Cereal Seed Value Chains in Nepal:

Current functions, changing context, and opportunities for upgrading

Dyutiman Choudhary, Narayan Khanal, Bandana Pradhan,
Hari K. Shrestha and Jason Donovan

CGIAR | CIMMYT MR
International Maize and Wheat Improvement Center

Cereal Seed Value Chains in Nepal:

Current functions, changing context, and opportunities for upgrading

Dyutiman Choudhary, Narayan Khanal, Bandana Pradhan,
Hari K. Shrestha and Jason Donovan

International Maize and Wheat Improvement Center (CIMMYT)

February 2022

CGIAR | CIMMYT MR International Maize and Wheat Improvement Center

The International Maize and Wheat Improvement Center (CIMMYT) is a non-profit international agricultural research and training organization. CIMMYT focuses on sustainable agri-food systems and improved livelihoods through research on maize, wheat and other food crops.

Applying high-quality science and strong partnerships, CIMMYT works for a world with healthier and more prosperous people, free from global food crises and with more resilient agri-food systems. Its research brings enhanced productivity and better profits to farmers, mitigates the effects of the climate crisis, and reduces the environmental impact of agriculture.

CIMMYT is a member of CGIAR, a global research partnership for a food secure future dedicated to reducing poverty, enhancing food and nutrition security, and improving natural resources.

Citation: Choudhary, D.; Khanal, N.; Pradhan, B.; Shrestha, H.K.; and Donovan, J. (2022). *Cereal Seed Value Chains in Nepal: Current functions, changing context, and opportunities for upgrading. Kathmandu*: CIMMYT

Acknowledgements: This report is made possible by the financial support of the United States Agency for International Development (USAID) and the CGIAR research program on Policies, Institutions and Markets (PIM). Its contents are the sole responsibility of CIMMYT and do not necessarily reflect the views of USAID, the United States Government or CGIAR.

Foreword

Agriculture is the single largest economic sector in Nepal, providing livelihoods for two-thirds of the population, largely at a subsistence-level. About 65% of Nepalese households still depend on agriculture for their livelihoods. The Government of Nepal's Agriculture Development Strategy (2015–2030) aims to commercialize agriculture while its National Seed Vision (2013–2025) aims to improve food security by increasing the domestic production of high-quality affordable seed and making it available to farmers. The production and availability of quality seed is crucial for improving agricultural productivity and commercializing Nepal's agriculture. Concern over low productivity in smallholder cereal production is warranted from a development and a food security perspective, as cereals cover 80% of the cultivated land area in Nepal. A key ingredient to improving cereal productivity in farms is enhanced access to and utilization of quality seeds and hybrid varieties.

Improving resilience and productivity of smallholder cropping systems is foundational to CIMMYT's sustainable agrifood systems program. This integrated approach is well represented in Nepal, with a focus on improved seed systems.

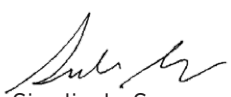
The assessment of the value chains for cereal seeds in Nepal was carried out by the Nepal Seed and Fertilizer (NSAF) project being implemented by CIMMYT with the support from United States Agency for International Development (USAID). NSAF focuses on promoting the domestic seed sector and facilitates private-sector businesses produce quality seeds and support the diffusion of new seed varieties through improved business practices and extension approaches. The overall objective of the assessment was to provide evidence-based recommendations for the development of Nepal's formal cereal seed sector focusing on maize and rice.

Although there has been scattered documentation on the various dimensions, challenges, and opportunities in the cereal seed sector in Nepal, it is widely felt that there is a lack of comprehensive documentation and analytical assessment in the context of a changing market, governance and COVID-19 pandemic scenario in the country. This publication attempts to fill that gap.

The publication highlights the need for a well performing seed system where high-quality seeds of a wide range of varieties and crops are produced and available in time and affordable to farmers. It identifies the actors, functions, volumes, gross margins, inter-firm relations, service providers and facilitators, and their activities and roles. The assessment brings together the related issues, challenges, risks and opportunities for a strong domestic cereal seed sector in Nepal.

The publication is timely and provides information on the market, political and social dynamics in the Nepalese seed sector. The recommendations provide strategic directions for private and public sector to formulate and implement inclusive seed sector upgrading strategies in a changing context.

I would like to congratulate the authors for their hard work in bringing out this work. I am confident that this publication will stimulate discussions among various stakeholders and will make important contributions to a strong seed sector in Nepal.



Sieglinde Snapp
Program Director, Sustainable Agrifood Systems
CIMMYT

Executive Summary

About 80% of Nepal's cultivated land is under cereals, with a generally low level of productivity. Achieving higher productivity in cereal production will require, among other things, seed value chains that deliver timely, affordable, and quality seeds to farmers, the vast majority of whom are smallholders. The formal seed system provides roughly 17% of cereals seed used in Nepal. The remainder of cereal seed obtained comes from the informal system. The Government of Nepal (GoN), through its National Seed Vision, has mandated that private seed companies produce and make available to farmers five maize hybrids by the year 2025. The long-term objective of the strategy is to have a national seed industry able to meet the country's demand for hybrid maize varieties.

There has been a limited reflection on the current state of cereal seed value chains in Nepal and how to address the challenges and bottlenecks at multiple levels in the chains. Moreover, seed value chain development has taken place during a period of profound change in the larger political context. In 2018, Nepal adopted a federal system of governance with federal, provincial, and local tiers of government. This has led to the reorganization of the country's bureaucracy, including the agencies under MoALD, and the creation of new structures in provincial and local governments, thus affecting public sector seed production and distribution systems and rules with implications on private seed business. The design of effective strategies supporting cereal seed value chain development requires deeper insights into how the chain performs (products delivered, prices, volumes), the capacities, bottlenecks and incentives faced by those engaged, and the context in which chain actors operate. This provides the foundation for assessing opportunities for upgrading in terms of products and functions. Nepal's cereal seed value chains, particularly rice and maize, are rapidly evolving. The overall structure, functions, actors, and roles are changing with the adoption of a federal system of governance from 2017/18 and the COVID -19 related disruptions since 2020. A value chain assessment was conducted between 2018-2020 to bring out performance issues, drivers of competitiveness, and the interventions required to improve the performance of cereal value chains.

In Nepal, there are several registered small-scale seed companies in operation. The majority of seed sold to farmers is brought into the country by seed importers and wholesalers, who sell seed directly to farmers or indirectly through agro-dealers. The seed sector in Nepal is characterized by vertically organized production and the distribution of released and registered varieties by public and private organizations. The Nepal Agricultural Research Council (NARC) is the main entity working on seed research and development, including hybrids. Seed companies produce seeds of public varieties through contract growers and conduct quality control and periodic monitoring. All seed companies have adopted seed processing, quality control, marketing and sales with varying levels of consistency. Cooperatives are also important actors in Nepal's cereal seed value chain, mostly in the many parts of the Midhills where seed companies are not actively present. Seed is also brought into the country by importers and wholesalers, who ultimately make seed available to farmers through sales to agro-dealers. Seed importers mainly bring in high-yielding hybrids for use in commercial grain production, since Nepalese hybrids have yet to be commercialized.

In 2019, NARC produced and sold 27 Mt of rice breeder seed. The amount of breeder seed produced by NARC has increased by about 5% annually over the last five years. The largest market for both OPV and hybrid rice seed is in Madhesh province at 4,997 Mt. Karnali province has the smallest rice seed market at only 181 Mt. While the eastern regions of Nepal demand long-duration varieties, the western regions prefer short duration varieties of rice. Nepali varieties cover the spring season rice while domestic OPVs and imported hybrid and OPVs dominate the summer season. The domestically developed Khumal series are popular in the mid-hills. There is a huge rice seed supply gap in all seven

provinces, with an overall 77% gap across the country. Seed production trends and sales of coarse rice varieties decreased by 65% in 2019 compared to 2017. The gross margin realized by rice growers was 42% and 43.9% for fine and coarse rice varieties, respectively. Seed companies realized a gross margin of 13.4%, while agrovets realized 7%. In the case of maize, seed growers realized 25% gross margin, while seed companies realized a gross margin of 16% and agrovets 6%. The survey found that imported seed accounted for 43.3% of the 17,656 Mt formal rice seed market in Nepal in 2018. Out of this 18% (7,646 Mt), came through formal channels while the other 82% came through informal channels. Unregistered varieties of OPV seed constituted the major part (80%) of the informal imports. The survey found quite a high prevalence of unregistered rice seed in the Terai districts of Lumbini and Bagmati provinces. The demand for short duration and fine hybrid rice varieties is increasing. Most millers and grain producers (seed consumers) are unaware of improved rice seed produced by Nepali seed companies and cooperatives.

As of April 2020, NARC had released 30 maize OPVs. Additionally, 56 hybrids were registered, of which 50 are recommended for the Terai/Inner-Terai region and six for the foothills and river basins of the Midhills. NARC had also developed seven hybrids, of which one is recommended for the Midhills and six for Terai and inner Terai areas up to 700 msl. The open-pollinated varieties comprise 63% of the maize seed market. In the case of rice, Nepal had notified 181 varieties of rice. Among the 70 registered varieties, seven are imported fine quality OPVs; five are locally adapted varieties and 58 are medium-fine hybrid varieties. The new hybrid rice varieties Hardinath Hybrid-1 (HH-1) and Hardinath Hybrid-3 (HH-3) were released by the National Seed Board (NSB) in 2020. In 2019 the National Maize Research Programme (NMRP) produced 1.35 Mt of breeder seed, with Rampur Composite making up 30%, Arun-2 20% and Manakamana-3 35% of this amount. The largest market for both OPV and hybrid maize seed is in Lumbini province at 778 Mt. Gandaki province has the smallest market for maize seed at only 320 Mt. There is a maize seed supply gap in all the provinces, with the highest gap in Province 1. For maize, hybrid seeds are imported through formal and informal channels. In 2018, Nepal formally imported 1,364 Mt of hybrid maize seed, and importers estimate that the figure is at least 2,000 Mt if informal imports are also included. For both rice and maize seeds, wholesalers and retailers depend on importers to supply these varieties, as the availability of popular varieties is essential for maintaining and growing their customer bases.

Most farmers know which varieties of open-pollinated rice and maize they prefer to buy, but many are unfamiliar with the various brands. Many farmers have grown imported rice hybrids of various brands, but the uncertain availability of seeds of many unregistered varieties means that they usually buy seeds based on retailers' recommendations. The assessment found that hybrid rice varieties are replacing coarse and medium fine OPVs. This is because the hybrid varieties yield significantly more grain (by about 0.7 Mt/ha) than OPVs. In 2018, the Sabitri rice variety had the highest market share (20%) of the total 10,010 Mt Nepali seeds sold, followed by Radha 4 and Sawa Sub 1 varieties. Dang is Nepal's main hybrid rice-growing district. For maize, in 2018, Rampur composite held the highest market share at 40% of the total sales of 2,297 Mt, followed by Arun 2 (30%), both of which are 30-year-old varieties. Hybrid maize has been adopted in areas where feed mills have been established. Jhapa is Nepal's main hybrid maize growing district. About 63% of surveyed grain-producing households grew improved varieties, with 36% of the total sample growing hybrid maize.

Our assessment showed an overall lack of competitive Nepali hybrids (vis-a-vis imported hybrids) and low awareness and information on new varieties. Limited research and development in seed production and limited innovation in marketing continue to form significant bottlenecks to the growth and development of cereals seed value chains. Small seed businesses lack access to critical services needed to expand their capacity and compete with foreign seed companies. There is a weak link between the public and private sectors that affects the provision of public goods, such as research and extension on new seed varieties. The public sector continues to play a dominating role in the formal seed sector, providing limited options for expanding the private sector. The transition to an effective private sector-driven seed system has been hampered by a lack of complementarities in public and private investments, leading to deficiencies in the institutional linkages between the various stages

of seed production, from breeding to commercial seed delivery. We propose an upgrading strategy for cereals seed value chains, focused mainly on small-scale seed companies, with the following dimensions:

- Product upgrading - Conduct hybrid seed production research and seed producibility research; include new hybrid varieties of rice and maize seed in product portfolios; develop and produce three-way cross and single-cross hybrids; introduce new products such as biofortified maize for the food and feed sectors. Launch smart product, pricing and packaging strategies based on market segments and customer needs and diversify product categories for targeting various needs (economies of scope); Comply with safety, environmental and sustainability standards (such as safe seed treatment practices, product handling standards, soil conservation related information) and maintain steady quality and homogenous product standards.
- Process upgrading - Maintain parental lines of hybrids; improve the quality of OPV products by implementation of maintenance breeding; follow standard operating procedures for producing hybrid and OPV seed; develop contractual seed production systems between seed producers and seed companies; increase seed processing capabilities such as high-quality seed drying and packaging facilities. Improve logistics for supplying adequate volumes of seed.
- Functional upgrading - Introduce and strengthen the research and development function in seed companies; Develop and strengthen the marketing function of seed companies; Develop market research capabilities to nurture and expand market segments; Develop branding and engage with farmers and marketing channel partners. Develop communication and product promotion approaches including product demonstrations, dealer meetings, seed fairs, farmer clubs and farmer reward programs; Introduce crop advisory services for farmers; timely delivery to markets to meet farmer demands; Provide competitive incentives to agro-dealers and track performance of varieties and address complaints using digital tools.
- Interchain upgrading – Learning from the experiences in public varieties develop strategies to product development and marketing for seed companies exclusively licensed products.

Suggestions generating a more enabling environment in the areas of variety testing and release, quality assurance in seed production, quality assurance in seed commercialization and financial and business management services for seed value chain development are also proposed. Our diagnostic highlights the need for systematic planning for marketing seeds in various market segments of the country to counter the issues of low knowledge and information of Nepalese seed varieties among market actors and farmers. Finally, the capacity building needs of value chain actors and stakeholders in the areas of seed policy, research and development, seed production and market development and seed sales and use by consumers and to develop resilient seed systems, which will be useful to implement the proposed upgrading strategies are suggested. Recognizing that the informal sector can play a crucial role in the diffusion of new varieties to farmers, especially in countries such as Nepal where the formal sector cannot produce adequate seed to meet farmers' needs, several actions have been suggested. Likewise, strategies to address the different opportunities, constraints, priorities, abilities of women and various social groups have been discussed to develop an inclusive cereal seed system in Nepal. A strengthened and competitive seed system will open avenues for Nepali companies to deliver high-quality products to farmers in various agro-ecological regions that are currently unreached by imported varieties.

Contents

Tables

Figures

Abbreviations

AKC	Agriculture Knowledge Center
AICL	Agriculture Inputs Company Ltd.
CIMMYT	International Maize and Wheat Improvement Center
COVID-19	coronavirus 2019
DADO	District Agriculture Development Office
FGD	focus group discussion
GESI	gender equality and social inclusion
IARC	International Agricultural Research Center
MoALD	Ministry of Agriculture and Livestock Development
MoLMAC	Ministry of Land management, Agriculture and Co-operatives (provincial)
msl	meters above sea level
Mt	metric ton
NARC	Nepal Agricultural Research Council
NGO	non-government organization
NMRP	National Maize Research Programme
OPV	open-pollinated variety
R&D	Research and Development
SAN	Seed Association of Nepal
SEAN	Seed Entrepreneurs' Association Nepal
SQCC	Seed Quality Control Centre

1

Introduction

1.1. Background

Agriculture is Nepal's largest economic sector, employing more than two-thirds of the labor force and generating around 24% of the country's gross domestic product (World Bank, 2020). The sector is dominated by smallholder farmers. Although Nepal is endowed with rich soils, water resources, and diverse ecosystems, agricultural productivity is well below potential. Improving agricultural productivity and the production of the country's smallholder agriculture is widely recognized as a critical outcome on the pathway to growth and poverty alleviation. Increased crop productivity, especially of the major staple crops, will allow farmers to take advantage of growing market opportunities while increasing household food security and nutrition. A key ingredient to increase agricultural productivity and production is improving farmers' access to inputs, particularly quality seed of superior varieties (MOAD, 2015).

About 80% of Nepal's cultivated land is under cereals, with a generally low level of productivity. Despite the potential of improved seeds of new varieties to boost productivity, little has been done to develop a private sector led seed market in the country. Improved crop varieties and quality seeds have a critical role to play as they are vital inputs and vehicles for boosting food production and rural incomes. A lot of attention is being given to strengthening seed value chains at the policy level in Nepal guided by the National Seed Vison (NSV) (MoAD, 2013) and the Agriculture Development Strategy (ADS) (MoAD, 2014).

A well performing seed system is one where high-quality seeds of a wide range of varieties and crops are produced and available in time and affordable to farmers and other stakeholders. Seed systems research and development is key to promote a competitive and vibrant seed sector in a country (Tripp, 2001). A core part of analyzing seed systems is to understand the functioning of seed value chains. The value chain refers to the full range of activities required to bring a product or service from production through to final consumption (Kaplinsky and Morris, 2001). The term chain suggests a focus on 'vertical' relationships between buyers and suppliers and the movement of a good from producer to consumer. Seed value chains cover the range of activities from the use of plant genetic resources to the marketing and distribution of seed of specific varieties and of certain type of quality to farmers (Audet-Bélanger et al. 2013; Choudhary et al., 2020; Rutsaert, et al., 2021). Seed value chain analysis identifies the actors, functions, production volumes, gross margins, inter-firm linkages, service providers and facilitators and their activities and roles. The analysis of the value chains of a specific seed system will enable the identification of the major related issues, challenges, risks and opportunities. The findings of such analysis can guide stakeholders on strategies to minimize risks and increase benefits from seed value chains.

In value-chain analysis, the concept of upgrading is used to identify the possibilities for actors to 'move up the value chain', either by shifting to more rewarding functional positions, or by making products that have more value-added invested in them or that can provide better returns to producers (Riisgaard et al. 2010). Upgrading means acquiring the technological, institutional and market capabilities that allow value chain actors to improve their competitiveness and move into higher-value activities.

The following are the various types of upgrading:

- Product upgrading by moving into more sophisticated products with increased unit value.
- Process upgrading by achieving a more efficient transformation of inputs into outputs through the reorganization of productive activities.
- Functional upgrading by acquiring new functions (or abandoning old ones) that increase the skill content of activities (performing functions in a value chain that has more skill and knowledge content).
- Inter-chain upgrading by applying competencies acquired in one function of a chain and using them in a different sector or chain.
- Upgrading the enabling environment by recognizing that the competitiveness of the enabling environment for value chains is a major factor that contributes to the success of the operations of a value chain.

