strengthen and support local governments and communities to develop mechanism for monitoring the seed research and provide feedback	10	10		M L	RSTL, RS
323	Enhance scientific capacity in modern plant breeding techniques.	20	10	10	S M L	RSL, & RS, private sector, NGOs
330	<i>S3.3: Enhance access of new seeds and information to households and individual through participatory breeding.</i>					
331	Enhance farmers' adaptation to climate resilient varieties.	5	2.5	2.5	S M L	DADO,DLSO, VDC,DDC, NGOs, Private
332	Strengthen farmers' capacity to select, breed and maintain farmer preferred crop varieties.	15	10	5	S M L	DADO,DLSO, RSVDC,DDC, NGOs and Private sector
333	Develop mechanism for the regular flow of information of the new varieties to farmers and provide regular feed back to research scientists.	5	3	2	S M L	AICC,SQCC, DADO,DLSO, NGOs and Private sector
400	S4: Enhance marketing skills of seed entrepreneurs and invest in seed related infrastructure					
410	<i>S4.1: Develop and strengthen seed networks, seed dealers and seed supply channels in public and private sectors.</i>					
411	Develop policies, mechanism and procedures for a prompt popularization of seeds of new varieties to farmers.	2	1.5	0.5	S M	NSB,AICC,NA RC, DoA,, DoLS, Private
412	Establish linkage with foreign seed companies to promote seed export.	5	1	4	S M	NSB, TPC, FNCCI, Private
413	Strengthen government capacity to monitor, analyze and disseminate information on current and future seed sector status.	10	10		S M L	NSB, AICC, RD,MoAD
414	Promote FDI and domestic private sector to invest in seed business.	5	2	3	S M L	MoAD, MoI,MoF, MoFA, Private
415	Develop a modality for protecting farmers' rights on seeds and planting materials.	2.5	2.5		S	NSB, MoAD
420	<i>S4.2: Support local institutions in planning and marketing quality seeds.</i>					
421	Establish linkage with national and foreign seed companies to promote domestic seed marketing.	2.5		2.5	S M L	Private, cooperative
422	Devise plans and policies to protect farmers' rights in specific geographical domain.	5	5		S	DDC, RSTL

423	Support popularization of new varieties in its domain.	15	10	5	S	RS, RD DADO, NGOs and CBOs
424	Strengthen the capacity of local institutions to market, monitor, analyze and disseminate information on current and future demand for quality seeds.	5	4	1	S M L	DADO, DLS, DDC, Private
430	<i>S4.3: Enrich farmer's knowledge and skills on quality seed use.</i>					
431	Avail HH with social and economic safety nets.	100	60	40	S	DADO, DDC, CBOs
432	Enhance peoples' access to seasonal forecasts of demand and supply.	15	15		S M	DADO, DDC
433	Support people accessing knowledge and skills on quality seed use.	10	5	5	S M	DADO, DDC NGOs, CBOs, Private
434	Increase farmers' access to information on seed requirement.	5	3	2	S M	DADO, DDC,
435	Increase access of public sector to the seed multiplied and marketed by private sector.	85	50	35	S M	NSB, DADO, DDC, private sector
500	S5: Provide supports in developing efficient and effective seed related organizations with business culture through appropriate monitoring and evaluation system.					
510	<i>S5.1: Develop a system and or support NSB on collection, processing and dissemination of seed related information.</i>					
511	Review and adjust NSB structure to make seed industry competitive and sustainable.	15	15		S	MoAD NSB
512	Provide human and financial resources to NSB to collect seed demand and supply information and produce periodic status of seed sector development.	5	5		S	MoAD, MoF
513	Develop and strengthen monitoring and evaluation system.	2.5	2.5		S M	NSB, MoAD
514	Designate NSB secretariat to coordinate and guide national level seed programmes.	10	10		S	MoAD, GoN
520	<i>S5.2: Promote seed entrepreneurs to make their small and micro-enterprises competitive.</i>					
521	Train seed entrepreneurs to enhance their business skills and knowledge.	15	7	8	S M	NSB, MoCI, Private
522	Create enabling environment for business linkage and entrepreneurship development.	15	5	10	S M	NSB, MoAD, NGOs/CBOs Private
523	Provide soft loans and policies support to expand their business.	50		50	S M L	MoF, Banks
	Total	827	491	336		

It is envisaged that actors in the seed value chain will fulfil their pragmatic roles, responsibility and commitment at the national, regional and local level for achieving Seed Vision goals. The total cost for proposed activities is NPR 827 million per annum estimated at the constant price of 2012. Out of this cost, NPR 491 million will be borne by the public sector and NPR 336 million will be borne by the private sector. The public sector needs to increase the existing investment from the central to district level through Government organizations, research organizations,

academic institutions, and local authorities, such as DDC and VDC to accomplish the activities proposed in this matrix. The increasing investment from the public sector is also required to mobilize resources and encourage more investment from the private sector, which includes I/NGOs, farmers, seed entrepreneurs, cooperatives, seed companies, and financial institutions.

5.4 Expected results

The implementation of seed vision envisages bringing following results by 2025:

Expected results following the implementation of Seed Vision 2013 - 2025

1. 10 lakh farm families will have access to quality seeds upon demand prior to planting season. The country will be self-sufficient in food crop seeds.
2. 88 mt breeder, 2,978 mt foundation and 92,527 mt improved seeds will be produced through formal system by 2025.
3. 750 mt Nepal produced high quality seeds will have improved access to export by 2025.
4. Seed replacement rates will be increased up to 25 percent for cereals and over 90 percent for vegetables.
5. Good quality seeds will be available in market through quality assurance with genuine label.
6. Four hundred twenty-three open pollinated varieties and 60 hybrids will be released by 2025.
7. 40,000 seed samples will be tested and analyzed annually by seed laboratories.
8. Seed production and marketing will be done through structured and efficient seed system.
9. Yield of rice and vegetable crops will be increased up to 3.8 mt/ha and 19 mt/ha respectively.
10. Enhanced participation of private sector will increase availability of quality seeds in the market. Private sector will establish or strengthen four big seed companies.
11. 293 highly skilled seed specialists will be developed in private and public sectors.
12. Farmers' rights will be protected and breeders will get incentive for developing better varieties.
13. Seed import and export regulations will be harmonized in line with WTO and SAARC.
14. All the stakeholders will be accountable to farmers and be responsible participants of Nepalese seed system.
15. 255 thousand people will get additional full time employment upon the implementation of Seed Vision 2013 - 2025.
16. Seed Vision will contribute to food security. Edible food availability by 2025 will reach 8 million mt, worth around 200 billion rupees at current price.
17. Agro-based industries will have adequate raw materials from increased production.
18. Nepal's seed sector will be able to share its experience and knowledge to other countries.

6 IMPACT

The seed sector development strategy has identified five strategic directions as mentioned in the Seed Vision framework. Each strategic direction has been analysed at national, regional and farm level. These strategies with identified activities help in establishing a competitive seed sector development in Nepal which shall have significant direct and indirect impacts, mainly as: (i) Ensuring food security and reducing poverty (ii) Generating employment opportunities (iii) Contributing in biodiversity conservation and adapting to adverse impact of climate change, and (iv) Contributing in gender equality and social inclusion.