Previous analyses of Nepal's seed value chains have mostly concentrated on seed producers and the production and distribution of seeds produced under government subsidy schemes (Khanal and Maharjan 2010; Prasad et al. 2011; Kafle et al., 2012). Nepal's seed systems and issues and challenges have been documented by Joshi and Bauer (2006), Ghimire et al. (2015), Gauchan et al. (2016) and MoAD (2017). A detailed and holistic value chain assessment of cereal seeds has yet to be conducted.

Nepal's rice and maize cereal seed system is evolving and the overall structure, functions, actors, and their roles are changing with the adoption of a federal system of governance from 2017/18 and the COVID -19 related disruptions since 2020. A value chain assessment of the cereal seed sectors has the potential to bring out issues of performance, drivers of competitiveness and the interventions that are required at the micro, meso and macro levels to improve their performance. In 2020/21, due to the COVID-19 pandemic, the country's agricultural seed systems have been exposed to new risks, which has reinforced the need for a strong seed system. A value chain analysis can identify risks and suggest measures to develop resilience and sustainability in seed value chains. A holistic and integrated national-level assessment of the cereal seed system is imperative to effectively contribute to informed debates on effective policies and strategies for engagement with cereal seed value chain actors – principally smallholders, seed businesses, agro-dealers and government agencies.

1.2. Seed Value Chains Study

An assessment of the value chains for cereal seeds in Nepal was carried out by the International Maize and Wheat Improvement Center (CIMMYT) between 2018-2020. The overall objective of the study was to provide evidence-based recommendations for the development of Nepal's formal cereal seed sector focusing on maize and rice. The specific objectives were as follows:

- To determine the size of the market and market trends for hybrids and open-pollinated variety (OPVs) of rice and maize seeds and their production, procurement, distribution systems, and utilization.
- To assess value chain actors, their relations, margins across the different functions, risks and vulnerabilities, and options for supporting upgrading in production and marketing.
- To identify the features of the external environment in which seed value chains operate in Nepal, including the provision of services by the Government of Nepal (GoN), NGOs and others, and the implications of these features and services for the development of the cereal seed value chain.

1.3. Assessment Framework and Methodology

The assessment began by identifying the main functions and actors and the conditions that enable the growth of Nepal's agricultural seed value chain (Figure 1.1). These were identified based on past work and CIMMYT's review of the current state of Nepal's seed sector.

The assessment mainly considered the functions carried out by domestic seed sector actors. The assessment also covered seed import and risks and vulnerabilities in the seed import business in recognition that much crop seed is imported into Nepal. The assessment was carried out through the four steps illustrated in Figure 1.2.

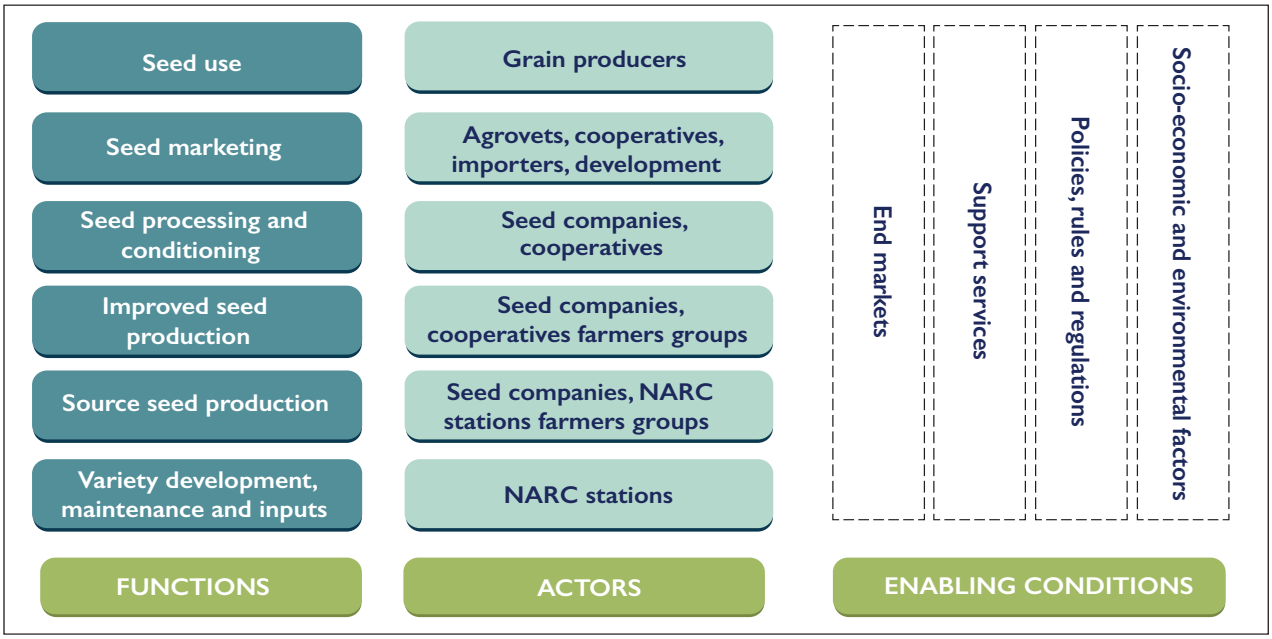


Figure 1.1: Value chain assessment framework.

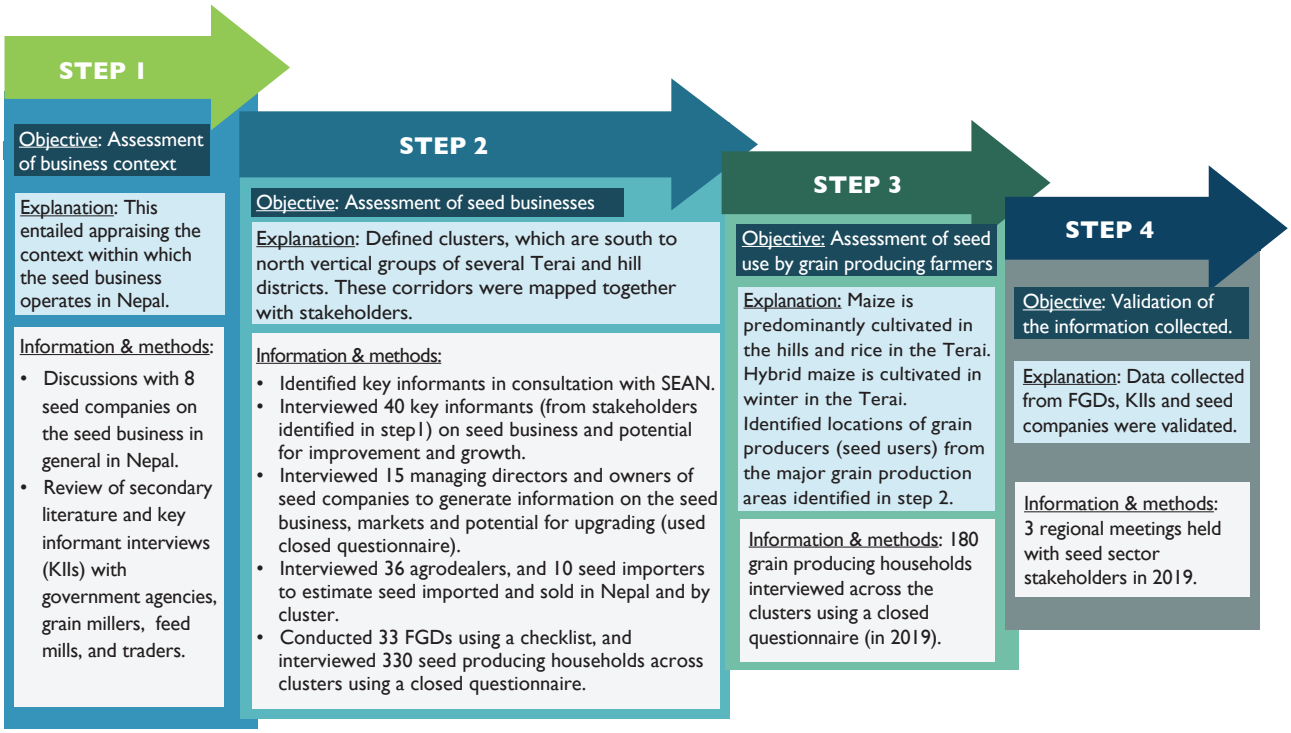


Figure 1.2: The four-step methodology used to carry out the value chain assessment.

The study covered a nationally representative sample of 330 seed producer households, 15 seed companies, 18 seed cooperatives, 36 agrodealers, 10 seed importers, 16 local grain traders, 180 grain producer households, 18 grain mills, and 5 Nepal Agricultural Research Council (NARC) research stations scattered across 36 of Nepal's maize and rice producing districts. The sample was representative of both hill and southern Terai plain areas. The following sampling meant that the major actors, seed markets and facilitators were covered to make the assessment representative of the rice and maize seed market across the whole of Nepal.

Identifying study sites – Multi-stage sampling was used to identify the sampling clusters for the assessments through the following steps:

- First, to make the survey representative of the country's main maize and rice growing areas, the country's hill and Terai maize and rice growing areas were divided into nine clusters based on the road corridors connecting Terai and hill areas.[1]
- Then, one Terai and one hill district were selected from each of the nine clusters to give 18 districts (Figure 1.3).
- Then one cereal seed producing cooperative was randomly selected from each of the 18 districts from a list of active cereal seed cooperatives working in each district.
- Then 15 seed companies were selected from the 9 clusters. As the distribution of seed companies was not uniform across the clusters, these 15 companies were selected from among cereal seed producer companies registered with the Seed Quality Control Centre (SQCC).
- Ten seed producing households were then randomly selected from each of the selected cooperatives and seed companies giving 330 households for the seed growers household survey.
- Then one cereal grain production village was selected from each of the 18 districts and 10 cereal grain producer households were randomly selected from each of the villages giving 180 households to be surveyed under the grain producers survey.

Group discussions – Thirty-three focus group discussions were held with the heads of the selected cooperatives and companies to complement and triangulate the information collected from the household surveys.

Market Data – Information about the demand trends and marketing dynamics of OPV and hybrids were collected from a sample of 36 seed dealers and retailers (agrovets) comprising two randomly selected from each of the 18 districts. 10 seed importers were interviewed to assess seed import into the country.

Validation meetings – Upon completion of the field study, three regional seed value chain validation meetings were held with seed traders in Sarlahi, Rupandehi and Surkhet districts.

Apart from collecting data and information from value chain actors, factors enabling seed market development that were identified in the value chain assessment framework (Figure 1.1) were further assessed. Following information was collected for each of the four enabling conditions:

- **End markets** – In each of the 9 seed market clusters the major rice millers, feed manufacturers and processors of the target crops were identified and interviewed to understand the status, problems and opportunities which reflect how end markets affect crop demand and their implications for seed systems.

[1] Refer to Annex 1 for details of the clusters

[I] 18 cooperatives x 10 households + 15 seed companies x 10 households = 330 households

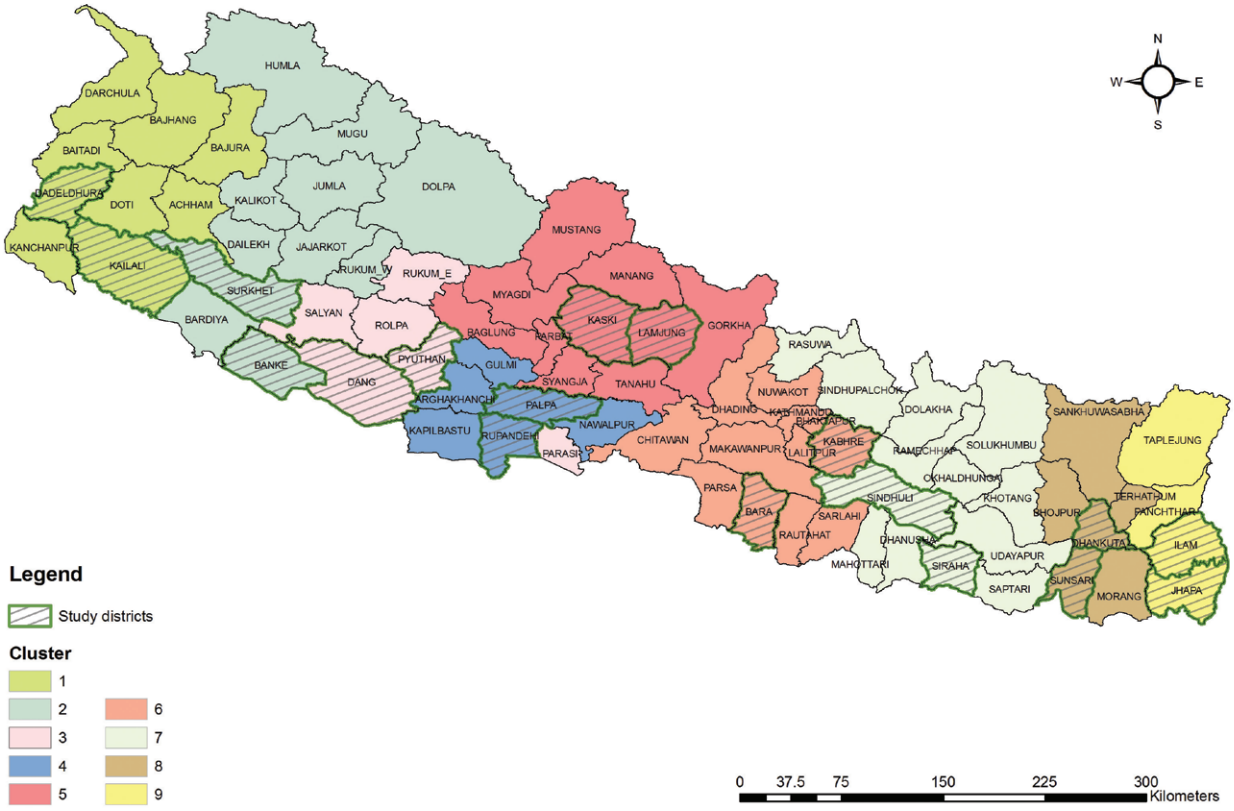


Figure 1.3: The nine seed market assessment clusters.

- **Support services** – The service providers in terms of banks, micro finance institutions (MFIs), insurance companies, aggregators of grains, laboratory services, and technical advisory service providers in the seed sector were interviewed and the information analyzed to understand the present service provision, gaps, and needs of stakeholders and their implications for seed value chains.
- **Policies rules and regulations** – Related policies and the regulatory environment that governs the seed sector were analyzed based on the literature and key informant interviews to understand how they affect the seed system stakeholders at various levels and the opportunities for improvement.
- **Socioeconomic and environmental factors** – The socioeconomic factors of population dynamics, incomes and gender and social inclusion issues were analyzed in the context of the use and adoption of improved seeds in Nepal. Risks and opportunities from biotic and abiotic factors were analyzed at the seed and grain production levels.

The data were analyzed using a combination of qualitative and quantitative approaches.

- Data collected from the clusters were analyzed to produce information at the provincial level
- The analysis of the functioning of the seed value chains and their underlying factors was based on direct observations; the results of focus group discussions; interviews and validation meetings with stakeholders, agro-dealers and the cross-verification of information.
- Results from the farmer household, agro-dealer and seed company interviews were analyzed using descriptive statistics.
- The views of stakeholders were analyzed using ranking and three-point Likert scales.

2

Cereal Seed Value Chains in Nepal

The results of the seed value chain analysis are structured into six levels. These include the business context; product portfolio and seed production; seed demand and supply; margins in the seed business; inter-business relations; and trends in seed use. Each of these are explained in the sections below.

2.1. The Business Context

2.1.1. Seed value chain structure, actors and functions

Nepal's formal seed system is characterized by vertically organized production and the distribution of released and registered varieties by public and private organizations. Figure 2.1 presents a generic formal sector value chain, contextualized to Nepal. The Nepal Agricultural Research Council (NARC) is the main entity working on seed research and development including hybrids. In terms of early generation seed, NARC stations and commodity programs produce breeder and foundation seeds. Some private seed companies have also acquired licenses to produce foundation seeds. While several seed sector development projects have been previously implemented in Nepal, none worked rigorously on strengthening research and development especially for the private sector. In general, the government has not encouraged the production of hybrid varieties. Since 2018 a number of Nepalese seed companies embarked on conducting varietal testing and hybrid seed production for maize and rice.

Nepal initiated a licensing system in 2021 for allocating hybrid maize varieties to the private sector, which is pending cabinet approval. NARC may allocate hybrids to any agency without attaching a sustainable commercial plan. The fact that the same hybrids can be allocated to several different seed companies and cooperatives makes private companies reluctant to invest in large scale production and promotion. The public sector does not view the private sector as capable and competent to produce hybrids. This lack of trust is largely based on most Nepalese seed companies lacking infrastructure, capacity and business plans to develop hybrids of their own.

Seed companies produce seeds of public varieties through contract growers and conduct quality control and periodic monitoring. Seed processing, quality control, marketing and sales have been adopted by all seed companies with varying levels of consistency. Most private seed companies are small or medium sized enterprises. Cooperatives are also important actors in Nepal's cereal seed value chain, mostly in the many parts of the Midhills where seed companies are not present. In some regions, cooperatives have developed strong market networks and market shares comparable with the private seed companies. The distribution of seed producing enterprises (seed companies, cooperatives and groups) producing rice and

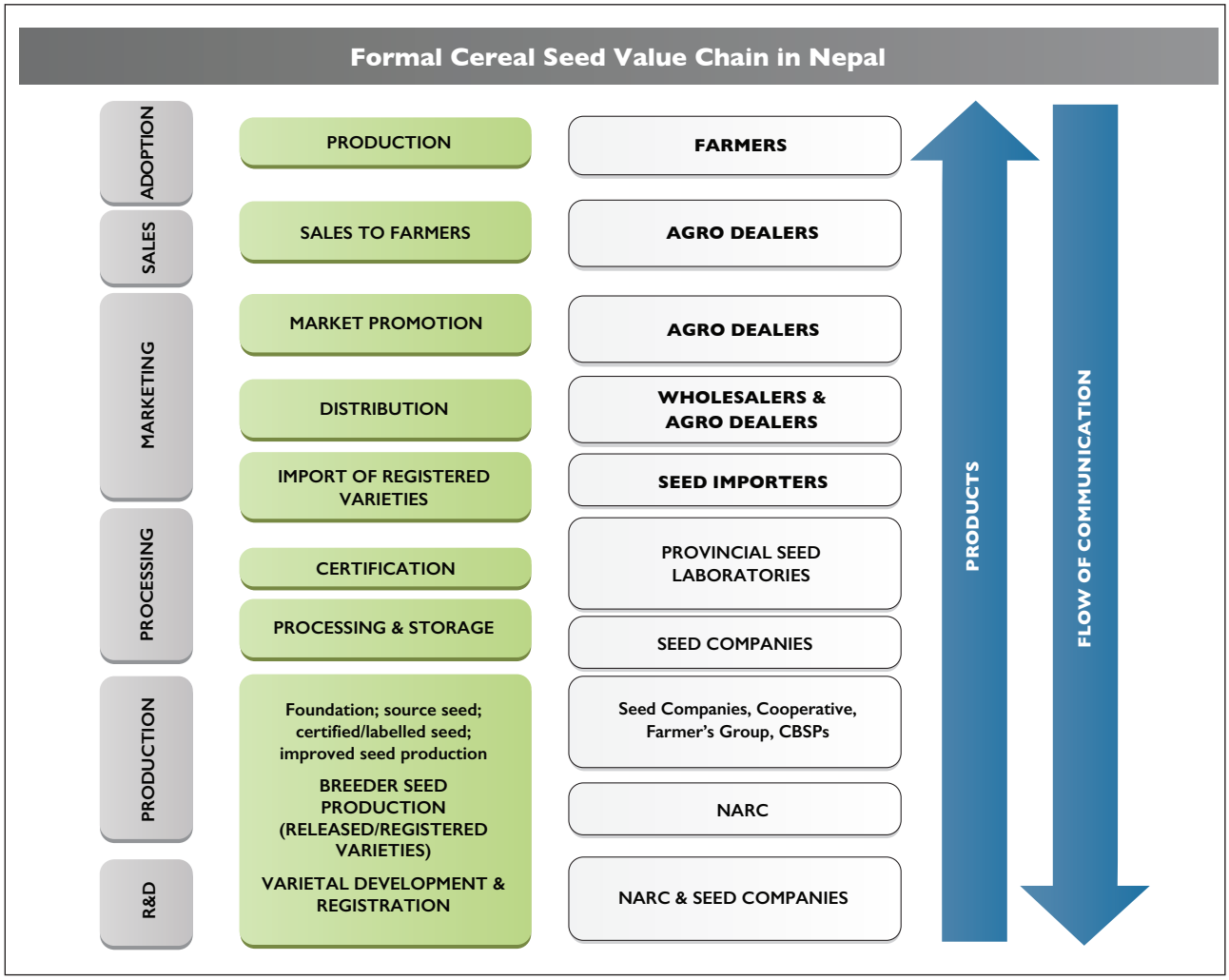


Figure 2.1: The formal cereal seed value chain in Nepal.

maize seeds in Nepal's hill and Terai areas is shown in Figure 2.2.[2] It is evident that seed production groups and cooperatives, dominate the type of seed producing enterprises, comprising both the formal and informal sector in Nepal.

Seed importers mainly bring in high yielding hybrids for use in commercial grain production, since Nepalese hybrids have yet to be commercialized. Since around a decade ago, due to policy shifts and support from seed sector programs, more seed has been imported into the country. Imported cereal seeds are registered in the SQCC by local counterparts of foreign companies after following multi-locational trials under NARC (SQCC 2016). These seeds are then distributed by importers and large wholesalers through their dealer networks.

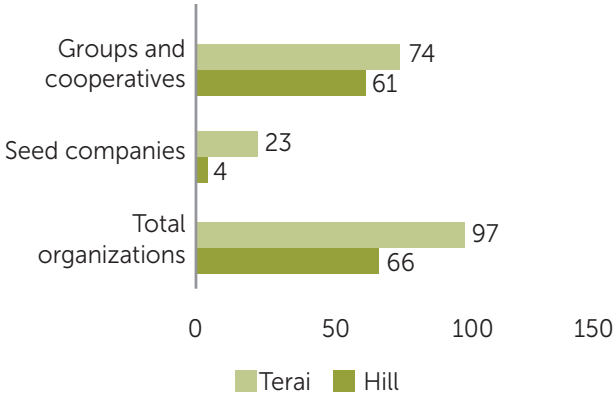


Figure 2.2: Rice and maize seed producing enterprises in Nepal's hills and Terai.

[2] Nepal's Terai and hills areas are delineated on Figure 2.5

Other actors in the formal seed sector include parastatal organizations, such as the Agriculture Inputs Company Ltd. (AICL), which procures and distributes subsidized rice, maize and wheat seed to farmers. These formal actors contribute to the two different market systems of the commercial production system (driven by hybrids) and the subsistence farming system (driven by OPVs), which is focused on food security mainly using open-pollinated varieties.

2.1.2. Seed value chain facilitators

Nepal's seed sector is heavily dependent on the public sector for seed production and distribution. Hence the main value chain facilitators are NARC, the Seed Quality Control Centre (SQCC) and the Ministry of Agriculture and Livestock Development (MoALD). At the provincial levels, ministry of land management, agriculture and co-operatives (MoLMACs), agriculture development directorates (ADD), agriculture knowledge centers and the agriculture units of rural municipalities have been established since 2017/18 to facilitate seed sector development at the provincial and local Government levels. A few NGOs, including Forum for Rural Welfare and Agricultural Reform for Development (FORWARD), Local Initiative for Biodiversity Research and Development (LIBIRD) and Center for Environmental and Agricultural Policy Research Extension and Development (CEAPRED) are engaged in building the capacity of seed producer groups and cooperatives, and scaling up new crop varieties in remote areas.

The international agricultural research centers (IARCs) and donor-supported seed development and promotion programs play an important role in seed sector policies and strategies in Nepal. The Seed Entrepreneurs Association of Nepal (SEAN), the Seed Association of Nepal (SAN) and the Seed Producers Association of Nepal are private sector associations that lobby for the growth of the seed sector in Nepal.

2.2. Product Portfolio and Seed Production

Nepal's cereal seed sector is dominated by public varieties with the breeder and foundation seed of these varieties being provided to companies, cooperatives and groups for producing and selling. Up to April 2020, Nepal has developed 30 OPVs of maize. Seven of them are suitable for growing in the Terai, 12 in the Midhills, 2 in the high hills and 9 varieties for growing across all three domains. Nepal has also developed seven hybrids, of which one, Khumal hybrid 2 is recommended for the Midhills in summer and Terai and Inner-Terai in winter and six for Terai and inner Terai areas up to 700 msl (Gaurav and Rampur 2, 4, 6, 8 and 10). Additionally, 56 imported hybrids have been registered, of which 50 are recommended for the Terai region and 6 for the foothills and river basins of the Midhills. The open-pollinated varieties comprise 63% of the maize seed market (Figure 2.3).

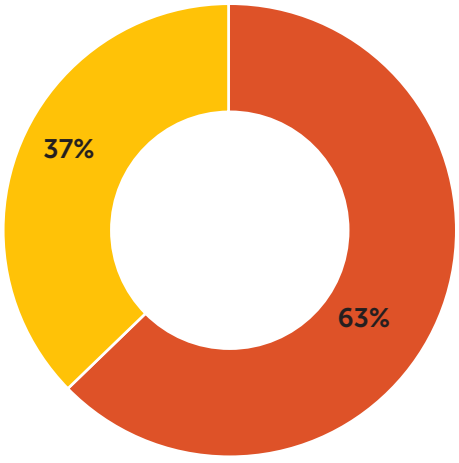


Figure 2.3: Market share of OPV and hybrid maize seed.

Up to April 2020, Nepal had notified 163 varieties of rice, 151 (23 were de-notified) of which are on the active list, including 81 released and 70 registered varieties. Among the 81 released varieties, 11 are categorized as fine varieties (Chaite 5, Sukkha-4, Sukkha-6, Bahuguni-1, Sambha Masuli Sub-1, Sawa Masuli, Ramdhan and Khumal 4,8 and 10) and 4 as fine and aromatic varieties (Lalka Basmati, Jetho Budho, Sugandhit Dhan 1 and Sunaulo Sugandha). Among the 70 registered varieties 7 are imported fine quality OPVs – 5 locally adapted varieties (Sarju-52, coarse; Ranjit Masuli, medium fine; Sawa Masuli, fine; Kalanamak-fine and Barkhe 1027-fine) and 58 are medium fine hybrid varieties. The new hybrid rice varieties Hardinath hybrid-1 (HH-1) and

Hardinath Hybrid-3 (HH-3) were released by the National Seed Board (NSB) in 2020. Overall, open-pollinated varieties still dominate Nepal's rice seed markets (Figure 2.4).

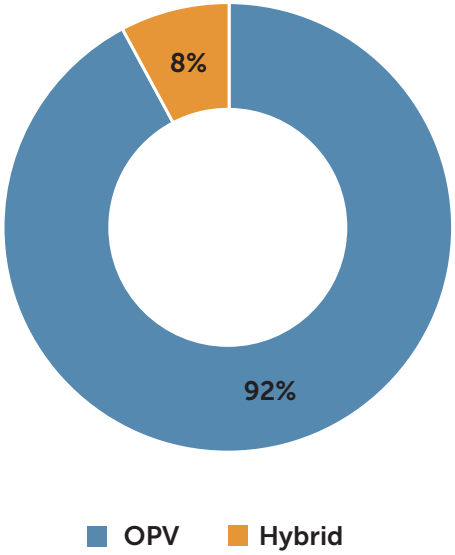


Figure 2.4: Market share of OPV and hybrid rice seed.

2.2.1. Major seed production areas

Rice seed production is mainly concentrated in the Terai districts (Figure 2.5). The five main seed production areas (clusters) are:

- the far-western cluster in Kailali and Kanchanpur
- the mid-western cluster in Banke and Bardiya
- the western- cluster in Rupandehi, Kapilvastu and Parasi
- the central cluster in Chitwan and Rautahat
- the eastern cluster in Jhapa, Morang and Sunsari districts.

There is some location specificity in the selection of particular varieties. For example, Sarju 52 is the main rice variety grown by farmers in the far-west, and its seed is also produced in the same region. Radha-4 is the main variety used in the mid-western region though its seed production is also carried out in the central and western development regions. The grain production of Sawa Masuli and Samba Masuli Sub-1, Ramdhan and Sabitri is concentrated in western and central Terai respectively. Seed of these varieties are also produced in these regions. Moreover, seed production and grain production Ranjit Masuli in limited to the eastern cluster.

Most of Nepal's OPV maize seed is produced in hill districts (Figure 2.6). Unlike with rice, the seed production locations of maize have changed over time as the focus of subsidies for seeds provided by local governments and development projects has changed. The current main locations for maize seed

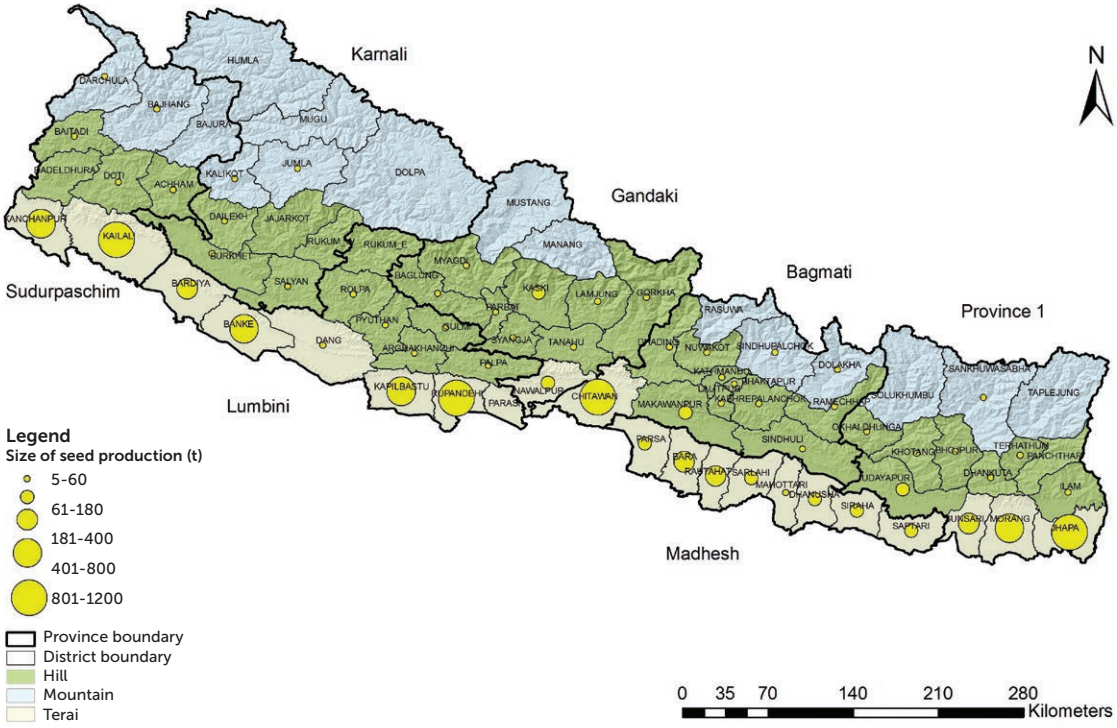


Figure 2.5: Major rice OPV seed production locations.

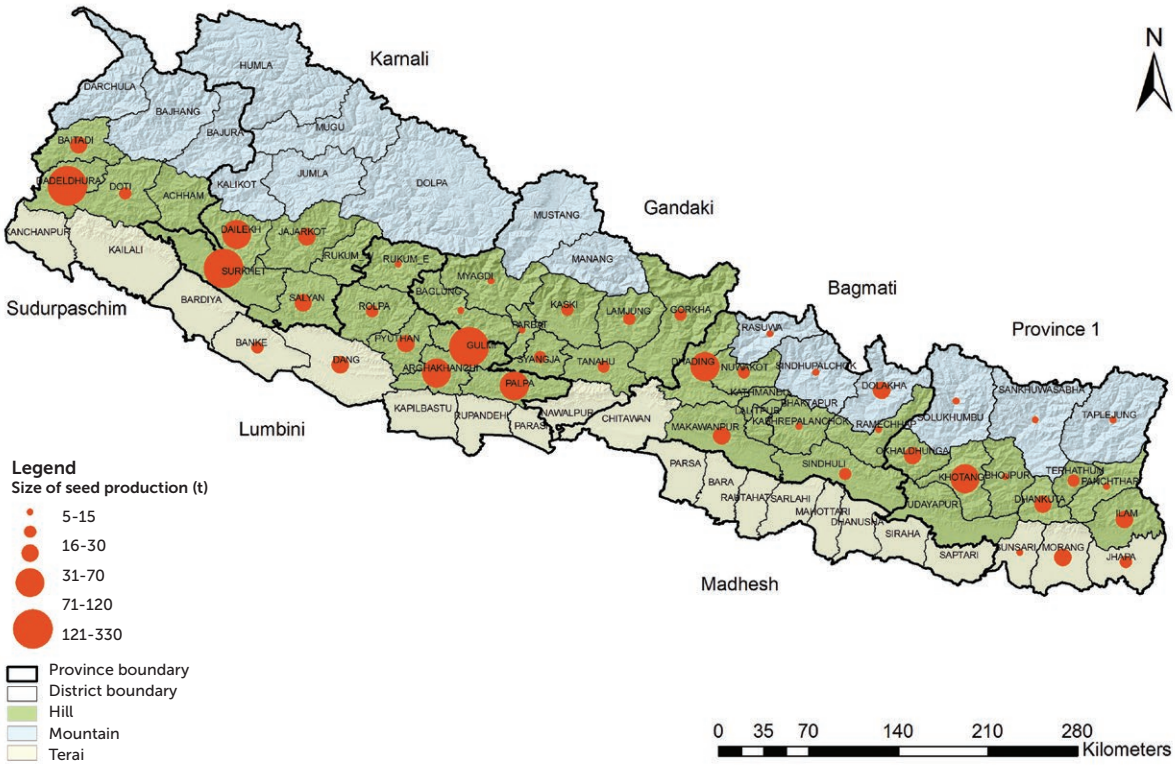


Figure 2.6: Major maize OPV seed production location.

production are the i) far-western hills in Dadeldhura, ii) the mid-western hills in Surkhet and Dailekh and iii) the western hill in Gulmi, Arghakhanchi and Palpa. This seed is mostly sold locally through subsidy programs, and to the central and eastern region through agro-dealers.

2.2.2. Seed production models

Seeds are produced by seed producing enterprises in Nepal following different process and systems. These are highlighted below:

The agrovet model of seed production is found in remote areas where seed producer groups, cooperatives and seed companies are largely absent. In this model, agrovets receive source seed from NARC stations and private seed companies and distribute it to lead farmers for improved seed production. Agrovets provide technical support to farmers by orientating them at the time of seed supply on seed production approach and by carrying monitoring through farm visits and over the phone conversations. During seed harvesting, agrovets collect seed samples and sends them for laboratory testing seed quality. The seed is sold on the market as agrovet seed.

The farmer groups and cooperatives model is where these member-based organizations are engaged in seed production and marketing, especially in the marginal areas where the presence of seed companies is weak. Cooperatives receive foundation seed from seed companies and NARC stations and provide technical support to their members for seed production through training and monitoring and facilitate marketing. While farmer groups mostly sell to local governments (previously district agricultural development offices, DADOs), cooperatives mostly sell seed to government agencies, development projects and through agro-dealers.

Private seed companies: The two main types of private seed companies are:

- member-based limited companies formed by members of single or multiple seed cooperatives to jointly produce and sell seeds under a new brand.

- private limited companies owned by individuals or shareholders who entered the seed industry to carry out seed business activities.