6.1 Poverty and food security

Implementation of Seed Vision will result to seed security thereby increasing food production which shall contribute significantly in poverty reduction through increased household income. In 2025, food production shall increase by over 40 percent from the base scenario of 2010 as a result of increase in area under quality improved seeds and increased crop productivity (Table 6.1.) Total edible food production (including pulses) is estimated to be 8.0 million tons from the present level of 5.67 million tons in 2010 based on estimated yield increase as shown in Annex 3.7 and 3.8. The imputed value of food produced in 2025 is estimated at 200 billion rupees at current price. This will have significant impact on poverty reduction.

Table 6.1. Projected food production increment (%)*

Food Production	2015	2020	2025
Cereal grain production	8.21	19.47	41.89
Pulse production	6.47	14.02	22.84
Total food grain production	8.15	19.31	41.32

* Estimation based on MoAC, 2010 and Economic Survey, 2010

6.2 Employment generation

The seed sector development strategy aims at contributing in employment generation from the increased cropped area under quality seeds. The additional employment is generated from increased area under seed crops, cereals, legumes, vegetables, and potatoes.

Total additional full time employment generated with the implementation of seed sector development strategy in 2025 will be around 255 thousand persons³³ at the producers, processors and buyers' level, of which 243 thousand will come from the business activities created by increased cropped area of food crops due to increased cropping intensity and 12 thousand from increased seed crop area³⁴. This will have significant impact on out migration for employment and rural income generation. Furthermore it will have multiplier effects on generating employment through post-harvest processing, value addition, marketing, transportation, packaging and handling. This will provide impetus for a competitive agro-based industry development.

³³ Based on estimated average 150 labor days per hectare per crops and 220 working days per year

³⁴ The estimated area available for improved seed multiplication with public (e.g. NSCL) and private sectors is estimated to be, 13,241 ha in 2009. The total number of labour required for 32,352 tons of seed production in the above area in 2009 is estimated to be 2.65 million labor days (12,037 persons /year). The additional full time employment generated for the projected seed production of 92 thousand tons of seeds in 26,801 hectare in 2025 will be 12,328 persons /year.

6.3 Biodiversity conservation and climate change

The rich agro-biodiversity of Nepal is vital to the development of new competitive varieties for the sustainable and competitive seed sector development in Nepal. Continuous use of local land races and other genetic resources for the development of diverse varieties in different regions by public, private and community sectors will contribute to the on-farm maintenance of local diversity. Development and promotion of small-scale and location specific seed enterprises in each ecological region as envisaged by Seed Vision will contribute reducing genetic erosion and external dependence. In the context of changing climate scenario in Nepal, Seed Vision has focused particularly in developing and promoting climate resilient crop varieties (drought, flood and heat tolerant, etc). The promotion of climate resilient seed varieties will sensitize farming communities on climate change and allows for climate adaptation options in terms of food production. This will have impact on stabilizing food production and reducing risks of farming communities, resulting in increased livelihood options and strengthened capacity to adapt adverse effect of climate change.

6.4 Gender equity and social inclusion

Generally, two-thirds of agricultural operations are carried out by women in Nepal. Usually marginalized communities (landless labour, disadvantaged ethnic groups) also find employment opportunities in peak season of agricultural production. Seed Vision envisages that 50 percent of additional employment will be absorbed by rural women, landless labours and disadvantaged groups. Furthermore, the employment generated as a multiplier effect will also provide additional employment opportunities to these marginalized communities, and women particularly in post-harvest handling and marketing. In order to benefit fully from seed value chain, the Seed Vision recommends a combination of measures:

- Creating an enabling environment to promote value chain with a focus on poor, women and disadvantaged communities.
- Promoting gender equality in collaboration with private and civil society organizations.
- Encouraging the participation of women and disadvantaged groups in producers' groups and labours' organizations.
- Minimizing entry barriers for women and disadvantaged groups in seed value chains.
- Improving income from seed value chains to women and disadvantaged groups.

The Seed Vision suggests adopting a comprehensive approach towards increasing efficiencies along the entire value chain from seed production through processing to marketing and use, in order to increase productivity and align profit margins to chain actors for protecting women and disadvantaged groups.

Additionally, the seed sector development strategy will have impact on self-sufficiency, import substitution and export promotion. It will also contribute to reducing import of hybrid seeds in vegetables and other crops and save scarce foreign currency. Development of competitive seed industry will also increase the export of quality seeds to generate revenue and employment.

7. MONITORING OF SEED VISION

7.1 Monitoring

Monitoring plays a vital role in providing information on performance of objectives and the goals set in the plans. It also provides information whether the development programmes have been implemented appropriately or not and whether the expected outputs and outcomes have been achieved. Besides, it also provides grass roots information on main contributing factors behind success and failure. These lessons learned are useful for further consideration in future.

Monitoring of Seed Vision, as explained in Table 7.1, is proposed to take at 4 levels in line with Results Based Monitoring and Evaluation Guidelines, 2067 (2010), National Planning Commission³⁵.

Table 7.1 Monitoring of Seed Vision 2013 - 2025

Levels	Content	Responsibility	Frequency
District level	Measurement of achievement at activity level. Implementation of District Poverty Monitoring and Analysis System (DPMAS).	District Agriculture Development Committee (Communities Groups, seed companies Cooperatives, NGOs, VDC, ASC, and DADO, RARS)	Every four months
Regional level	Result indicators at the outcome and impact level. Overall monitoring and evaluation of the development activities operated within the region and should be reported to the centre.	Regional Agriculture Development Committee (Regional directorates , DDC, RSTL, RARS, Line agencies, NGOs and seed companies, Private sector)	Every four months and more frequently if required
Departmental and Ministerial level	The details of progress regarding implementation of the project are presented and reviewed. Consequently, efforts are made to identify solution measures of the problems.	Ministerial Level Development Action Committee (MDAC), SQCC/NSB, DoA and NARC, private sector	Every six months
National Level	Progress regarding implementation of projects under different ministries are reviewed and issues regarding inter-ministry coordination, policy issues as well as legal issues are discussed.	National Development Action Committee (NDAC) NSB	Meeting annually

7.2 Evaluation

The implementation of National Seed Vision 2013 - 2025 will be evaluated periodically once in every five years and its final evaluation will be carried out at the end. Period evaluation will be conducted by the Government's own resources or by independent evaluators, but the final evaluation will be conducted by independent evaluators. The recommendations of periodic

³⁵ NPC (2010). Results Based Monitoring and Evaluation Guidelines, 2067 (2010).

evaluation will contribute improving the implementation of this vision. However, the recommendations of the final evaluation will be helpful in the long run for effective implementation of policies, rules, regulations, and programmes related to the seed sector.