Private limited companies dominate Nepal's private seed production industry.

Both types of companies enter into purchase agreements with contract seed growers at the start of growing seasons. The companies subsequently provide source seed and training to their growers and carry out field monitoring and lastly purchase the seed. Under each of the three types of models, the terms of services such as subsidies on the cost of source seed, time and terms of payment, and the procurement of seeds as grain (in case of climatic hazards such as heavy and untimely rainfall) are defined and agreed to by growers.

In some cases, private limited companies make a deal with third parties such as agro-dealers and local agents to produce the seed for them through seed growers. In such cases, the seed companies provide support and services to agro-dealers for quality seed production. It is the responsibility of agents or agro-dealers to train the farmers and monitor the seed production process.

2.3. Seed Demand and Supply

Source seeds refer to breeder and foundation seed that are used to produce certified or truthful labelled seeds.

- Seed growers receive foundation seed for seed production through various channels, including directly from NARC stations, cooperatives, seed companies and development organizations. However, cooperatives and companies are the main sources of foundation seed.
- Most seed companies have licenses to produce foundation seed and mostly collect breeder seed from NARC or produce foundation seed for themselves.
- SQCC organizes seed stakeholder meetings annually in all seven provinces to develop the National Seed Balance Sheet. Based on the information provided in this balance sheet, source seed is produced at NARC stations, seed companies and cooperatives. With the implementation of federalism, this practice is being replaced by a digital seed information system which is being developed at SQCC.

2.3.1. Rice source seed

Rice breeder seed is produced by NARC stations. Figure 2.7 shows that coarse varieties still dominate rice breeder seed production in Nepal and that production of seed of fine rice varieties are increasing. The National Rice Research Program (NRRP) produces 20t breeder seed of 25 rice varieties, about 50% (9.5t)

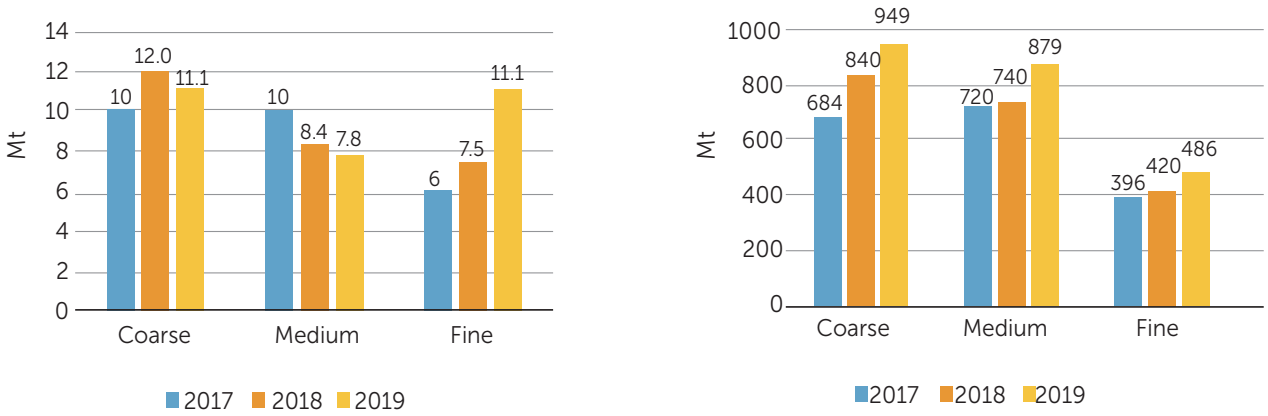


Figure 2.7: Trends in breeder (left) and foundation (right) rice seed production, 2017-2019.

of which belongs to the Sukkha series. These varieties are not however, preferred by seed companies, seed growers and seed consumers. This partly explains supply exceeding demand (Figure 2.8).

- In 2019, NARC produced and sold 27Mt of rice breeder seed. The amount of breeder seed produced by NARC has increased by about 5% annually over the last five years.
- NARC stations consume most of the breeder seed produced by their rice program. About 40% of rice breeder seed and 35% of rice foundation seed produced in NARC stations are distributed to seed companies and cooperatives.

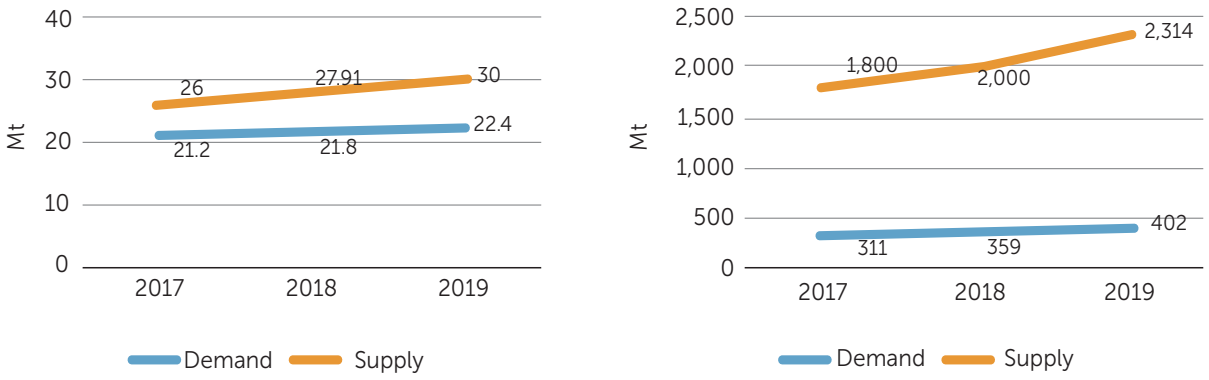


Figure 2.8: Trends in demand and supply for breeder (left) and foundation (right) rice seed, Nepal 2017–2019.

2.3.2. Province-wise rice seed market size and trends

Madhesh province has the largest area under rice production with an average yield of 3.2 Mt/ha (Figure 2.9). The average rice yield is highest in Bagmati province and the lowest in Karnali.

The largest market for both OPV and hybrid rice seed is in Madhesh province at 4,997 Mt, followed by Lumbini province (Figure 2.10). Karnali province has the smallest rice seed market at only 181 Mt.

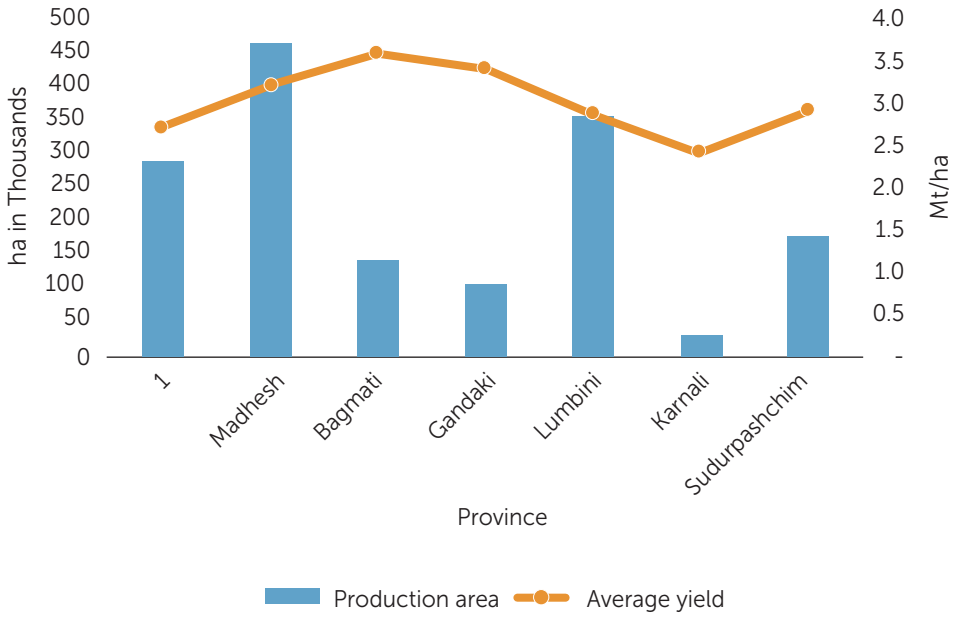


Figure 2.9: Rice production areas and average yields in Nepal's 7 provinces.

2.3.3. Rice seed requirement and supply situation and supply gap

There is a huge rice seed supply gap in all seven provinces, with an overall 77% gap across the country (Figure 2.11).

A larger area has been adopted for OPV than hybrid for rice grain production (Figure 2.12). Madhesh province has the highest grain production area under OPVs of 99,200 ha.

Seed companies and cooperatives increased production and sale of seed of fine rice varieties compared to 2017. Seed production trends and sales of coarse varieties decreased by 65% in 2019 compared to 2017 (Figure 2.13).

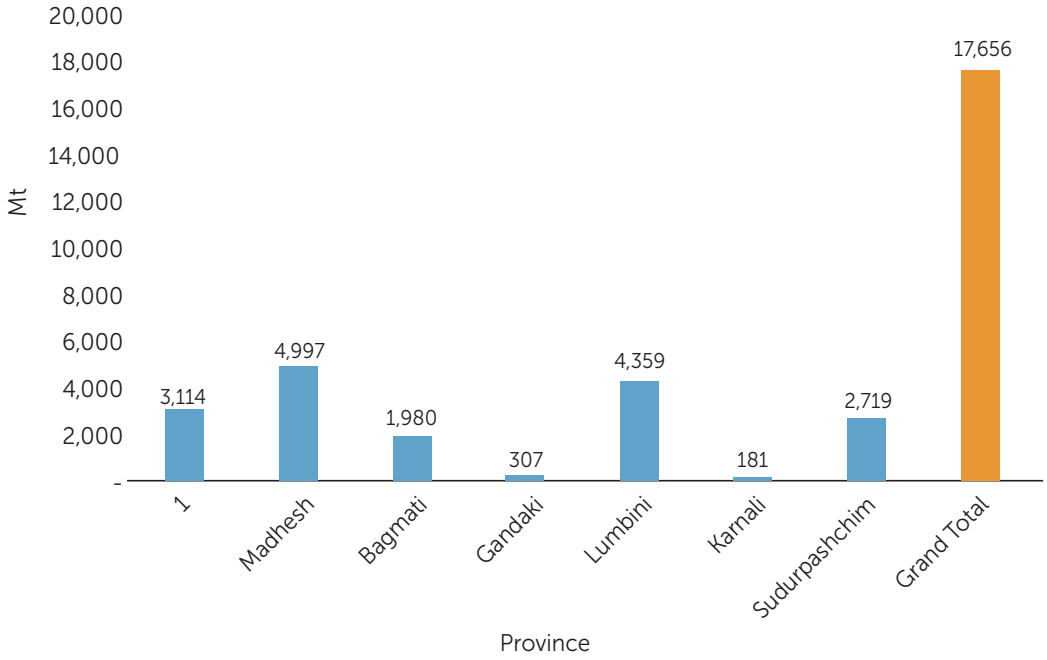


Figure 2.10: Size of the rice seed market by province.

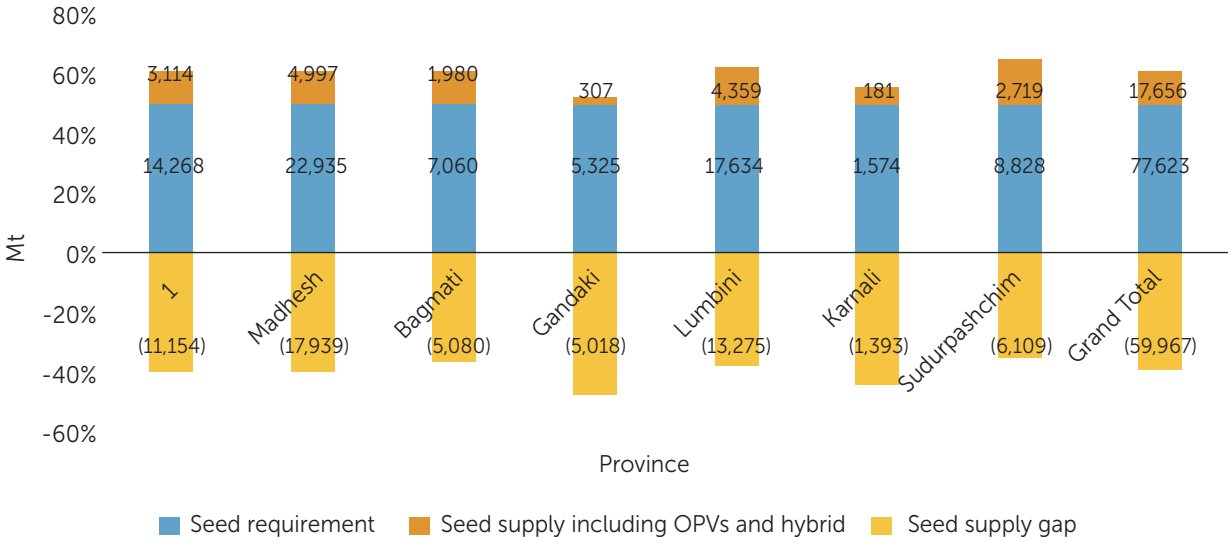


Figure 2.11: Rice seed requirement vs. supply by province.

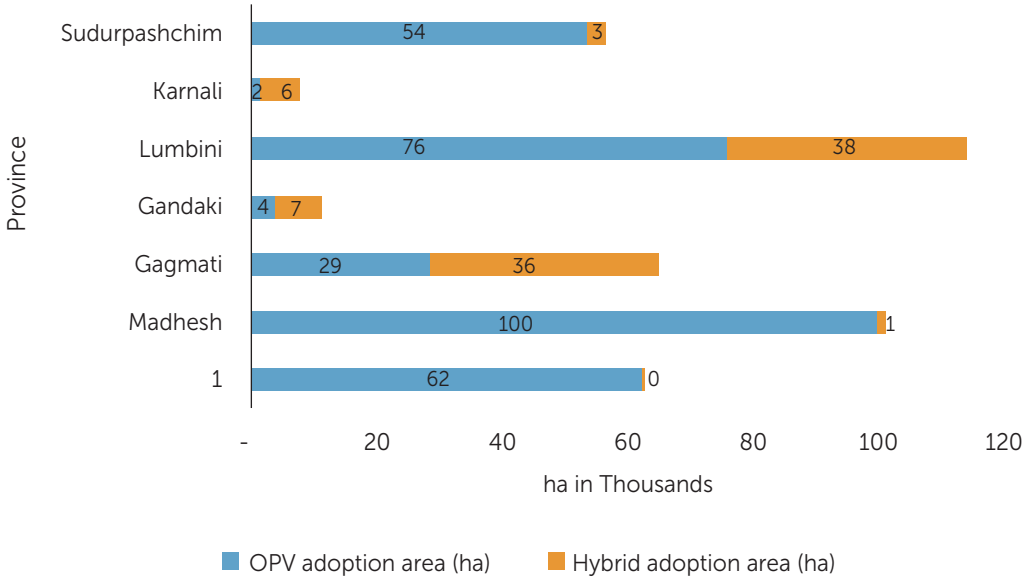


Figure 2.12: Adoption area under open pollinated (OP) and hybrid rice by province.

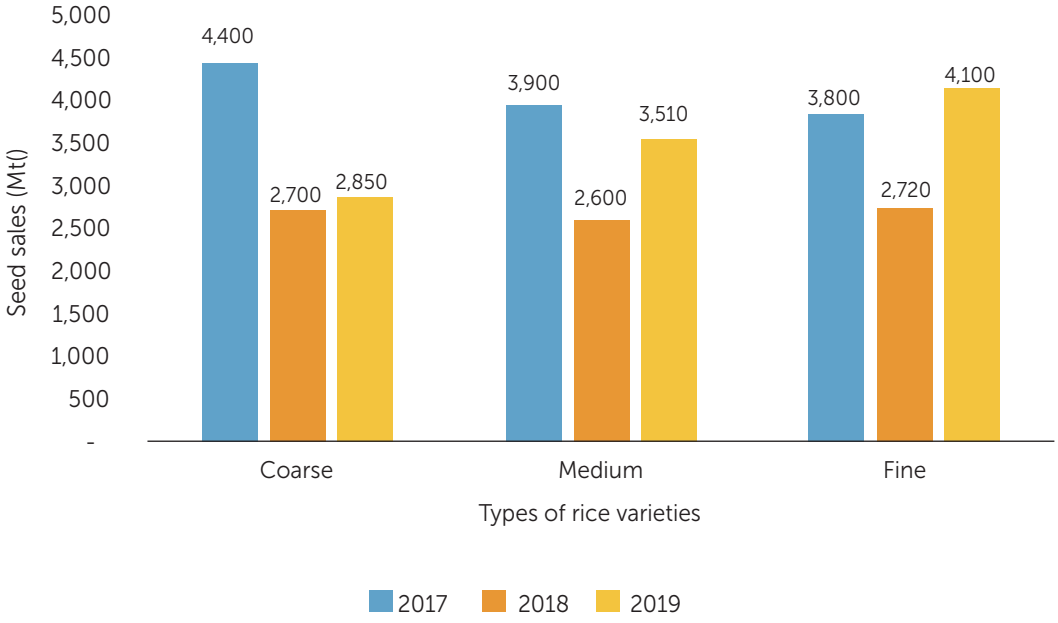


Figure 2.13: Trends of improved rice seed production and sales by seed companies and cooperatives.

The demanded traits for rice varieties, cultivation seasons, popular varieties and cropping patterns of rice across the main five ecological regions are given in Table 2.1. While the eastern regions of Nepal demand long duration varieties the western regions prefer to short duration varieties of rice. The spring season rice is covered by Nepali varieties while domestic OPVs and imported hybrid and OPVs dominate the summer season. The domestically developed Khumal series are popular in the mid-hills.

2.3.4. Maize source seed

The supply of breeder seed of maize varieties was constant in 2017 and 2018 and increased in 2019 (Figure 2.14). And the demand for maize foundation seed was greater than the supply in the 2017–2019 period.

In 2019 the National Maize Research Programme (NMRP) produced 1.35 Mt of breeder seed, with Rampur Composite making up 30%, Arun-2 20% and Manakamana-3 35% of this amount. In 2019, NARC's stations and seed companies produced 145 Mt of foundation seed, which is three times more than the National Seed Vision target for 2020 of 88 Mt, which is also 67% higher than targeted for 2025. The NMRP has also started producing the seed of parental lines of locally produced hybrid maize such as Rampur Hybrid-10.

Table 2.1: Demanded traits, seasons, popular varieties and cropping patterns of rice across different ecological regions.

Regions	Season	Demanded traits	Popular varieties	Cropping patterns
Eastern Terai	Summer	High yield, long duration, fine/medium	Resma 786, Champion, Ranjit	Rice-maize-fallow
	Spring	High yield, short duration	Chaite-2, Hardinath 1, 2,3	Rice-vegetables/ rapeseed-rice
Central Terai	Summer	High yield, long duration, fine/medium	NMH 713, NMH 731 Pac 801, DRH 775, Champion Raja, Arize, 6444, Sona Masuli, Kanchhi Masuli	Rice-maize-fallow
	Spring	High yield, short duration	Chaite-2, Hardinath 1, 2,3	Rice-vegetables or rapeseed-rice
Western Terai	Summer	High yield, short/ medium duration, fine	US 312, DY 69, Arize, 6444, Sawa Masuli, Sawa Sub 1, Sabitri, Ramdhan, Sawa Sampurna	Rice-maize-fallow
	Spring	High yield, short duration	Hardinath 1,3, Chaite 5	Rice-vegetables or rapeseed-rice
Far-western Terai	Summer	High yield, short/ medium duration, medium	US 312, DY 69, Tej Gold, Sarju-52, Radha 4	Rice-wheat/rapeseed or vegetable-fallow
	Spring	High yield, short duration	Hardinath 1, 3, Chaite 5	Rice-vegetable-rice
Inner Terai	Summer	High yield, short/ medium duration, fine	US 312, DY 69, Tej Gold	Rice-wheat or vegetable-fallow
	Spring	High yield, short duration	Hardinath 1, 3, Chaite 5	Rice-vegetables-rice
Midhills	Summer	High yield, short/ medium duration, fine	US 312, Khumal 4, 8,10,12	Rice-fallow-fallow
	Spring	High yield, short duration	Taichung, Hardinath 1	Rice-vegetables-rice

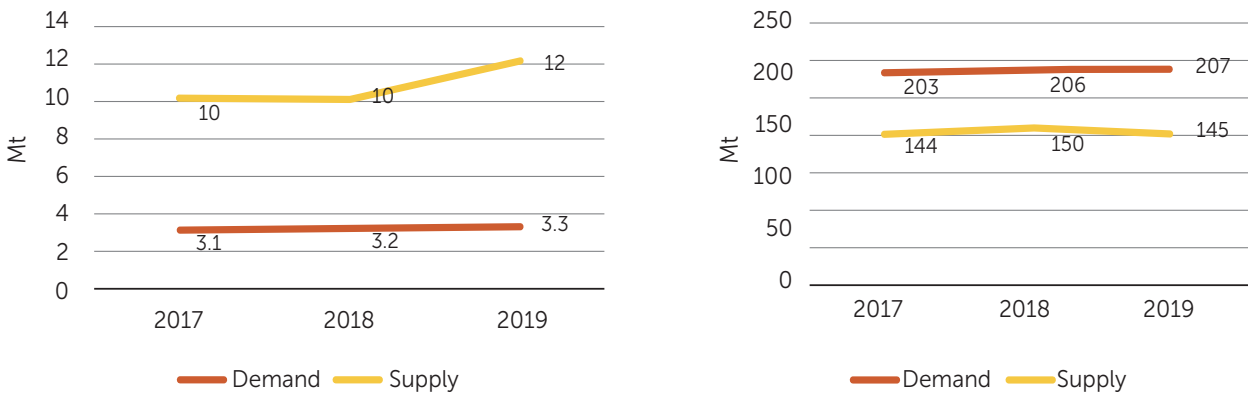


Figure 2.14: Trends in breeder (left) and foundation (right) maize seed.

Province-wise maize production area and yields:

- The largest area under maize production is in Province 1 with an average yield of 2.5 Mt/ha (Figure 2.15). The average maize yield is highest in Bagmati province and the lowest in Karnali province.
- The largest market for both OPV and hybrid maize seed is in Lumbini province at 778 Mt, followed by Province 1 (Figure 2.16). Gandaki province has the smallest market for maize seed at only 320 Mt.
- There is a maize seed supply gap in all the provinces, with the highest gap in Province 1 (Figure 2.17).

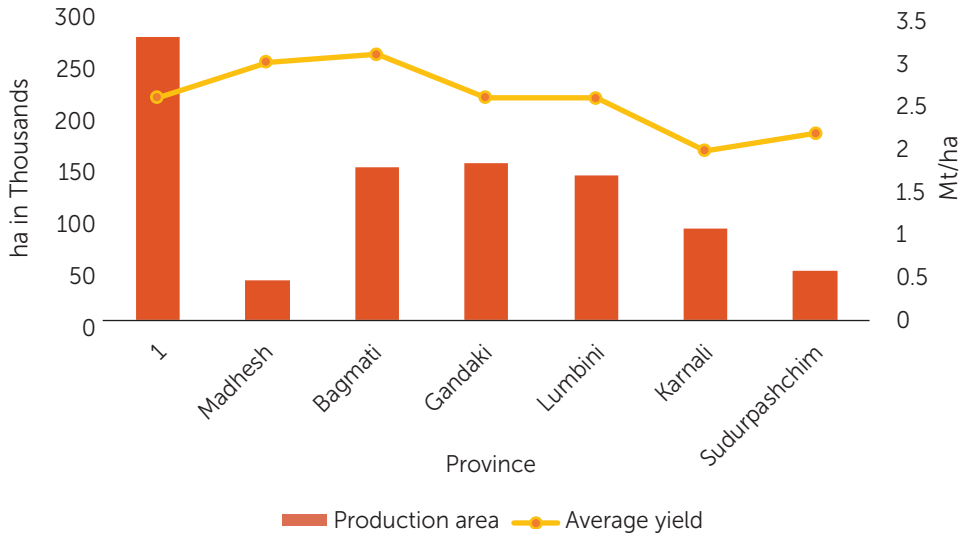


Figure 2.15: Maize production area and average yield by province. (source: MoALD, 2020).

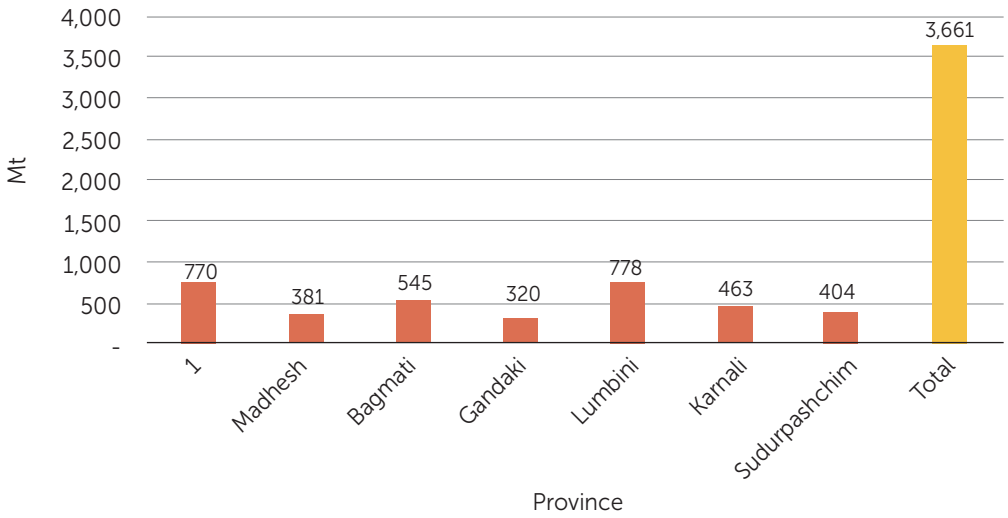


Figure 2.16: Maize seed market size by province.

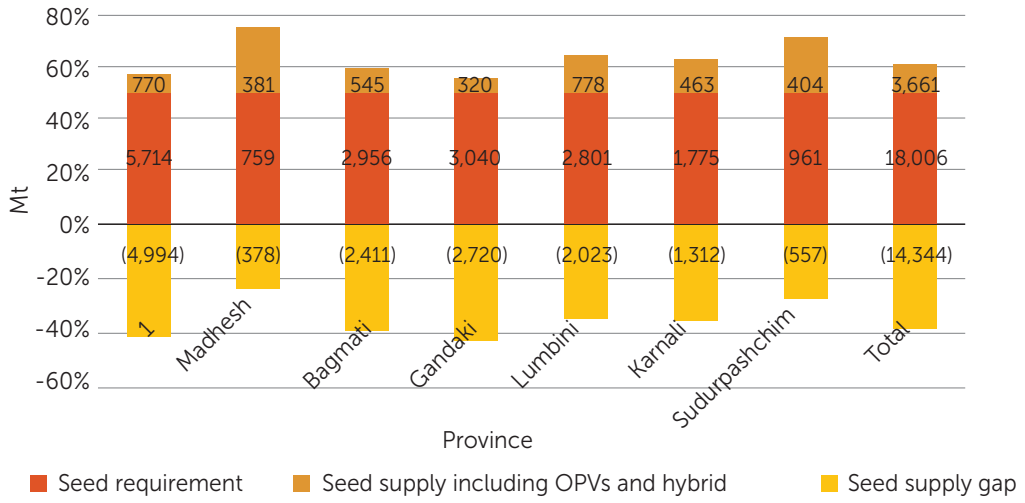


Figure 2.17: Maize seed requirement vs. supply by province.

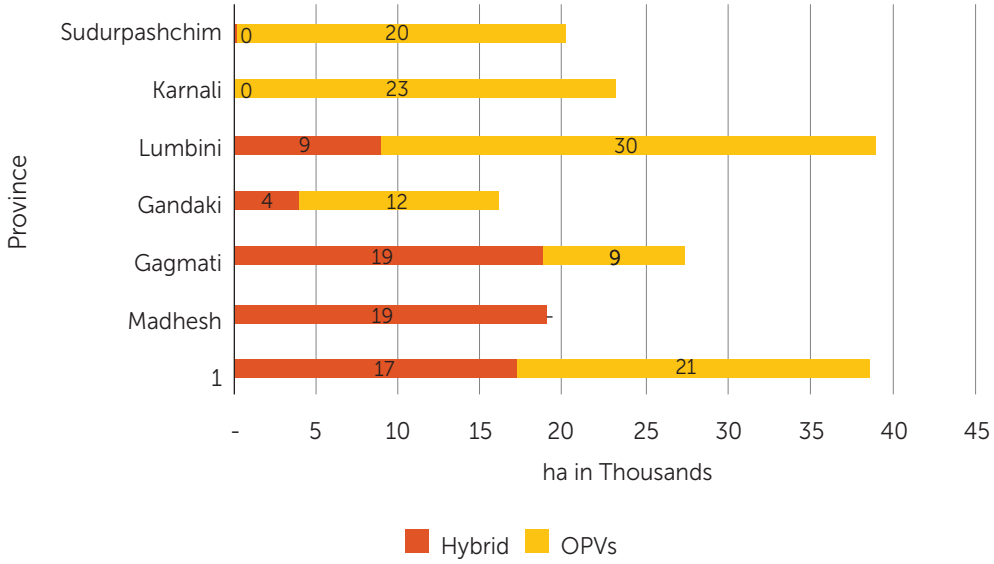


Figure 2.18: Adoption area under open pollinated and hybrid maize ('000 hectares).

- A larger overall area has been adopted for OPV maize production than hybrids (Figure 2.18). Only OPV maize is grown in Karnali and Sudurpashchim provinces while only hybrid maize is grown in Madhesh province. Bara, Parsa and Rautahat are the major hybrid maize production districts in Madhesh province, with about 19,000 ha grown in each winter season (November planting) as a cash crop for feed mills after rice. Much hybrid maize is also grown in Bagmati province (19,000 ha) principally in Chitwan, Dhading, Nuwakot, Kavre and Sindhupalchowk districts. Dang is the hybrid maize hub of Lumbini province (4,000 ha) while Jhapa district is the maize hub of Province 1 (9,000 ha). Gulmi, Arghakhanchi, Palpa, Syangja, Pyuthan, Dailekh, Dadeldhura and Baitadi are some of the main districts where farmers have adopted OPVs. The names and features of the most popular maize varieties are summarized in Table 2.2.

Table 2.2: Demand traits, seasons, popular varieties and cropping patterns of maize across different ecological regions.

Regions	Season	Demanding traits	Popular varieties	Cropping patterns
Eastern Terai	Winter	High yield, long duration, yellow	All round, NMH 713, 731, TX 369, BIO 9681	Rice-maize-fallow
	Spring	High yield, short duration, yellow	Shrestha, Nutan, Arun-2	Rice-r vegetables or rapeseed-maize
Central Terai	Winter	High yield, long duration, yellow	DKC 9041, NMH 713, 731, TX 369	Rice-maize-fallow
	Spring	High yield, short duration, yellow	Shrestha, Nutan, Arun-2	Rice-vegetables or rapeseed-maize
Western Terai	Winter	High yield, long duration, yellow	10V10, P 3396, 3322, Bisco 940	Rice-maize-fallow
	Spring	High yield, short duration, yellow	Nutan, Arun-2	Rice-vegetables or rapeseed-maize
Far western Terai	Winter	High yield, long duration, yellow	DKC 9041, P 3396, P3522	
	Spring	High yield, short duration, yellow	Nutan, Arun-2	
Inner Terai	Spring	High yielding, short duration, yellow	Nutan, Arun-2, Rajkumar, Shrestha	Rice-wheat/vegetable-maize
Midhills	Summer	High yield, short duration, yellow (livestock feed), white (food), resistant to northern and southern leaf blight, stalk rot	CP 808, CP 606, Rajkumar, Nutan, Arun-2, Rampur Composite, Manakamana-3, Deuti	Maize-fallow-fallow Maize-rapeseed/ vegetable/wheat- fallow
		Rice is not cultivated in the spring season in the mid-hills.		

2.4. Margins in the Seed Business

This section highlights the gross margins of seed sector actors, drawn from the study sample, involved in various stages of the rice and maize value chain.

2.4.1. The margins for rice seed production

Seed growers' major costs for producing improved varieties of rice seed are expenditure on foundation seed, fertilizer, pesticide and labor (Figure 2.19). The assessment calculated a total labor cost of NPR 61,903/ha for preparing land, planting, intercultural operations including rouging, harvesting and processing (Figure 2.20). Most households (60%) hired labor for seed production, especially for land preparation, planting and harvesting. The high share of labor cost indicates the low level of mechanization in rice seed production. Most farmers (60%) rented tractors for land preparation because only 8% have their own tractors. Similarly, 55% used a thresher for threshing the crops, while others use manual method.

The overall, the gross margin realized by fine rice growers was a little less (42%; NPR 11/kg) than that of coarse rice seed growers (43.9%; NPR 11.8/kg). The selling price of fine rice varieties was NPR 39.9/kg which is 10.4% higher for coarse rice (NPR 36.2/kg). A summary of the cost breakdown between coarse and fine rice varieties is given in Table 2.3.

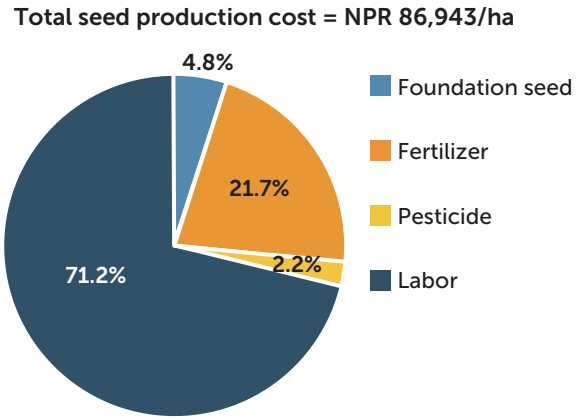


Figure 2.19: Share of improved rice seed production cost.

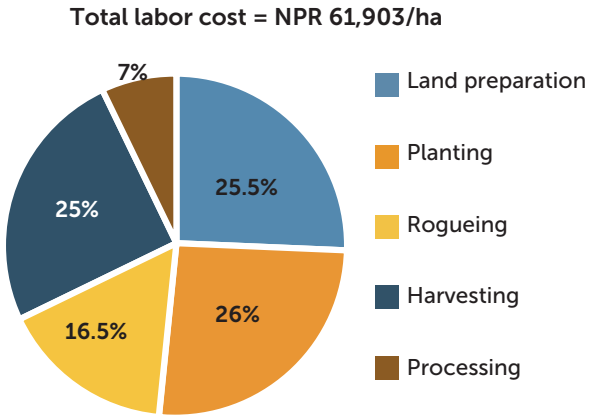


Figure 2.20: Share of the total labor cost for rice seed production.

Table 2.3: The price for fine and coarse rice seed production and marketing in the seed company and cooperative models (NPR/kg).

Types of actors	Cost items	Fine rice		Coarse rice	
		Company	Coop	Company	Coop
Seed growers	Production costs	23.1	23.1	20.1	20.1
	Marketing costs	5.0	5.0	5.0	5.0
	Total costs	28.1	28.1	25.1	25.1
	Sales price	39.9	39.9	36.2	36.2
	Margin (NPR)	11.8	11.8	11.0	11.0
	Margin (%)	42.0	42.0	43.9	43.9
Seed processors	Procurement price	39.9	39.9	36.2	36.2
	Processing costs	11.0	10.0	11.0	10.0
	Marketing costs	2.0	2.0	3.0	2.0
	Total costs	52.9	51.9	50.2	48.2
	Sales price	60.0	60.0	55.0	55.0
	Margin (NPR)	7.1	8.1	4.8	6.8
	Margin (%)	13.4	15.6	9.6	14.2
Agrovet	Procurement price	60.0	60.0	55.0	55.0
	Marketing costs	5.0	5.0	2.0	2.0
	Total costs	65.0	65.0	57.0	57.0
	Selling price	70.0	70.0	60.0	60.0
	Margin (NPR)	5.0	5.0	3.0	3.0
	Margin (%)	7.7	7.7	5.3	5.3
Total marketing cost		12.0	12.0	10.0	9.0
Producer share in consumer price (%)		48.5	49.8	54.0	55.6

Seed companies and cooperatives collect raw seed from contract seed growers. In most cases, these organizations send their own bags to collect the raw seed from seed grower farmers. So, the cost of seed companies and cooperatives includes the cost of raw seeds procured from seed growers and other costs such as processing and marketing.