7.3 Performance measurement framework

The performance measurement for the Seed Vision has been worked out based on the framework presented in Table 7.2

Table 7.2: Performance measurement framework

Performance framework	Indicators	Sources of information	Collection methods	Frequency	Responsibility
Outcome level					
Increased production and distribution of quality seeds	<ul style="list-style-type: none"> Yield increase of developed and released varieties (%). Number of new national plan and policies with seed issues. 	Progress reports, external evaluation of concerned bodies	Records	Annual	NSB, , DoA, NARC, DoLS DADO, DDC, VDC RSTL
Output level					
S1: Varietal development and maintenance breeding. Competitive varieties developed and released.	<ul style="list-style-type: none"> Number of varieties with climate resilience, high yield and nutritional value developed and released. Number of varieties required for different crops and agro climatic zones maintained. 	Progress reports, technical publications of concerned bodies	Records	Annual	NSB, NARC, Regional Research Stations, Farms
S2: Seed multiplication. Adequate quantity of seeds multiplied through standard seed multiplication steps.	<ul style="list-style-type: none"> Increased share of quality seed produced by private sectors (%). Rate of seed replacement increased (SRR) from (9 % to 25%) 	Progress reports of concerned bodies	Records	Annual	NSB, DoA, NARC, DoLS, NSCL, SEAN, SQCC, AEC/FNCCI
S3: Seed quality control. Quality of all seeds well maintained.	<ul style="list-style-type: none"> Increase on availability of high quality seed. Quality of our seeds accredited by international seed accrediting bodies. 	Progress reports of concerned bodies	Records	Annual	NSB/SQCC
S4: Seed marketing. Quality required seed distributed at the right time, right place and at affordable price.	<ul style="list-style-type: none"> Rate of popularization of new varieties (number/year) increased. Increased number of seed entrepreneurs. 	Progress reports of concerned bodies	Records	Annual,	NSB, DoA, DoLS, SEAN, AEC/FNCCI
S4: Seed use. Quality seeds of preferred varieties well accessible to farmers.	<ul style="list-style-type: none"> Increase in the number of households using good quality seeds. Percentage of areas covered by quality seeds increased. 	Progress reports of concerned bodies	Records	Annual	NSB, DoA, SEAN, AEC/FNCCI

8. CONCLUSION

The National Seed Vision 2013 - 2025 will lead the seed business towards developing a sustainable seed industry in Nepal. For the sustainability of this industry, contribution of public and private sector is envisaged in resource mobilization, planning, implementation, monitoring, and evaluation of seed production, marketing, and use.

The vision proposes promotional programmes to improve the quality of Nepalese seeds and to increase their demand in international market. Seed producers and organizations supporting seed production at the farm level play important role in creating both domestic and export demand. These actors will be rewarded for their contribution in identifying appropriate plant varieties and their registration, and producing high quality seeds of promising varieties.

The institutional growth in seed business is moving upward from farmers' groups and seed growers' associations at the grassroots level to producers' cooperatives and seed companies at the middle level. The size and scope of these seed companies are gradually increasing to undertake the business at the national and international levels. Since the institutions working at different levels are interlinked to each other, the National Seed Vision 2013 - 2025 aims to strengthen the capacity of institutions at the grassroots level to grow the size of seed companies and make them competent to hold sway in international seed market.

ANNEXES

Annex 1.1: Terms of references

1. Prepare inception report including a draft table of contents for Seed Vision 2013 - 2025 and discuss with Technical committee and finalize it.
2. Identify gaps in varietal development and release/registration, seed research, production and marketing, both in public and private sector.
3. Identify crops and varieties of vegetable and cereal crops to be promoted for seed production and distribution system for import substitution and export promotion.
4. Suggest ways and means to - increase public-private partnership and investment in seed sector R&D, and the ways of enhancing capacity to implement seed regulatory frameworks in private sector and in farmer friendly manner.
5. Recommend appropriate infrastructural development, accreditation process and policy besides legal reform to promote cereal and vegetable seed marketing and export.
6. Prepare and present programmes for conserving indigenous genetic resources (local land races) and for coordinating with concerned organizations to protect national rights on them.
7. Prepare plan and action line to enhance development of hybrid varieties in major vegetable and cereal crops.
8. Prepare National Seed Plan (2013-2025) including seed requirement on projected crop areas based on targeted food requirements and agreed seed replacement rates by class of seed types with tentative cost projection.
9. Draft reports and finalize them based on comments and suggestions from the expert panel, technical committee and the final workshop.

Annex 1.2: List of organization and authorities consulted

SN	Organizations	Personnel
1	National Rice Research Programme, Hardinath, Dhanusha	Mr S N Sah, Mr R B Yadav, Mr Dilip Shah, Mr Santosh Yadav, Mr Parmanand shah, Mr Dil Raj Yadav, Mr Kulananda Mishra, Mr Ram Babu Das
2	National Maize Research Programme, Rampur, Chitwan	Dr. D B Gurung, Mr P Thakur ,Mr Adhikari, Mr Babu R. Regmi, Mr. Mahendra Thapaliya, Mr Ghanshyam Bhusal, Jeevan Shrestha
3	National Legume Research Programme, Rampur, Chitwan	Dr. Renuka Shrestha Mr. Dhan B. Gharti Mr. Santosh Shrestha Ms Rita Amagain
4	Agricultural Botany Division, NARC	Dr.S P Khatiwada, Dr. D Thapa, Mr H K Upreti, Mr N. K. Dhami, Ms Sumitra Pant
5	Agronomy Division, NARC	Dr Jagat Devi Ranjit, Ms.D.M. Gautam
6	Vegetable Development Directorate, DoA	Mr G P Shrestha, Dr. R Manandhar, Mr, G Subedi, Mr Bhanu Poudel.
7	Horticultural Research Division, NARC	Dr K P Poudel, Dr D Bhattarai
8	Seed Science and Technology Division, NARC	Dr. Jwala Bajracharya
9	National Agricultural Gene Bank, NARC, Khumaltar	Dr. Hari KC
10	Unnat seed producers group, and Shreeram seed producers groups, Chitwan	Mr Umanath Poudel Mr Devi Prasad Luitel Mr Ramji Prasad Sapkota Mr Santaraj Acharya Mr Binod Sapkota Mr Kedar Prasad Poudel Mr Pitambar Sharma Poudel Mr Hari Krishna Subedi Me Krishna Prasad Parajuli Mr Pradip Poudel Mr Hom Bahadur Bhandari Mr Basu dev Sapkota Mr Sita Bastola Mr. Chiranjivi Pokhrel
11	Institute of Agriculture and Animal Science, Rampur, Chitwan	Prof. Dr. Sundra M Shrestha (Dean) Prof. Dr Resham Thapa Prof. N K Choudhary Mr. B B Tamang, Farm Manager
12	Federation of Chambers of Commerce, Chitwan	Mr. Jagannath Tiwari Mr. Mitra Raj Dawadi Mr. Shiv Malla Mr. Chiranjivi Pokhrel Mr. Dipak Raj Ghimire Mr. Y.B Thapa
13	NEAT, Kathmandu	Dr Dev Bhakta Shakya
14	National Seed Corporation, Teku	Mr Nunu Jha, Mr. Binay Kumar Singh
15	Subha Prabhat Seed producer Co-operative, Kanpur VDC, Kavre	Mr. Pasang Dorjo Lama (President) Bishnu Raj Bhandari

- Indra Raj Bhandari
Himal Singh Lama
Umesh Khakurel
Karna Singh Tamang
Krisna Bhurtel
- 16 Jorsalla Vegetable Seed Producer Cooperative, Methinikot VDC, Kavre Mr. Rudra B. Bistuke (Chair)
- Mr. Sher Bahadur Mijar
Mr. Kamalnath Chimauria
Mr. Lalchandra Regmi
- 15 Maize Seed Producer Group (Atma Nirvar Producer Cooperative), Kavre, HMRP supported Mr. Bishnu Sapkota
Nil Prasad Prajuli
- 17 Jaleswor Farmers group (NRRP outreach) Danusha Mr. Kedar Sapkota
Mr. Ram Sihasan Thakur
- Mr. Tara Nandan Thakur
Mr. Ram Sagar Sah
Mr. Bindeshwor Sah
M. Bailam thakur
- 18 Forum for Rural Welfare and Agricultural Reform for Development Mr N.P Sen
- Mr R K Neupane
Mr Y B Thapa
Mr Dharma Pandey
- 19 Seed Entrepreneurs Association of Nepal SEAN Mr. Durga P. Adhikari
Mr. D K Neupane
Mr. Damodar Poudel
- 20 Centre for Environmental and Agriculture Policy Research, Extension and Development Ms. Puspa Devkota
Dr, Bharat P Upadhyaya
- 21 Crop Development Directorate, DoA Dr. Suroj Pokharel, MS Niru Dahal
- 22 National Seed Board/ SQCC Mr. Dilaram Bhandari
Mr. Madan Thapa
Mr. Basu Regmi
Mr. L P Acharya
Mr. A Tamang
Mr. Dhrurba Raj Bhatta
23. Hill Maize Research Programme Mr. Nirmal Gadal
- 24 National Pasture and Nutrition Development Centre Mr. Subal Shah
- 25 Fodder and Pasture Research Division Mr. Kishor Shrestha
- 26 Agriculture Business and Market promotion Directorate Mr. Kamal Raj Gautam
- 26 Experts consultants Mr. Bishnu Aryal
Mr. Madan Kumar Rai
Dr. Prahlad Kumar Thapa
Ms. Kamalesh Rajbhandari
Mr. Mahesh Nath Shrestha
Dr. Hari Kumar Shrestha
27. Participants of National Seminar on Seed Vision 2013 - 2025 dated 18 March 2012

Annex 2.1: SWOT Analysis

	Varietal development and maintenance breeding	Seed multiplication	Seed processing and conditioning	Seed marketing	Seed Use
Strengths	<p>Process:</p> <ul style="list-style-type: none"> Well established procedure in key crops (rice, Wheat and Maize) research. Functional Coordination with IARC (IRRI, CIMMYT, etc) Seed multiplication system is established with its components. <p>Structures</p> <ul style="list-style-type: none"> National commodity research programme for major crops. Research scientists available in key cereal crops. Establishment and operation of gene bank. <p>Delivery</p> <ul style="list-style-type: none"> Fairly good number of varieties released in cereal crops. Fairly good quantity of BS available in key cereal crops. 	<p>Process</p> <ul style="list-style-type: none"> Established system for seed multiplication (BS-FS-CS-IS) Identified seed production pockets for major vegetables crops. Crops and varieties identified for diverse climatic conditions. Devolved seed multiplication practices. <p>• Contract seed production.</p> <p>Structures</p> <ul style="list-style-type: none"> Involvement of public (NSCL), private, NGO, Cooperative, and Community groups and seed banks. Seed infrastructure including laboratories available in public and private sectors Fairly good number of trained seed growers. <p>Delivery</p> <ul style="list-style-type: none"> Increasing trend of quality seed production Increased quality of seeds 	<p>Process</p> <ul style="list-style-type: none"> Seed cleaning and packaging practiced. Standard developed for genetic and physical quality. Post harvest technologies for seed harvesting available. Practice of labelling Initiated. <p>Structures</p> <ul style="list-style-type: none"> Some facilities available at key location with NSCL. Storage room operational at VDD Khumaltar. <p>Delivery</p> <ul style="list-style-type: none"> Seed distributed in plastic packets and jute bags. Clean and conditioned seeds in formal sector. 	<p>Process</p> <ul style="list-style-type: none"> Network of seed dealers in marketing. Umbrella organization for vegetable seed marketing (SEAN). Pilot imitative for seed export. Favourable policy environment for private sector development. <p>Structures</p> <ul style="list-style-type: none"> Presence of NSB for regulatory function. Provision of seed inspectors. Donors and public market. Infrastructure support for seed industry. <p>Delivery</p> <ul style="list-style-type: none"> Increase quality seed supply from private sector. 	<p>Process</p> <ul style="list-style-type: none"> Moderate level of awareness on quality seed. Seed traders and retailer preferring local adapted varieties/seeds. Seed traders and contract seed growers for quality seed. Preparation of balanced sheet by NSB for BS and FS seed distribution. <p>Structures</p> <ul style="list-style-type: none"> Provision of regulation on consumers rights protections. Registration of import and export of seeds with NSB and National Plant Quarantine Programme. <p>Delivery</p> <ul style="list-style-type: none"> Practice of delivery in good packages. Increasing use of good quality seeds.