Seed companies realized a gross margin of NPR 7.1/kg (13.4%) for coarse rice seed and NPR 4.8/kg (9.6%) for fine rice varieties. Seed cooperatives make a margin of NPR 8.1/kg (15.6%) for fine rice and NPR 8/kg (14.2%) for coarse rice seed.

For seed companies and cooperatives, the total cost incurred for purchasing the raw seed and processing and marketing it is similar for fine and coarse rice varieties (Figure 2.21). The processing costs consist of monitoring costs (2%), the cost of sacks (5%), transporting raw seed from farmers' fields to company stores (2%), cleaning (5%), storage (2.4%) and packaging, chemical treatment and bagging (8%). The marketing costs include the commission to agro-dealers and seed transportation from company stores to dealers' shops. The selling price of fine rice seed was NPR 60/kg and NPR 55/kg in case of coarse rice seeds.

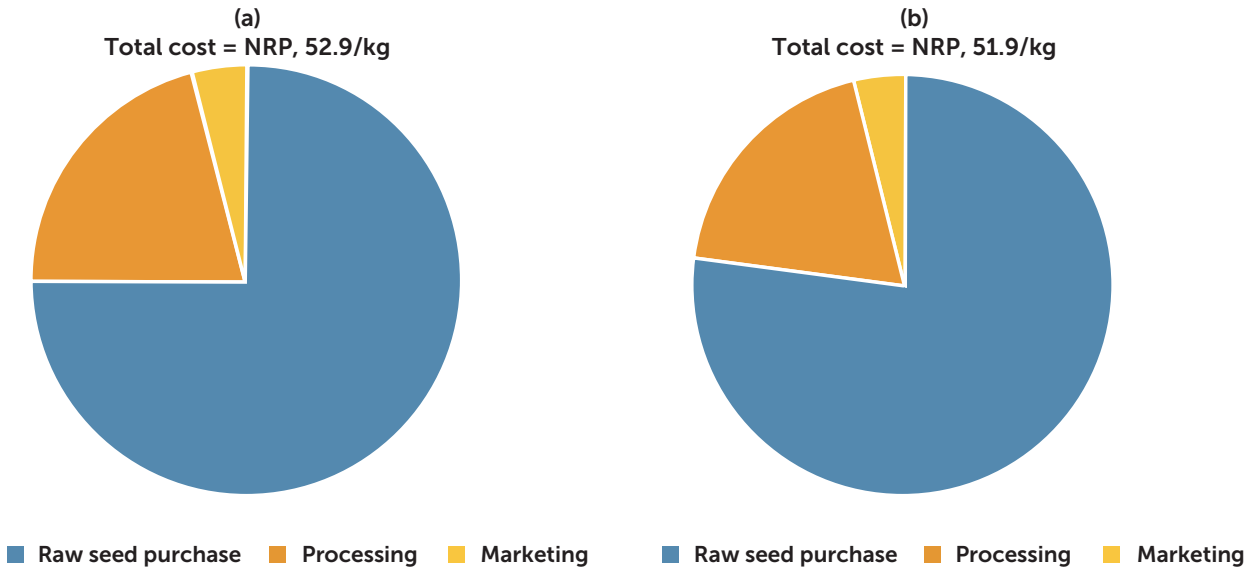


Figure 2.21: Share of total costs for fine quality and coarse rice variety for (a) seed companies and (b) cooperatives.

Agrovets and agro-dealers collect processed seed from seed companies and cooperatives just before each cropping season. They realize a gross margin of NPR 5/kg for fine varieties and NPR 3/kg for coarse varieties, with seed purchases constituting 90% of their costs. They normally sell seed for cash. The sale price was NPR 70/kg for the seed of fine varieties and NPR 60/kg for the seed of coarse varieties.

Seed users: Seed users are the farmers who buy seed from agro-dealers for producing grain. Although seed companies do invest more on seed processing, seed users pay the same price for the seed supplied by seed companies and cooperatives. The price of fine quality rice varieties a bit higher (NPR 10/kg) compared to coarse varieties.

Figure 2.22 shows the gross margin for three of the main actors in the rice value chain, with seed growers realizing the highest margins from selling rice seed.

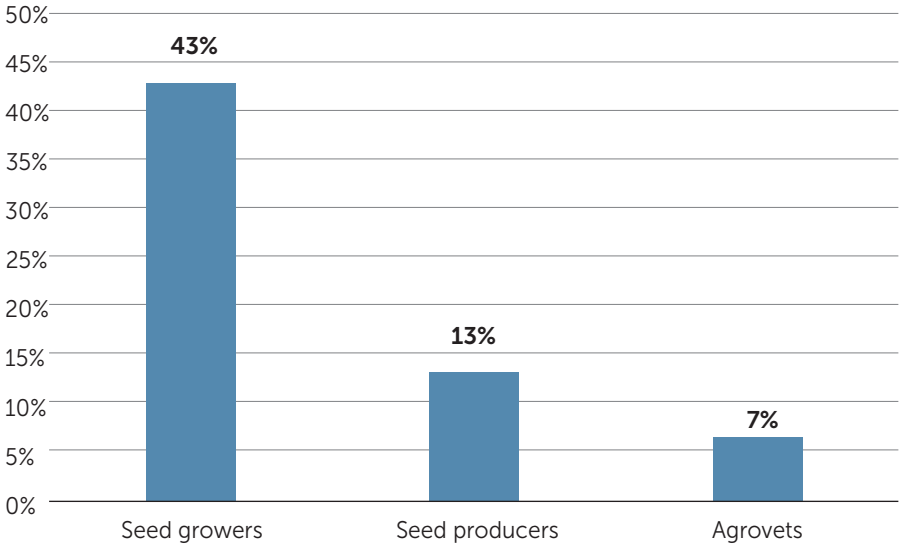


Figure 2.22: Gross margin of rice seed across the seed value chain.

Price spread and margins in seed companies and cooperative models

The study found that seed growers' share of the amount paid by consumers was higher in the cooperative model compared to the seed company model for both fine and coarse rice seed (Table 2.3). This is due to seed cooperatives having less seed processing and marketing costs than seed companies. And the seed growers' share in the amount paid by consumers is higher in coarse rice varieties than fine rice varieties. Moreover, seed cooperatives realize higher margin than seed companies in selling both fine and coarse rice seed.

2.4.2. The margins for maize seed production

Seed growers' major costs for producing the seed of improved maize varieties include foundation seed, fertilizer, pesticide and labor (Figure 2.23). Family labor costs comprised 80% of the total maize seed production cost, and farmers said they had little chance of engaging in other income generating enterprises during maize growing seasons. The cost of fertilizer for maize seed production was found

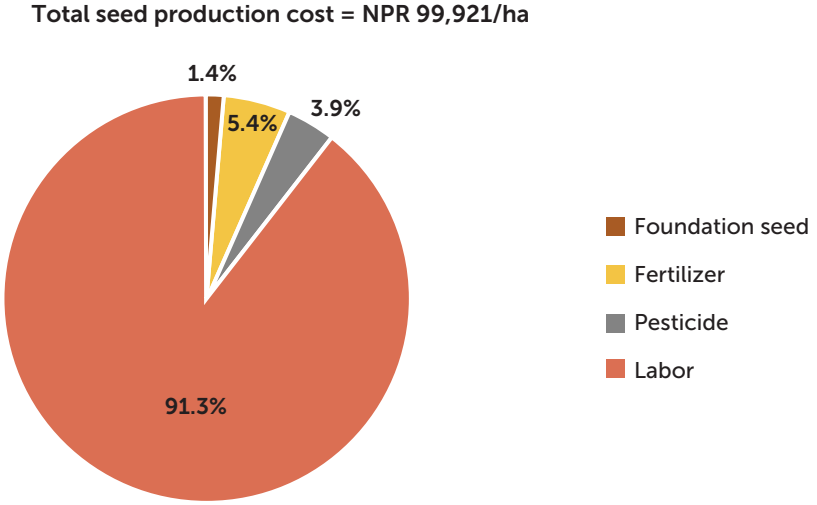


Figure 2.23: Share of seed producers improved maize seed production costs.

to be almost a quarter of that calculated for growing rice seed due to the less chemical fertilizer used in maize seed production. The study found that 50% of seed growers used chemical fertilizer in maize seed production, and 40% used urea, 20% diammonium phosphate (DAP) and 5% potash. Of their total labor cost (NPR 91,227/ha), the share of tillage was 27%, planting 22%, inter-culture operation 25%, harvesting 20% and processing and marketing costs 6%. The average maize production area was 0.88 ha (range 0.1 to 10 ha), seed yield was 2.5 t/ha and output prices were NPR 55/kg of seed. The raw seed production cost for maize seed growers was therefore found to be NPR 39.96/kg with them making a gross margin of NPR 15/kg by selling at NPR 55/g to seed companies and cooperatives.

Seed companies and cooperatives buy raw seed from contract seed growers. So, the cost to seed companies and cooperatives of growing improved maize seed is the selling price of seed growers and processing and marketing costs. In most cases, these organizations send their bags to collect the raw seed from seed growers' farms. However, seed growers pay the cost of transportation including loading and unloading costs.

The study calculated that it costs seed companies NPR 67 to produce 1 kg of improved maize seed with the costs being buying and processing the raw seed and marketing the seed (Figure 2.24). The processing cost (20%) consists of the cost of sacks (5%), raw seed transportation cost from farmers' fields to the company store (5%), and the costs of monitoring (2%), cleaning (1%), storage (2%), and packaging, chemical treatment and bagging (5%). The marketing costs includes commissions to agro-dealers and seed transportation from company stores to dealers' shops. It was therefore calculated that seed companies realized a gross margin of NPR 8/kg by selling seeds at NPR 75/kg to agro-dealers.

The study calculated that it costs cooperatives NPR 62 to produce 1 kg of improved maize seed with the costs being purchasing and processing the raw seed and marketing the seed (Figure 2.24). They also sell maize seeds at NPR 75/kg but earn a higher gross margin of NPR 13/kg, which is NPR 5/kg more than the seed companies due to the lower seed processing cost. This shows that seed cooperatives are more competitive in supplying improved open pollinated maize seed than seed companies, assuming that seed quality is the same.

Agrovet and agro-dealers normally collect seeds from seed companies and cooperatives at the start of each cropping season. They incur a cost of NPR 5/kg to purchase improved maize seed and sell it for NPR 85/kg to realize a gross margin of NPR 5/kg (6.3%). Unlike with hybrid varieties, there is no practice of return sales of unsold open pollinated seed to seed companies and cooperatives in Nepal. The agro-dealers realize a gross margin of NPR 30-50/kg while selling the imported hybrid seed CP 808.

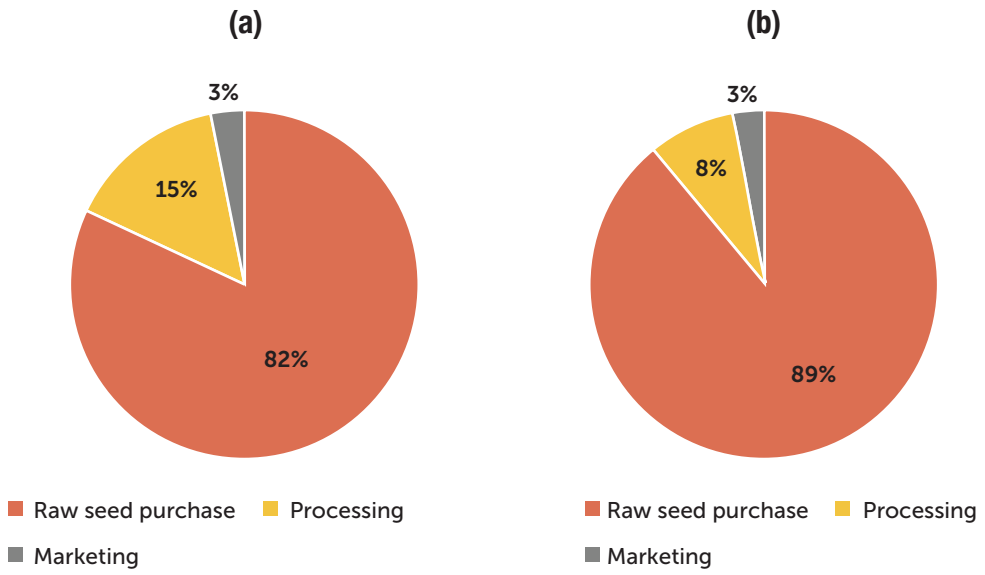


Figure 2.24: Share of improved maize seed production cost by (a) seed companies and (b) cooperatives.

Seed users are the farmers who buy seed from agro-dealers for producing grain. The open pollinated maize seed users pay NPR 85/kg for the seed of Rampur Composite maize while the cost ranges from NPR 300–750/kg to buy hybrid maize seed.

Figure 2.25 shows the gross profit margins for the various actors in the maize seed value chain, with seed growers realizing the highest margins from selling maize seed.

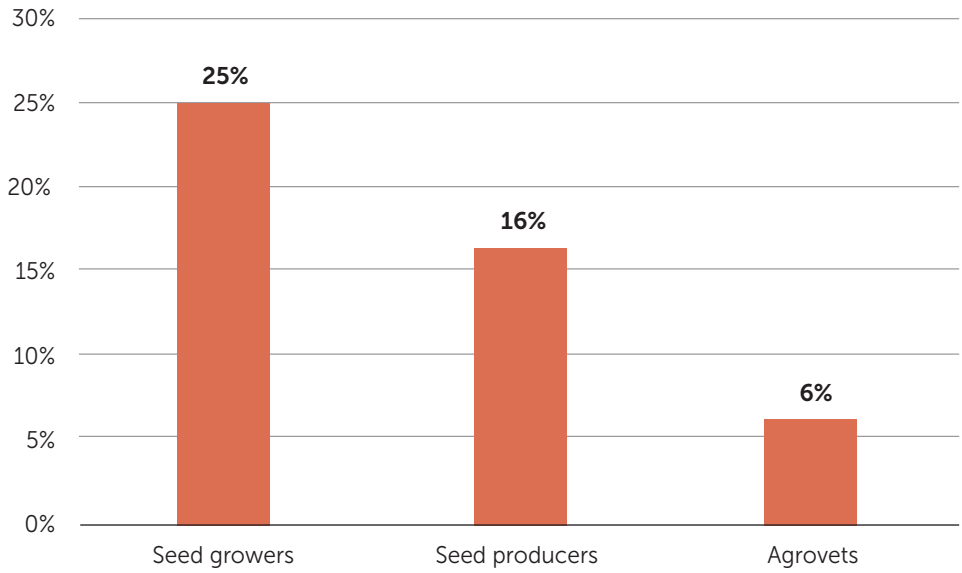


Figure 2.25: Gross margin of maize across the seed value chain.

Price spread and margins in seed company and cooperative models

The study found that the seed growers' share in consumers' price is higher in the cooperatives model than in the seed company model (Table 2.4). This is due to the lower seed processing and marketing cost of cooperatives than seed companies, and the lack of product differentiation. This means that, even though seed companies invest more on seed processing than cooperatives, they have not been able to get the additional benefits due to lack of branding and marketing. And the margins of seed companies and cooperatives were found to be less for selling maize than rice seed.

Table 2.4: Price spread of open-pollinated maize seed production and marketing in seed company and cooperative models (NPR/kg)

2.4.3. Price spread and margins in imported maize and rice seed

The three types of market actors involved in importing seed into Nepal are importers, wholesalers (also called distributors, and retailers (also called agro-dealers). The importers purchase seed from foreign companies and store it for a few days or send it directly to wholesalers. For hybrid maize, the retail price of seed varies from NPR 300–800/kg and also varies according to the location of markets. The price of hybrid seed is normally higher in the hills than in the Terai.

The study used Pioneer 3522 as the reference variety for Terai maize seed and CP 808 as the reference variety for hills to calculate the gross margins of the actors. The study found that the actors realize a less than 6% margin, with agro-dealers realizing the highest margin. The seed users' pay 80% of the importers' price which indicates that the total margin taken by market actors is less than 20%. These actors prefer to sell hybrid seed for a small margin because i) unsold seed can be returned to the concerned seed companies, and b) the limited storage time of seeds. The return from this investment can be covered within two months.

Table 2.4: Price spread of open-pollinated maize seed production and marketing in seed company and cooperative models (NPR/kg).

Actors	Items	Seed companies	Seed cooperatives
Seed growers	Production cost	41.0	41.0
	Marketing cost	3.0	3.0
	Total cost	44.0	44.0
	Sales price	55.0	55.0
	Margin (NPR)	11.0	11.0
	Margin (%)	25.0	25.0
Seed processors	Procurement price	55.0	55.0
	Processing cost	10.0	5.0
	Marketing cost	2.0	2.0
	Total cost	67.0	62.0
	Sales price	75.0	75.0
	Margin (NPR)	8.0	13.0
	Margin (%)	11.9	21.0
Agrovet	Procurement price	75.0	75.0
	Marketing cost	5.0	5.0
	Total cost	80.0	80.0
	Selling price	85.0	85.0
	Margin (NPR)	5.0	5.0
	Margin (%)	6.3	6.3
Total marketing cost		10.0	10.0
Producer share in consumer price (%)		61.1	64.7

US 312, which is the most popular hybrid rice variety with Nepal's farmers, was taken as the reference variety for the study. The types of actors in the imported rice value chain are the same as for imported maize seed. Table 2.5 provides the breakdown of the gross margin for the various actors in the rice and maize value chains. Results show that rice importers have a higher margin than maize importers. The wholesalers earn a higher margin in the hills than in the terai for both the crops while agro-dealers earn a higher margin in the hills and a higher margin in maize in both the hills and terai.

2.5. Inter-Business Relations

Effective inter-business relationships are essential in creating and maintaining value chain competitiveness. There are inter dependencies among the value chain actors and strong relationships lead to competitiveness in the sector. The upstream level focuses on seed growers while the downstream levels deal with seed delivery and use. The nature of inter-business relationships in the seed value chain is explained below.