Weak	<p>Process</p> <ul style="list-style-type: none"> • Long cycle of breeding. • Low budget available for crop breeding and maintenance. • Limited use of decentralized participatory breeding and variety maintenance. • Narrow range of multi-location testing and recommendation domains. • Absence of standard variety development and maintenance for vegetables, forage, flowers, NTFF, trees and other crops. • Noncompliance of zoning concept in maintenance of unique varieties. • Absence of crop breeding and maintenance in private sector. • Lack of adequate incentives for breeders and research scientists. <p>Structures</p> <ul style="list-style-type: none"> • Limited autonomy for national coordinated crop research programme. • Absence of national coordinated research programme for vegetable, forage and other crops. • Absence of regular feedback mechanism for farmer preferred traits. • Absence of linkage between academia (IAAS, HICAST,) and seed research. <p>Delivery</p> <ul style="list-style-type: none"> • Limited farmer-preferred varietal choice. • Inadequate availability of farmer-preferred varieties of breeder seed. • Slow release of farmer preferred varieties. 	<p>Process</p> <ul style="list-style-type: none"> • Mismatch of source seed. • Unrealistic distribution of source seed. • Inadequate technical support for quality seed multiplication. • Inadequate seed multiplication zones. • Absence of total seed vision and planning at national and district levels. • Noncompliance of contract rules between seed growers and entrepreneurs • Limited investment in seed multiplication <p>Structures</p> <ul style="list-style-type: none"> • Weak integration between varietal development and seed multiplication chains. • Low investment for seed production. • Weak structure for seed production in hills. • Lack of seed specialists in seed production pockets. • Inadequate number of seed quality control specialists. • Inadequate technical capacity with private and cooperatives for quality maintenance. <p>Delivery</p> <ul style="list-style-type: none"> • Inadequate multiplication of seeds to meet market demand. • Low seed multiplicity. 	<p>Process</p> <ul style="list-style-type: none"> • Unavailability of soft loan for seed infrastructure development. • Seed industries not included as industry in Industrial policy (2010). • No policy and programme for Buffer stock management. <p>Structure</p> <ul style="list-style-type: none"> • Poor processing facilities and insufficient cold storage capacity for potato. • Underutilization of public processing facilities. • Storage of fertilizers in seed godowns. • Long term storage unavailable. • Lack of trained seed processors and technicians. • Low investment in processing and conditioning. • No proper guidelines for quality maintenance in informal seed supply system. <p>Delivery</p> <ul style="list-style-type: none"> • Lack of awareness on TLS. • Limited use of quality packaging materials. • Content and quality of packaged seeds not guaranteed. • Seed certification not enacted in all district of Nepal 	<p>Process</p> <ul style="list-style-type: none"> • Market intelligence service unavailable • Effective demand forecast not practiced. • Ad hoc supply management. • No provision of market extension services. • Lengthy custom clearance and exporting procedures. • High tariffs and bureaucratic delays in export markets. <p>Structures</p> <ul style="list-style-type: none"> • Inadequate seed marketing extensions. • No investment in marketing research. • No accreditation of domestic labs with international seed labs. • Absence of facilities and storage in border points for exports. • Absence of seed certification schemes for organically produced seeds. <p>Delivery</p> <ul style="list-style-type: none"> • Uncontrolled flow of exotic seeds • Demand of quality seeds not met. 	<p>Process</p> <ul style="list-style-type: none"> • Status of seed use not surveyed and recorded. • Quality seed campaign rarely supported by projects. • Demand from projects and other supporting agencies met on ad hoc basis. • Absence of guidelines for farmers on seed selection, savings and use. <p>Structures</p> <ul style="list-style-type: none"> • No system of preparing balance sheet for improved seed. • No systematic of data collection on seed use and farmer preference • Weak structure for popularizing new better varieties. • No investment on seed use and promotion. <p>Delivery</p> <ul style="list-style-type: none"> • Sale of loose seeds still in practice. • Presence of many untested varieties of OP and hybrids.
	Seed Vision 2025				Page 76

Opportunity	<p>Process</p> <ul style="list-style-type: none"> • Use of modern crop breeding techniques including shuttle breeding. • Strengthening Regional Technical Working Group (RTWG). • Standardization of breeding practices in vegetable, forage and other crops. • Development of standard breeding practices in hybrid research. • Continued investment in crop breeding and maintenance. • Harmonization of seed research with international and regional organizations. 	<p>Process</p> <ul style="list-style-type: none"> • Use of varied agro climatic conditions. • Use of modern techniques (shuttle Seed Multiplication). • Human resources for hybrid seed production. • Collaboration with multinational seed companies. • Increased involvement of private sector and cooperatives in seed multiplication. 	<p>Process</p> <ul style="list-style-type: none"> • Public sector support in OP seed and private sector lead in Hybrid seeds. • Component breeding. • Financial institution and banks business developed. 	<p>Process</p> <ul style="list-style-type: none"> • Enhancing marketing for seed entrepreneurs. • Harmonization of export import seed regulations. • Export of temperate vegetable seeds. • Increased policy support and linkage with export market. 	<p>Process</p> <ul style="list-style-type: none"> • Supporting studies of farmers' choice and use of quality seeds. • Implementing new varieties and quality seed promotion campaign. • Coordinating and preparing updated demand and supply of improved seeds. • Improving demand forecasting of improved seeds. • Monitoring seed use in market by seed inspectors.
	<p>Structures</p> <ul style="list-style-type: none"> • Coordinated support for decentralized varietal development and maintenance. • Evolving role of Public private partnership in seed research. 	<p>Structures</p> <ul style="list-style-type: none"> • Use of infrastructure, communication network and trained human resources. • Favourable policy and environment. • Developing seed popularization mechanism. • Strengthening of informal seed sector. 	<p>Structures</p> <ul style="list-style-type: none"> • Development of trained human resources. • Accreditation of Seed labs with ISTA. • Networking of seed laboratories. • Harmonization of seed quality services with SARRC countries. 	<p>Structures</p> <ul style="list-style-type: none"> • Investment in marketing infrastructure. • Development of seed marketing institutions. • Support to growing private sector including cooperatives. • Massive distribution of good quality seeds resulting in food security. • Development of HR in seed marketing. 	<p>Structures</p> <ul style="list-style-type: none"> • Mechanism for feedback collection from users to seed researchers. • Supporting district and national seed related institutions for preparing balanced sheet of quality seeds supply. • Improving packaging, storage and seed handling in the retailer chain.
	<p>Delivery</p> <ul style="list-style-type: none"> • Expanding varietal choice • Development and promotion of Climate resilient varieties. • Faster breeding cycle using modern techniques. 	<p>Delivery</p> <ul style="list-style-type: none"> • Integration of formal and informal seed system. • Private delivery of public seeds. 	<p>Delivery</p> <ul style="list-style-type: none"> • Use of high quality packaging materials. • Consumer friendly containers size. • Proper labelling and growing guidelines. 	<p>Delivery</p> <ul style="list-style-type: none"> • Adequate quantity of quality seed supply based on market demand for domestic and export market. 	<p>Delivery</p> <ul style="list-style-type: none"> • Varietal choice in required quantity. • Adequate information on seed available in the market.

Threat	<p>Process</p> <ul style="list-style-type: none"> • Justification of varietal development and maintenance • Climate change impacts on seed research • Increasing dependency for exotic OP and hybrid varieties <p>Structures</p> <ul style="list-style-type: none"> • Declining role of public expenditure in crop breeding and maintenance • Weak implementation of regulatory framework <p>Delivery</p> <ul style="list-style-type: none"> • Increased Import and use of exotic varieties • Uncontrolled flow of exotic varieties 	<p>Process</p> <ul style="list-style-type: none"> • Reduced competitiveness of national seed entrepreneurs. • Dependency on seed supply. • Loss of business attractiveness. <p>Structures</p> <ul style="list-style-type: none"> • Weak private sector. • PPP threatened. • Wreaking formal seed system. <p>Delivery</p> <ul style="list-style-type: none"> • Seed hazards. • Seed insecurity. • Hunger/ calamities. • Threatening of GMOs/ terminator gene and varietal failure. 	<p>Process</p> <ul style="list-style-type: none"> • Imported and high quality packaged seed cheaper than domestic. • National Seed industry not well protected. <p>Structures</p> <ul style="list-style-type: none"> • Impeding growth of processing and conditioning facilities. • Redundancy of processing facilities. <p>Delivery</p> <ul style="list-style-type: none"> • Loose seed supply with inferior quality. • Dominance of imported seeds in market. 	<p>Process</p> <ul style="list-style-type: none"> • Impeding of evolving seed marketing. • Restrictions and increased hassles at border points for export markets. <p>Structures</p> <ul style="list-style-type: none"> • Imperfect marketing system. • Hoarding and black marketing. • Closing of border points for export markets. <p>Delivery</p> <ul style="list-style-type: none"> • Carryover of old seeds and dumping • Seed wastage. 	<p>Process</p> <ul style="list-style-type: none"> • Isolated and ad hoc activities. • Restricting availability of quality seeds. • Non responsive research, seed multiplication and marketing. <p>Structures</p> <ul style="list-style-type: none"> • Market monitoring of seeds non functional. • Flow of inferior quality seed during planting season causing low productivity. <p>Delivery</p> <ul style="list-style-type: none"> • Farmers forced to buy low quality seeds. • Non response on seed users' choice
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Annex 3.1.Organizations responsible for maintaining crop varieties in Nepal