Seed companies depend upon the NARC centers for their supplies of breeder seed as none of them are licensed to produce breeder seed, or to develop and maintain varieties. They also mostly depend upon

Table 2.5: Gross margin and price spread of imported hybrid rice and hybrid maize in Nepal.

Types of actors	Cost items	Rice		Maize	
Importers					
	Import price	535.0		625.0	
	Marketing costs	10.0		10.0	
	Total costs	545.0		635.0	
	Sales price	560.0		650.0	
	Margin (NPR/kg)	15.0		15.0	
	Margin (%)	2.8		2.4	
Wholesalers		**Terai**	**Hills**	**Terai**	**Hills**
	Procurement price (NPR/kg)	560.0	560.0	650.0	650.0
	Marketing costs	10.0	15.0	10.0	15
	Total costs	570.0	575.0	660.0	665.0
	Sales price	590.0	600.0	680.0	690
	Margin (NPR/kg)	20.0	25.0	20.0	25
	Margin (%)	3.5	4.3	3.0	3.8
Agro-dealers					
	Procurement price (NPR/kg)	590.0	600.0	680.0	690
	Marketing costs	10.0	15.0	10.0	15
	Total costs	600.0	615.0	690.0	705
	Selling price to seed users	625.0	645.0	725.0	745
	Margin (NPR)	25.0	30.0	35.0	40
	Margin (%)	4.2	4.9	5.1	5.7
Seed users' share in imported price (%)		85.6	82.9	86.2	83.8
Reference varieties		US 312	US 312	P 3522	CP 668

regional seed testing laboratories (RSTLs) for the field monitoring and certification of their seed, as private seed inspection does not function well, and seed laboratories at private seed companies are yet to become fully functional. The SQCC issues licenses to seed companies for foundation seed production, for conducting research and development, and allocating foundation and breeder seed through the seed balance sheet approach. Seed importers depend upon NARC to conduct multi-locational varietal trials and then submit proposals for registration to SQCC. Since seed companies had not registered any varieties by the time of this assessment in 2020, the relationship of seed companies with the National Seed Board was not operational. There was a system for preparing national seed balance sheet annually for every three years, but it proved difficult to operate after the introduction of a federal system of governance in 2017/18.

At the upstream level of the value chain, seed companies deal with seed growers. This important part of the seed value chain determines seed quality and the companies' seed performance and brand image. Seed growers also depend upon seed companies for source seeds, finance, monitoring support and purchase. Seed companies often compete to retain their seed growers. Losing experienced seed growers to competitors or for other forms of land use is detrimental for seed companies' business growth.

Table 2.6 shows the services provided by different organizations including seed companies to their growers. The responses show the percent of seed growers who agreed to have received these services from the service providers in 2018.

At the downstream level of the value chain, seed companies depend on i) the market intermediaries such as wholesalers and retailers who sell seed through commercial market channels, and ii) public agencies and development projects and programs that purchase seed under subsidies for distributing to farmers. The relationship of seed companies with market actors in the downstream part of the market is based on personal dealings and profit margins. The competition among seed companies that normally produce the same seed varieties with minimum product differentiation, is low. However, there have been instances when seed companies have sold seeds in each other's territories by undercutting prices. Efforts to develop brands and product identities and differentiation are gradually picking up in the market.

Seed companies' relationships with donor-supported projects and the Government of Nepal's seed subsidy program provides an assured market that can be attained with minimum effort and cost. However, this relationship is mired in controversy especially related to seed quality and the procurement procedure. While the National Seed Company (now merged with AICL) was functioning and procured seeds for distribution to farmers under a subsidy program, seed companies strived to sell most of their rice and maize seeds to this company. In the case of maize, seed companies are less active in the hills (the main maize growing area), and therefore the share of maize seeds in their overall portfolio is around 10%. Most of the formal sector maize seeds are sold by cooperatives. As for seed companies, maize seed cooperatives have been unable to increase their market shares over the years due to market distortion as a result of the unmanaged subsidies.

Seed wholesalers and retailers depend upon seed companies to supply quality seed. As the volume of seed production varies from year to year, wholesalers and retailers maintain links with a wide network of suppliers, including those in India, who can supply seeds in case of shortages. Seed companies in Nepal rarely promote their brands in their market segments using their own costs, although some of them have started sharing product information through radio jingles with the support of development agencies. Sales on credit, sales with discounts and product demonstrations are the major market promotional

Table 2.6: Services provided by service providers to seed growers (% of sample receiving services).

Types of service providers	Provision of source seed	Seed processing training	Field inspection	Lab testing	Advisory services	Physical inputs
NARC stations	51.4	24.2	25.7	12.1	17.2	0
Seed companies	31.4	30.3	28.6	24.2	24.1	15.6
Cooperatives	20.0	24.2	20.0	6.1	20.7	40.6
District agriculture development offices & agriculture service centers	34.3	57.6	22.9	27.3	62.1	25.0
Local governments	2.9	3.0	0	0	3.4	0
NGOs & projects		15.2	0	0	10.3	6.3
Agrovets	2.9	0	0	0	0	18.8
Seed labs	0	0	14.3	27.3	3.4	0

(n=330).

strategies adopted by seed companies in recent years (Table 2.7). The companies mainly face challenges when trying to sell new products and varieties, and in such cases, wholesalers and retailers push the products to farmers based on the price margins offered. In some cases, especially with hybrids, Indian and multinational companies conduct campaigns and offer incentives for distributors by providing field technicians to organize field demonstrations, allowing the return of unsold seed, and providing competitive sales margins which supports wholesalers and retailers to sell these varieties. Since farmers are knowledgeable about such brands, these companies are able to develop a market for their products.

The survey found that imported seed accounted for 43.3% of the 17,656 Mt formal rice seed market in Nepal in 2018 (Figure 2.26). Out of this 7,646 Mt, only 18% came through formal channels while the other 82% came through informal channels. Unregistered varieties of OPV seed constituted the major part (80%) of the informal imports. Such varieties are mainly grown in the Terai districts of Province 1 and Madhesh province. Generally, several new unregistered rice hybrids enter Nepal each year. The survey found quite a high prevalence of unregistered rice seed in the Terai districts of Lumbini and Bagmati provinces. The demand for short duration and fine hybrid rice varieties is increasing.

Table 2.7: Market promotion strategies adopted by seed companies (n = 21).

Strategies	Adopted	Score (average)	Rank
Sales on credit	16 (76.2)	3.933	1
Commission	12 (57.1)	3.727	2
Sales at a discount	16 (76.2)	3.600	3
Demonstration/Field days	13 (61.9)	3.167	4
Advertisements	11 (52.4)	3.100	5
Participation in seed fairs	7 (33.3)	2.857	6
Posters, flyers	7 (33.3)	2.167	7
Radio jingles	4 (19)	2.000	8
Seed samples (small packs)	2 (9.5)	2.000	9

Note: Figures in brackets indicate percentage, score: 1= least important, 5= most important.

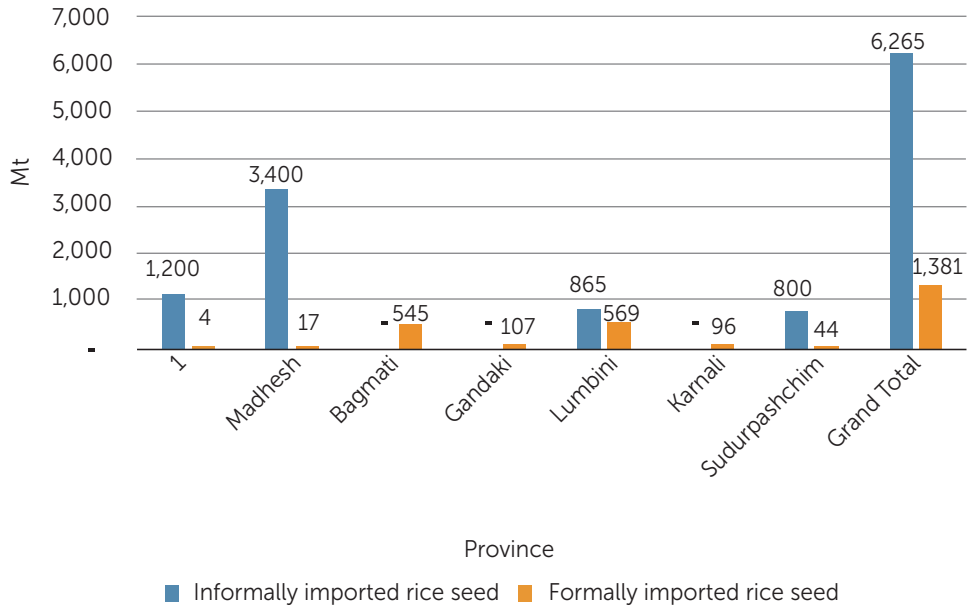


Figure 2.26: Formally and informally imported rice seed.

Retailers are bound to sell unregistered informally imported varieties as wholesalers provide the main varieties on demand upon the condition of also selling new varieties, for which they get high margins. Moreover, Nepal does not have competitive hybrid varieties/products from domestic companies, and hence retailers depend on imported varieties.

For maize, hybrid seeds are imported through formal and informal channels. In 2018, Nepal formally imported 1,364 Mt of hybrid maize seed, and importers estimate that the figure is at least 2,000 Mt if informal imports are also included (Figure 2.27). Seed wholesalers and retailers thus depend on importers to supply these varieties, as the availability of popular varieties is essential for them to maintain and grow their customer bases.

Most farmers know which varieties of open-pollinated rice and maize they prefer to buy; but many are unfamiliar with the various brands. Many farmers have grown imported rice hybrids and brands; but the uncertain availability of seeds of many unregistered varieties means that they usually buy seed based on retailers' recommendations. Retailers provide seed on credit to push their sales.

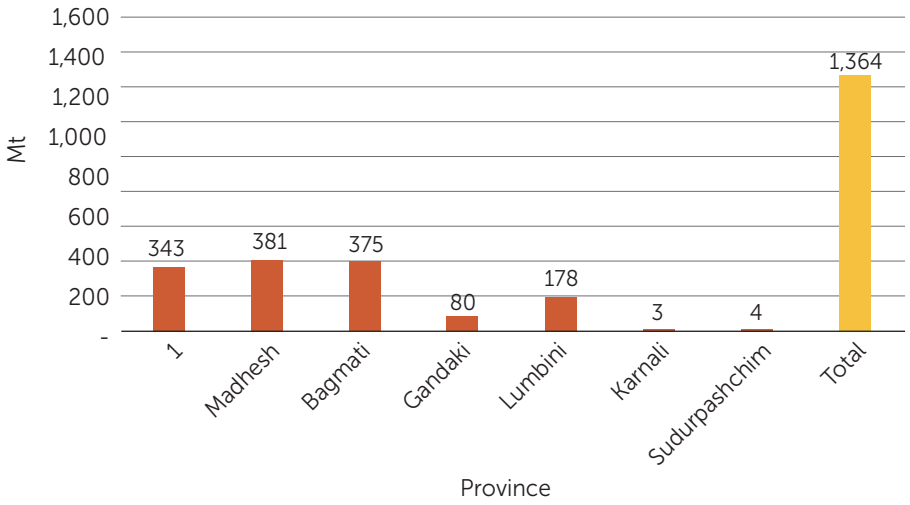


Figure 2.27: Formally imported maize hybrid seed.

2.6. Trends in Seed Use

Rice

- Most Terai farmers grow both hybrid and open pollinated fine rice varieties (fine varieties for household consumption and hybrids for cash incomes).
- The types of rice varieties used by farmers are location specific (Table 2.1). In Jhapa and Morang districts, long duration rice varieties such as Ranjit Masuli are preferred, and Sona Masuli and Kanchhi Masuli have been adopted in the area between Makwanpur and Saptari. These are medium duration maturing varieties. Ramdhan and Sabitri are the most popular varieties in Chitwan, Parasi, Rupandehi and Bardiya. These varieties are also medium duration varieties.
- Hybrid varieties are replacing coarse and medium fine open pollinated rice varieties in the rice grain production domain. This is because the hybrid varieties yield significantly more grain (by about 0.7 Mt/ha) than open pollinated varieties.
- In 2018, the Sabitri rice variety had the highest market share of the total 10,010 Mt seeds sold, followed by Radha 4 and Sawa Sub 1 varieties (Figure 2.28).
- Dang is Nepal's main hybrid rice growing district.

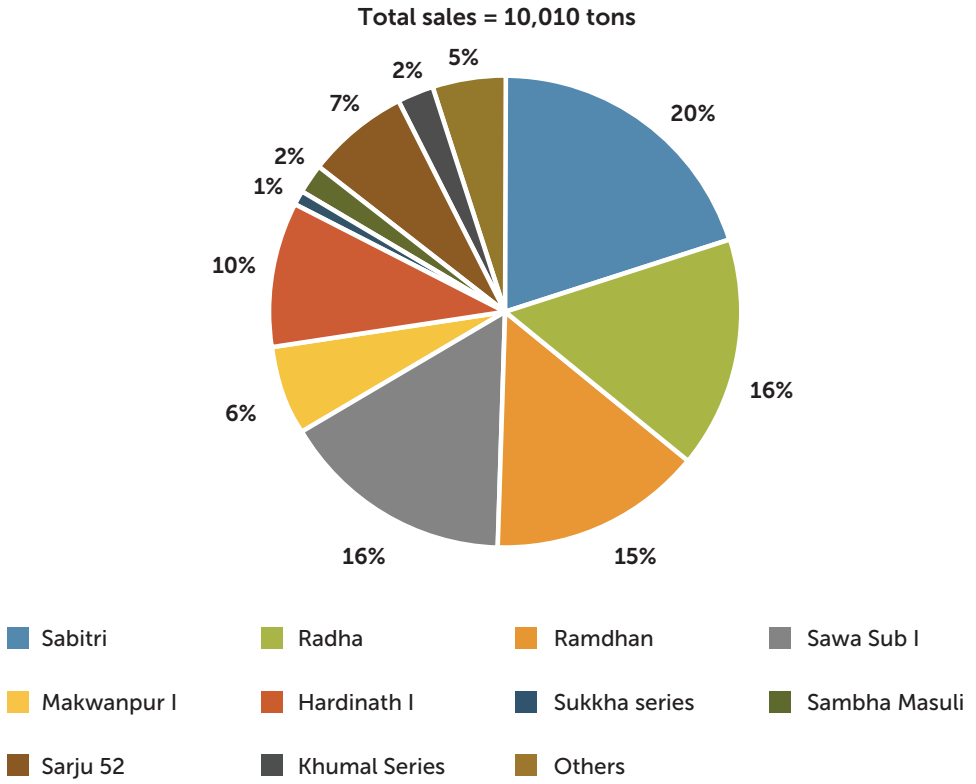


Figure 2.28: Market share of rice varieties in 2018.

Maize

- In Terai districts such as Jhapa, Sunsari, Morang, Sarlahi, Bara and Chitwan, farmers mostly grow hybrid maize to sell to feed mills. They grow high yielding, long duration yellow kernel hybrid maize mainly during the winter season with seed sowing in November and harvesting in April.
- In hill districts such as Kavre, Dhading, Nuwakot, and Dang, farmers grow hybrid maize commercially during the summer season mainly to sell to feed mills.
- Most of the hybrid maize varieties registered with the SQCC are recommended for growing in the central and eastern Terai region. There is only a very limited portfolio of registered varieties for growing in the western Terai and there is consequently a large opportunity for the commercialization of hybrid maize varieties in this region.
- About 63% of surveyed grain producing households grew improved varieties with 36% of the total sample growing hybrid maize. There has been a gradual decline in the use of farm-saved maize seed by farmers.
- The unmanaged subsidy schemes have led to the production and sales of OPV maize seed fluctuating from year to year.
- In 2018, Rampur composite held the highest market share at 40% of the total sales of 2,297 Mt, followed by Arun 2 (30%), both of which are 30-year-old varieties (Fig 2.29).
- Hybrid maize has been adopted in areas where feed mills have been established. Jhapa is Nepal's main hybrid maize growing district

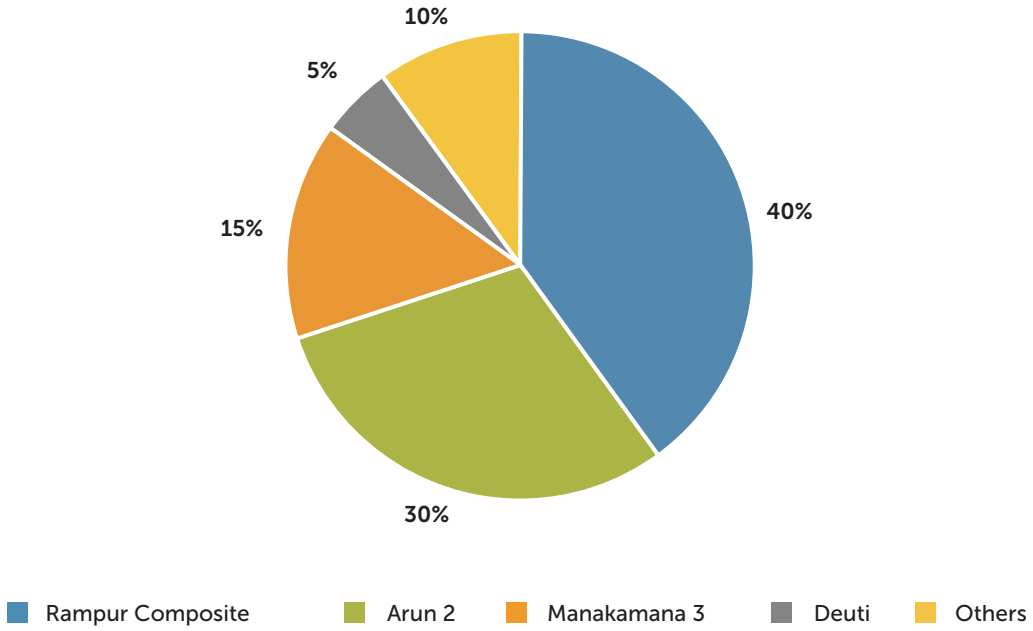


Figure 2.29: Market share of maize varieties in 2018.