Crop	Variety	Variety maintenance organisation
Rice	All varieties released for Terai and Inner-Terai	National Rice Research Programme Hardinath, Dhanusha
Rice	Varieties released and recommended for Hills and Mountains (Khumal-2,3,4,5,6,7,8,9,11,, Taichung-176, Chainung-242, Himali Kanchan, Palung-2, Machhapuchhre, Chhomrong, Chandannath-1 & 3)	Agricultural Botany Division, NARC
Rice	Pokhreli Jethobudho and Sunaulo Sugandha	LIBIRD, Pokhara, Nepal
Wheat	All released wheat varieties	National Wheat Research Programme, Bhairahawa
Wheat	WK 1204	Agricultural Botany Division, Khumal, NARC
Maize	All released varieties	National Maize Research Programme, Rampur, Chitwan
Maize	Ganesh-2, Manakamana-5 and 6	Regional Agricultural Research Station, Lumle
Maize	Khumal Panhelo, Manakamana-4, Deuti,	Agricultural Botany Division, Khumal, NARC
Finger millet	All released varieties	Hill Crop Research Programme, Kavre, Dolakha
Grain legumes	All released varieties	National Grain Legume Research Programme
Mungbean	Kalyan, Pratiksha	FORWARD
Vegetable Soybean	All released varieties	Agronomy Division, Khumal, NARC
Oilseeds (Rape seed, Rayo, Sesame, Niger, Groundnut)	All released varieties	Oilseed Research Programme, Sarlhai, NARC
Potato	All released varieties	Potato Research Programme, Khumal, NARC
Tomato	Sirijana hybrid	Horticulture Research Division, Khumal, NARC
Tomato	Pusa Ruby	Sarlahi Horticultural Farm (DoA)
Tomato	NCL	Horticulture Research Station, Malepatan, NARC
Radish	Mino Early	Agriculture Research Station Dailkeh, NARC
Radish	Pyuthane Red	Horticulture Farm (DoA), Palpa
Radish	40 days	Regional Agriculture Research Station Lumle
Radish	Tokinashi	Horticulture Research Station, Jumla (NARC)
Rayp	Marpha Broad Leaf	Horticultural Farm Mustang (DoA)
Rayo	Khumal Red Leaf	Vegetable Seed Production Centre, Dadeldhura
Rayo	Khumal Broad Lead	Horticulture Research Division, Khumal, NARC
Onion	Red Creole	Agriculture Research Station Dailkeh, NARC
Pea	Sarlahi Arkel	Regional Agriculture Research Station Nepalganj (NARC)
Pea	Sikkim Local	Regional Agriculture Research Station Lumle
Cauliflower	Kathmandu Local	Horticulture Research Division, Khumal, NARC
Forage (Oat)	Kamdhenu Jai and Netra jai	Forage and Pasture Research Division, Khumal (NARC)

Annex 3.2 Vegetable variety maintenance and seed production pockets / zones

SN	Crops	Varieties	Suitable seed production pockets/zones
1	Tomato	NCL, Lapsigede, Monprecos, Pesarubi	Midhills and InnerTerai and Terai
2	Carrot	Nantes Fort, Newkoroda	Mountain regions of Karnali
3	Onion	Redcreole	Mid hills and Mountains of mid Western region (Rukum, Rolpa, Dailekh, Pyuthan etc)
4	Turnip	Purpletop	Mountains and mid hill regions (Kalikot, Humal, Mugu, Rukum, Rolpa, Pyuthan)
5	Cress	Local	Mid hills (Rolpa, Kalikot, Dailekh, Rukum)
6	Rayo	Khumal Broad leaf, Khumal Red leaf and Marpha Broad Leaf	High mountains and Mid hills of Western (Mustang) and Mid Western (Karnali zones) and Central Mid Hills (Kavre, Dhading etc.)
7	Brinjal	Nurki, PPL	Inner Terai and Terai region (Chitwan, Dang, Sarlahi, Udayapur) and lower valleys of Mid Hill regions
8	Pepper	California Wonder	Mountains and Mid Hills of Mid-Western (Kalikot, Dailekh, Rukum, Rolpa, Dang, Surkhet)
9	Chilli	Pusa Jwala	Mountains and Mid Hills of Mid-Western (Kalikot, Dailekh, Rukum, Rolpa, Surkhet)
10	Lady's finger	Parbati, Parwani, Kanti	Inner Terai and Terai region (Chitwan, Dang, Sarlahi, Udaypur) and lower valleys of Mid Hills
11	Swisschard	Fordhook joint	High mountains and Mid hills of Western (Mustang) and Mid Western regions (Karnali)
12	Spinach	Patane, Kande, All green	Mountains and Mid Hills of Mid-Western regions(Kalikot, Dailekh, Rukum, Rolpa, Dang, Surkhet)
13	Cucurbitaceous vegetables	Sarlahi green (cucumber), Jukini (Squash),	Inner Terai and Terai region (Chitwan, Dang, Sarlahi, Udayapur) and lower valleys of Mid Hills
14	Beans	Tane (khumal, Sarlahi), Four season	Mid hills, Inner Terai and Terai region (Syangja, Kavre, Chitwan, Dang, Sarlahi, Udayapur)
15	Cauliflower & Cabbage	Cauli (KTM local), Dolpa Snowball local, Giant cabbage, Copenhagen market (Cabbage)	High mountain regions of Karnaili (Humla, Dolpa, Kalikot) and Mid hills of mid-western region (Rukum, Rolpa, Salyan, Pyuthan)

Annex 3.3: Seed Replacement Rate (%) in food crops and vegetables

Sn	Crops	Status				Projection		
		2001	2005	2009	2010	2015	2020	2025
1	Paddy	0.71	5.35	9.14	11.38	15.06	20.05	24.25
2	Maize	0.99	3.32	6.54	9.03	14.43	20.10	31.57
3	Wheat	3.6	7.19	9.4	11.0	13.09	18.10	22.53
4	Millet	0	0	1.97	2.35	5.68	6.82	11.27
5	Barley	0	0	0	0	3.25	6.5	11.66
	Total Cereals	2.02	5.82	8.78	10.68	13.78	18.79	23.84
6	Lentil	0.37	0.30	3.08	3.26	6.17	10.61	22.04
7	Oilseeds	0	0	2.62	2.86	5.87	9.44	13.87
8	Potatoes	1.0	3.0	5.0	5.5	9.0	14.0	15.0
9	Vegetables	65.9	65.4	66.3	68.3	80.0	85.0	90.0

Source: SQCC, 2011 and authors' projection

Annex 3.4: Crop production and projected seed requirement

Description	Unit	2001	2005	2010	2015	2020	2025
Paddy							
Crop production	mt	4,164,687	4,209,297	4,437,801	4,90,430	5,458,588	6,103,552
Area coverage under crop production	ha	1,516,980	1,549,447	1,488,695	1,526,287	1,564,828	1,604,341
Seed replacement rate	%	0.71	5.35	11.38	15.06	20.05	24.25
Formal sector seed production	mt	542	4,142	8,470	11,490	15,690	19,450
Improved Seed Area required	ha	282	2,178	4,059	5,087	6,248	6,368
Maize							
Crop production	mt	1,510,770	1,734,417	2,019,177	2,288,767	2,687,839	3,234,159
Area coverage under crop production	ha	825,980	850,947	881,352	910,371	940,345	971,306
Seed replacement rate	%	0.99	3.32	9.03	14.43	20.10	31.57
Formal sector seed production	mt	163	565	1,592	2,627	3,780	6,132
Improved Seed Area required	ha	137	426	1,069	1,608	2,035	2,833
Wheat							
Crop production	mt	1,258,045	1,394,126	1,689,470	1,888,745	2,111,524	2,360,580
Area coverage under crop production	ha	667,077	672,040	732,959	742,167	751,490	760,931
Seed replacement rate	%	3.60	7.19	11.01	13.09	18.10	22.53
Formal sector seed production	mt	2,878	5,796	9,680	11,659	16,325	20,570
Improved Seed Area required	ha	2,180	3,992	5,999	6,545	8,300	9,472
Millet							
Crop production	mt	282,570	290,936	301,377	318,159	348,050	404,074
Area coverage under crop production	ha	258,120	261,673	268,607	269,279	269,953	270,629
Seed replacement rate	%	-	-	2.35	5.68	6.82	11.27
Formal sector seed production	mt	-	-	63	153	184	305
Improved Seed Area required	ha	-	-	80	185	204	292
Barley							
Crop production	mt	30,790	27,786	28,202	41,983	45,340	49,134
Area coverage under crop production	ha	27,722	26,227	26,605	26,632	26,659	26,685
Seed replacement rate	%	-	-	-	3.25	6.50	11.66
Formal sector seed production	mt	-	-	0.5	78	156	280
Improved Seed Area required	ha	-	-	1	71	131	217
Formal Cereal Seed production	mt	3,583	10,503	19,806	26,007	36,135	46,737
Total Cereal Seed requirement	mt	177,771	180,376	185,363	188,671	192,326	196,063
Replacement rate for Cereals	%	2.02	5.82	10.68	13.78	18.79	23.84
Lentil							
Crop production	mt	148,384	157,963	153,907	170,255	193,225	221,456
Area coverage under crop production	ha	180,210	183,170	188,843	196,031	203,494	211,240
Seed replacement rate	%	0.37	0.30	3.26	6.17	10.61	22.04
Formal sector seed production	mt	27	22	246	484	864	1,862
Improved Seed Area required	ha	46.84	36.44	431.20	796.11	1,300	2,537
Oil seed							
Crop production	mt	134,950	139,322	157,384	172,972	191,986	217,321
Area coverage under crop production	ha	187,820	188,062	199,533	204,571	209,737	215,033
Seed replacement rate	%	0.00	0.00	2.86	5.87	9.44	13.86
Formal sector seed production	mt	-	-	57	120	198	298
Improved Seed Area required	ha	0	0	111	218	333	454
Vegetables seed							
Crop production	mt	1,738,086	2,190,100	3,071,407	3,598,001	4,488,533	5,404,431
Area coverage under crop production	ha	161,048	189,832	230,981	254,522	265,708	290,723
Seed replacement rate	%	65.9	65.4	68.3	80.0	85.0	90.0
Improved seed area required	ha	849	994	1,117	1,566	1,506	1,745
Formal sector seed production	mt	629	763.77	1100	1756	1909	2407
Potato							
Crop production	mt	1,472,757	1,974,755	2,542,864	2,966,369	3,380,474	4,019,654
Area coverage under crop production	ha	135,093.0	150,864.0	183,076	189,463	190,129	196,539
Seed replacement rate	%	1	3	5.5	9	14	15
Formal sector seed production	mt	2,161	7,241	16,111	25,577	37,265	41,273
Improved Seed Area required	ha	283	790	1,657	2,334	2,994	2,883

Source: MOAC (2010), MOF (2010), SQCC,(2011), CDD (2010) and authors' projection

Annex 3.5: List of Seed Processing Plants

S N.	Name of Seed Producer	Address	No
1	National Seed Company Limited	Itahari, Janakpur, Hetauda, Bhairahawa, Banke, Dhanaghadi	6
2	Salt Trading Corporation Limited	Hetauda	1
3	Samuhik Bij bridhi Co. Pvt. Ltd	Dumariya, Rautahat	1
4	Unnat Bij Bridhi Samuha	Patehani, Chitwan	1
5	Shree Ram Bij Bridhi Co. Pvt. Ltd	Parbatipur, Chitwan	1
6	Malla Bij Suppliers	Tadi Chitwan	1
7	Manaslu Seed Co. Pvt. Ltd	Tadi Chitwan	1
8	Bij Bridhi Co. Pvt. Ltd	Pithuwa, Chitwan	1
9	Lumbhini Seed Co. Pvt. Ltd	Bhairahawa	1
10	Kalika Seed Co. Pvt. Ltd	Bhairahawa	1
11	Universal Seed Co. Pvt. Ltd	Bhairahawa	1
12	Annapurna Krishi Sahakari Sastha	Manapakadi, Rupandehi	1
13	Mechi Krishi Sahakari Sastha	Jhapa	1
14	Unique Seed Co. Pvt. Ltd	Dhanaghadi	1
15	Pancha Sakti Seed Co. Pvt. Ltd	Dhanaghadi	1
	Total		20

Annex 3.6: List of Seed Testing Laboratories

S.N.	Name of Laboratories	Code No.
1	Regional Seed Testing Laboratories, Jhumka***	01
2	Regional Seed Testing Laboratories, Hetauda***	02
3	Regional Seed Testing Laboratories, Bhairahawa***	03
4	Regional Seed Testing Laboratories, Nepalgunj***	04
5	Regional Seed Testing Laboratories Sundarpur***	05
6	National Seed Company Limited, IQCL Itahari*****	06
7	Central Seed Testing Laboratory, Hariharbhawan	07
8	Centre for Environmental and Agricultural Policy Research, Extension and Development *****	08
9	Regional Agriculture Research Station, Pakhribas **	09
10	Regional Agriculture Research Station, Lumle **	010
11	National Seed Company, IQCL Bhairahawa*****	011
12	Sean Seed Service Centre, Thankot*****	012
13	Agriculture Techonology Centre, Pulchowk **	013
14	Seed Science and Technology Division, Khumaltar*****	014
15	Rhizobium Laboratory, Janakpur****	015
16	National Agriculture Genetic Resource Centre, Khumaltar (Seed Laboratory)	016
17	Sub-tropical Vegetable Seed Production Centre, Rukum (Seed Testing Laboratory)***	017

** Not in function.

*** Under Department of Agriculture

**** Under Livestock Department

***** Under NARC

***** Under NSCL

***** Private

Annex 3.7 : Yield level of major crops (mt/ha)

Sn	crops	Status			Projection		
		2001	2005	2010	2015	2020	2025
1	Rice	2.15	2.72	2.98	3.21	3.49	3.80
2	Maize	1.82	2.0	2.29	2.51	2.86	3.33
3	Wheat	1.88	2.07	2.30	2.54	2.81	3.10
4	Millet	1.09	1.11	1.12	1.18	1.29	1.49
5	Barley	1.11	1.06	1.06	1.58	1.70	1.84
6	Lentil	0.82	0.86	0.81	0.87	0.95	1.04
7	Oilseeds	0.72	0.74	0.79	0.85	0.91	1.01
8	Vegetables	10.79	11.54	13.06	14.73	16.72	19.24
9	Potato	10.9	13.09	13.89	15.66	17.78	20.45

Source: MOAC (2010), MOF (2010) and authors' projection

Annex 3.8: Annual compound growth rate (%) of area, prod and yield of food crops and vegetables in Nepal (1985/86-2009/10)

Crops	1985/86-1989/1990			1990/91-1994/95			1995/96-1999/2000			2000/01-2004/5			2004/5-2009/10			1985/86-2009/10		
	Area	Prod	Yield	Area	Prod	Yield	Area	Prod	Yield	Area	Prod	Yield	Area	Prod	Yield	Area	Prod	Yield
Rice	1.43	7.04	5.61	-0.95	-2.9	-1.96	0.73	2.37	1.64	0.04	1.02	0.98	-0.12	1.16	1.28	0.5	1.99	1.49
Maize	5.42	8.47	3.02	0.35	1.54	1.15	0.79	1.88	1.09	0.70	3.43	2.69	0.62	1.92	1.31	1.32	3.11	1.78
Wheat	5.63	8.85	3.22	1.69	4.03	2.33	0.21	3.25	3.45	1.01	5.38	4.38	1.57	1.00	-0.57	1.27	3.86	2.58
Potato	4.43	1.75	1.3	3.44	2.77	-0.6	3.54	6.39	2.85	3.15	6.7	3.55	5.81	7.06	1.25	3.94	7.22	3.28
Lentil	-	-	-	7.81	10.27	2.47	3.66	3.74	0.09	1.49	2.99	1.49	0.17	-1.88	-2.04	1.85	3.68	1.84
Oilseeds	2.96	6.52	3.37	4.69	6.68	1.99	0.94	1.17	0.22	-0.12	1.25	1.37	0.93	2.12	1.2	1.31	2.39	1.08
Vegetable	-	-	-	0	2.99	3.12	0.19	2.19	2.01	3.49	5.29	1.79	5.87	8.12	2.25	2.85	5.33	2.51

Source: Authors estimation using data from MOAC (2010) and VDD (2010)

Annex 5.1: Log frame - Seed Vision

NARRATIVE SUMMARY	EXPECTED RESULTS	PERFORMANCE MEASUREMENT INDICATORS	ASSUMPTIONS/RISKS
Project Goal	Impact	Performance indicators	Assumptions/Risks
To improve the well being of farming families through sustainable and competitive seed system.	Improved and sustainable economic and social well being of poor including women and disadvantaged groups.	<ul style="list-style-type: none"> Enhanced HDI (as per TYIP and MDG) Number of new national plan and policies with seed issues (to be established). 	Commitment to the wellbeing of people remains the highest priority. Risk: medium

Purpose	Outcome	Performance indicators	Assumptions/Risks
To increase crop productivity, raise income and generate employment through self sufficiency, import substitution and export promotion of quality seeds.	Increased production and distribution of quality seeds. Increased income and employment opportunities among rural farming families.	<ul style="list-style-type: none"> Yield of developed and released varieties increased (Rice - 28%, Wheat- 35%, Maize - 45%, and vegetable - 47% by 2025). Increased income and employment (%) through quality seed use. 	Poverty reduction, food security and biodiversity conservation are incorporated in national plan and policies. Risk: low
Inputs/Activities	Outputs	Performance indicators	Assumption/Risks
<ul style="list-style-type: none"> Collection, evaluation, conservation, hybridization, and release of new varieties. Support modern seed research infrastructure development. Capacity development of farmers and protecting their breeders' rights. Development of regular feedback mechanism. 	<p>Variety development and maintenance breeding;</p> <p>Competitive varieties developed and released.</p>	<ul style="list-style-type: none"> Number of varieties with climate resiliency and high nutritional value developed and released. Number of varieties, required for different crops and agro climatic zones maintained (to be established). Number of hybrid varieties developed/released (Maize-17, Rice-13 and vegetables -30 by 2025). 	Plant breeding and varietal maintenance research activities are prioritized by GoN. Risk: medium
<ul style="list-style-type: none"> Improvement of seed multiplication steps, Increase public private partnership. Buffer stock management. Devolved seed production system. Seed saving, multiplication and storage support at farmers' level. Capacity development. Integration of seed into national policies. Harmonization of seed policies at least within SAARC. 	<p>Seed multiplication;</p> <p>Adequate quantity of seeds multiplied through standard cycle of seed production.</p>	<ul style="list-style-type: none"> Increased contribution of domestically produced quality seeds (% by 2025). Increased share of quality seed produced by private sector (63 % by 2025). Rate of seed replacement increased (SRR) from (9 % to 25% by 2025). 	GoN emphasizes the production of quality seeds. Risk: low
<ul style="list-style-type: none"> Strengthening of seed networks, dealers and supply channels. Improvement of seed policies, act and regulation. Partnership development among stakeholders. Capacity development. Farmers' rights protection. 	<p>Seed marketing</p> <p>Good quality of required seed distributed at the right time, right place at an affordable price.</p>	<ul style="list-style-type: none"> Rate of popularization of new varieties increased (number/year to be established). Increased number of seed entrepreneurs and agro based industries (to be established). Increased quantity and value of quality seed exported by 2025 (%). Decreased quantity and value of seed imported by 2025 (%). 	GoN continues with open liberal economic policy. Risk: low
<ul style="list-style-type: none"> Reduction in low quality seed use. Vulnerability assessment of poor. Seed campaign. National seed survey. Market monitoring. Seed handling in retailer chain. Provision of rights to information. 	<p>seed use</p> <p>Quality seeds of preferred varieties accessible to farmers.</p>	<ul style="list-style-type: none"> Increased number of households using quality seeds. Increased area covered by quality seeds increased. 	GoN promotes use of good quality seeds Risk: low