3

The External Context and Enabling Conditions

The external environment consists of factors outside of the core seed value chain that includes laws, regulations, policies, that influence functioning of the value chains, offer performance incentives and impacts upgrading of the value chain.

Nepal has informal and formal seed systems. The informal system is characterized by farmers producing and preserving seed from their own fields and exchanging or selling it to neighbors. It also includes the informal import of registered and unregistered seed varieties. The commercial seed sector has been slow to develop in Nepal as more than 83% of cereal seed comes from the traditional or informal system (SQCC, 2020). The rice and maize seed standards are shown in Annexes 2 and 3.

Until 1990, the public sector played a key role in the production and supply of seeds to Nepal's farmers. A number of seed companies subsequently emerged from the various seed sector development programs that were implemented by the Government of Nepal and donors. These companies started by producing seed of released and registered varieties to sell to national seed sector support programs and projects, which sold seeds at a subsidized rate to farmers. The companies engaged in contract seed production and sold seed to institutional buyers with little or no emphasis on research and market development. The formal market has been largely driven by public seed varieties. Unmanaged subsidies distorted competition and discouraged private sector growth.

Nepal's main seed policy document is the National Seed Vision (2013–2025). The National Seed Vision emphasizes seed industry growth led by the private sector with an explicit focus on hybrids. The main policies, rules and guidelines that govern the functioning of the seed value chain, in terms of their implications for the development of seed businesses in Nepal, are summarized in Table 3.1.

Table 3.1: Seed-related policies and influence on seed value chain development.

Policies, rules and guidelines	Influence on seed value chain development
Seed Act (1988 and 2008 and 2020) Seed Regulations (1997 and 2013) National Seed Policy, 1999 National Agriculture Policy, 2004 National Agro Biodiversity Policy, 2006 National Seed Vision (2013-2025) Agricultural Development Strategy (2015-2035) Seed Guidelines/Directive (DISSPRO), 1997	*Research And Development* Compulsory variety registration and/or release before production and marketing Provision for licensing seed companies for breeder and foundation seed production and maintenance. Fast tracking variety release and registration process. Output-based incentive to seed companies and cooperatives on producing foundation and certified seeds. Seed companies must upgrade their R&D capacity for being licensed for hybrid seed production. Exclusive licensing of varieties to private sector is under consideration.
Community Based Seed Production (CBSP), 2000 Community Seed Bank, 2009 Seed Entrepreneurs' Registration and Monitoring Directive, 2016 Seed Compensation Directive, 2016 Seed Destruction Directive, 2016 Directives for Appointing Crop Inspectors Seed Sampler and Seed Analyst, 2016 Seed Sampling Guidelines, 2016 Seed Approval, Release and Registration Directive, 2016 Seed Production of Pipeline Varieties, 2017	*Seed Production* Some seed companies and seed cooperatives started producing hybrid seed of tomato, maize and rice in collaboration with NARC and CIMMYT. Guidelines available for producing seed of pipeline varieties. Private seed companies and cooperatives started producing and supplying foundation seed. Guidelines for hybrid seed production and certification approved in 2021.
	Seed Processing 45 seed processing plants have been established with a capacity of 112 t/hr and a storage capacity of 30,000t. Private companies are establishing seed labs and upgrading their seed storage buildings by leveraging support from government agencies and development projects.
Plant Protection Act, 2009, Pesticide Management Act, 2019 Seed Certification Directive, 2017 Seed Testing Laboratory Operation Directive. 2017 Seed Testing Guidelines, 2017	*Seed marketing including imports* Nepal started importing seed formally in 2009. There are 43 registered importers. There is an increasing demand for hybrid seed.
	Seed use The seed replacement rate (SRR) is increasing in Nepal highlighting the demand for new seed varieties.

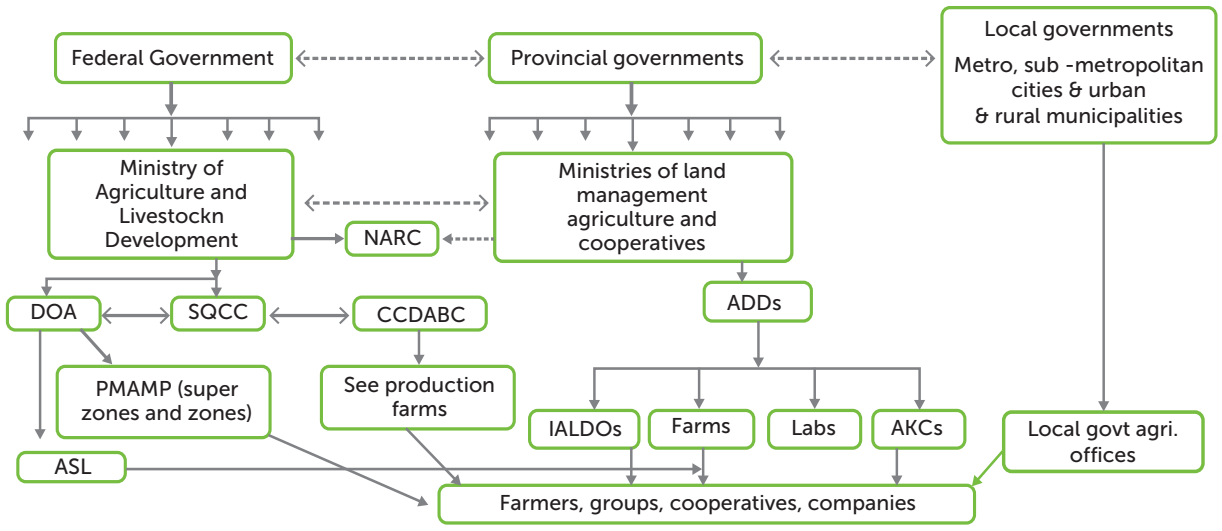
3.1. Institutional Mechanism for Seed System Functioning under Federalism

In 2018, Nepal adopted a federal system of governance with federal, provincial and local tiers of government. This has led to the reorganization of the country's bureaucracy including of the agencies under MoALD and the creation of new structures in provincial and local governments (Figure 3.1).

The Ministry of Agriculture and Livestock Development (MoALD) leads seed system management and development under the federal system. A seed coordination unit has been established in MoALD under the leadership of a joint secretary. This unit coordinates seed related projects and policies. The SQCC is the regulatory body responsible for variety release and registration and for facilitating the implementation of seed law and policies. The Directorate of Agriculture Development (DoAD) coordinates with the Agriculture Seed Laboratory (previously called the Central Seed Testing Laboratory). All NARC farms are under the federal government. These farms provide source seed and technical support (training) to government and private seed companies. Seed production farms operating under the Centre for Crop Development and Agro Bio-diversity Conservation (CCDABC) and zones and super zones of Prime Minister Agriculture Modernization (PMAMP) represent the presence of the federal government at the local level.

The seven provincial MoLMACs are responsible for developing and implementing seed policy at the provincial level. These MoLMACS also coordinates with agriculture knowledge center (AKCs) and seed laboratories through provincial agriculture directorates and livestock and fishery directorates.

All local governments have agriculture units, which support farmers and entrepreneurs in collaboration with AKCs and PMAMP. Until 2018, district and local government level agriculture activities were coordinated by district agriculture development offices through agriculture service centers. Under the federal system level agriculture activities are now the responsibility of local governments. Each local government has an agriculture committee headed by the local government chairperson and agriculture and livestock development officers with the membership of local stakeholders. These committees decide and monitor agricultural activities planned by local, provincial and central governments. The organizations engaged at federal, provincial and local levels are summarized in Table 3.2.



Abbreviations: ADD agriculture development directorates, AKC agriculture knowledge centers, ASL Agriculture Seed Laboratory, CCDABC Centre for Crop Development and Agro Bio-diversity, DoA Department of Agriculture. DoLS Department of Livestock Services, Integrated Agriculture and Livestock Development Office (IALDO) LFD livestock and forestry directorates, NARC Nepal Agriculture Research Council, SQCC Seed Quality Control Cennter.

Figure 3.1: Institutional structure of Nepal's seed system under the federal system.

Table 3.2: Seed sector organizations and their roles under the federal system.

	Organizations	Roles
Federal government		
1.	Ministry of Agriculture and Livestock Development (MoALD)	Policy, planning, and resource allocation for the seed sector Human resource development and creating enabling environment
2.	National Seed Board (NSB)	Guidance, coordination and leadership on all seed related programs; policy support and advice to the government; variety release and registration
3.	Seed Quality Control Centre (SQCC)	Serves as the National Seed Board secretariat; implements seed policies and provides regulatory and quality control services
4.	Nepal Agriculture research Council (NARC)	Agricultural research, variety development and maintenance, germplasm conservation, source seed production (breeder and foundation seed), partnership in seed research with private sector
5	Department of Agriculture (DoA)	Planning and technical support in coordination with NSB/SQCC
6	Agriculture Seed Laboratory	Laboratory tests seed samples and provides technical support to seed entrepreneurs
7	Prime Minister Agriculture Modernization Project (PMAMP) (super zones, zones, blocks, pockets)	Supports commercialized agriculture including seed production and marketing in collaboration with farmer groups, cooperatives, companies, agrovet and local governments
8	Other agencies (SEAN, agricultural university, Agriculture Input Company Ltd.)	SEAN represents seed companies in seed policy dialogue and to NSB The agriculture university develops human resources AICL provides improved seed of food security crops as per the government mandate
Provincial governments (as provisioned)		
1.	Ministries of land management, agriculture and cooperatives (MoLMACS)	Policy, planning, and resource allocation for the seed sector
2.	Provincial seed boards	Guidance, coordination and leadership to all seed related programs at the provincial level, policy support and advice to MoLMAC; recommendation of varieties for release/registration to NSB
3.	Provincial seed laboratories	Implement seed policy and provide regulatory and quality control services
4.	Regional agriculture research stations (RARS/NARC)	Agricultural research, variety development and maintenance, germplasm conservation, source seed production (breeder and foundation seed), partnership in seed research with private companies
5	Directorates of agriculture and fisheries development/livestock services	Planning and technical support in coordination with provincial seed boards and seed laboratories
6	Directorates of agriculture extension and directorates of livestock and fisheries	Coordination and capacity building for local governments to implement agriculture and livestock-related activities
7	Agriculture knowledge centers, veterinary hospitals and livestock knowledge centers	Technical support to seed producers, processors and seed entrepreneurs, in coordination with provincial seed laboratories
Local governments		
1	Local government agriculture units	Design and implement programs for improved seed production and distribution in collaboration with groups, cooperatives, companies, agriculture knowledge centers, PMAMP, agrovets and NARC centers.

3.2. Socio-Economic and Environmental Factors

The section below explains the soico-economic conditions of seed growers and environmental factors that influence maize and rice seed production of the sampled households:

- The average age of the seed grower household heads was 48 years, ranging from 16 to 86 years.
- Most of the households (74%) were headed by males. Males and females were engaged in seed production activities with the males more focused on land preparation, procuring seed and fertilizers and threshing, while the females were mainly engaged in planting, weeding, harvesting and cleaning.
- The average number of years of formal education of the household heads was 6.5 years, with 42% of them having at least primary level education.
- The average landholding size of the households was 0.7 ha and 30% were marginal farmers (<0.5ha), 45% medium sized and (0.5 to 2ha) and 25% large farmers (>2ha).
- The average annual household income was US$ 3,483 (US$ 535.8 per capita income), and seed production provided an average of 40% of household incomes.
- 22% of the households receive remittances incomes, mainly from relatives working in India and the Gulf countries.
- 92% of the seed growers were associated with farmer groups or cooperatives.
- The seed growers reported facing increasing temperatures (49%), decreasing temperatures (69%) and changed (decreased) rainfall patterns (65%). Although the total amount of rainfall was said to have decreased, 76% of the households perceived increased flooding due to increased rainfall intensity. About 29% suffered more drought and 78% more cold waves, while 93% of them perceived a lowering of the water table in their areas.
- Most households (78%) said that climatic changes would have negative impact on farming, including seed production.
- The main adaptation practices adopted by seed grower households were variety diversification (32.1%), adjusting crop calendar (31.8%), crop diversification (15.4%), and maintaining irrigation infrastructure (29%).

3.3. Support Services

The status of support services for seed production in the study areas seed are provided below:

- Financial institutions such as banks, cooperatives and microfinance institutions are poorly aware of the functioning of the seed value chain and financial needs, and most of them consider agriculture, including seed production, as a risky business.
- Financial institutions hesitate to invest in the seed sector under the Government of Nepal's subsidized agriculture loan schemes, although some seed companies and cooperatives have started accessing these loans.
- Micro-finance and cooperatives charge an interest rate of 12–24% on loans, which is almost double than that provided by commercial banks'.
- The Government of Nepal pays 75% of the cost of insurance for agriculture crops including seed crops. Twenty insurance companies provide insurance for farmers' crops. However, there is poor progress in the implementation of seed crop insurance in the field.
- PMAMP is in the process of developing 3,500 agriculture insurance agents to serve Nepal's farmers.

- It is estimated that about 5,000 rice aggregators (*gallawala*) operate in Nepal's Terai. They collect rice grain from farmers and sell it on to rice millers.
- Nine government laboratories (eight in provinces and a central one in Kathmandu) provide seed quality testing, capacity building and seed certification services to farmers and entrepreneurs. Some seed companies and NGOs have also established seed laboratories, but they are yet to be functional. The limited number of technical staff and budgetary constraints impede their effectiveness.
- Post federalism, local governments are responsible for providing technical and business management advisory support to seed growers and users; but many of them lack agricultural technicians and technicians need to be capacitated on seed production, certification and seed business promotion.

3.4. End Markets

The nature of demand of end use markets for maize and rice is provided below:

- Nepal imported 750,000 Mt of milled rice in 2018. Rice imports have increased dramatically over the years (TEPC, 2019).
- Nepal's poultry feed industry consumes 0.6 million tons of maize per year with more than 70% of it fulfilled by imports.
- More Nepalis are consuming fine rice. The Government of Nepal has responded to this by registering a large number of fine quality rice varieties.
- There is an increased trend of producing breeder seed of fine rice varieties at NARC stations. The share of fine rice breeder seed at NARC stations increased from 19.5% in 2015 to 27.4% in 2019.
- Seed companies and cooperatives are growing more fine and medium fine varieties (Figure 2.13).
- Most millers and grain producers (seed consumers) are unaware of improved seed produced by Nepali seed companies and cooperatives.
- Millers who have been processing and selling coarse or medium fine rice varieties hesitate to use fine quality rice brands for two main reasons. First, the milling recovery percentage from fine quality rice varieties is 6–10% less using the same processing machine used for coarse rice. Second, the return on investment of fine quality rice is questionable considering the scattered small-scale production of fine rice. Millers say that to start up a new fine rice brand needs at least 30 Mt of rice grain, and that it needs to be planted in blocks to minimize the mixing in of other rice varieties.
- Millers mainly value the three traits of duration, milling recovery and yield in rice they buy. Most millers are unaware of the improved seed available in the country. Some have started importing fine rice varieties from India to produce grain of fine quality rice in Nepal, including Sampurna by Marutinandan Rice Mill, Kapilvastu.
- Feed mills mainly value yellow color, low moisture content (<14%) and lack of rotten grain in the maize grain they buy.

4

Challenges and Risks in the Cereal Seed Business

The assessment found that several challenges were faced by the actors in Nepal's maize and rice seed value chains (Table 4.1).

Table 4.1: Challenges faced by private sector seed businesses.
The seed sector is also constrained by the enabling environment that hinders business growth. These issues are highlighted in Table 4.2.

Issues	Details	Implications
Research and Development		
Low capacity and innovation in public and private seed institutions	• The inadequate number of trained/ qualified breeders, seed technologists and agronomists • Low investment in research and development (R&D) facilities • Inadequate land available for hybrid parental line maintenance • Slow varietal R&D, and maintenance of varieties	• Dependence on imported and/or sub-standard seed • Dominance of old public varieties in product portfolios • Seed companies, cooperatives and seed producer groups do not have the capacity nor the mandate to conduct R&D • Poor private sector investment in hybrid variety development, and lack of competitive Nepali varieties in the market. • Lack of quality source seed for seed production.
Seed Production		
The mismatch between demand and supply of early generation seed	• The dominance of old varieties in markets • Seed companies and cooperatives do not get adequate quantities of their demanded early generation seed that are preferred by buyers	• The slow commercialization of new varieties • NARC stations unable to sell early generation seed • Inadequate production of demanded early generation seed.

Issues	Details	Implications
Inconsistent seed quality	• The high rate of staff turnover and transfers in public and private sector organizations • The insufficient quantity of parental lines • Lack of implementation of hybrid seed production and certification guidelines • The inadequate number of seed technologists • Inadequate quality monitoring and testing • The limited number of technical professionals for seed quality monitoring at seed labs • The poor maintenance of source seeds	• The hybrid seed production system is not effective • The effect on quality seed production • Lack of consistency in varietal performance • Inconsistent seed demand.
Low return of seeds from growers	• Farmers retain 30-40% of seed for home consumption	• Weak relations with seed growers • Less seed recovery leads to low seed output or low seed replacement rate • Growers lack access to affordable finance
Threats due to changing weather and human-wildlife conflicts	• Farmers plant limited areas for seed production due to weather and wildlife risks • Farmers produce less seed than estimated or planned	• Less seed recovery leads to low seed output.
Seed processing		
Poor utilization of existing seed processing plants and seed storage structures	• Most existing seed processing plants do not have pouch packing or seed drying facilities • Most seed storage structures were developed with subsidy push without tailoring to business plans	• Less competitive products on the market • Poor or slow growth of the seed replacement rate.
Poorly developed or underutilized seed laboratories in private companies	• Lack of trained seed technologists	• Less competitive seed products on the market • Risk of substandard seed available in the market.
Marketing		
Lack of market development activities by seed companies	• Seed companies do not focus on brand development and product promotion. They prefer to sell public varieties that are purchased by the government and development projects for selling under subsidy schemes.	• Lack of competitive Nepali seed products in markets • Limited contacts with grain producing farmers and demonstration of product attributes and advisory services • Agro-dealers lacking information about new varieties • New market segments remain untapped.

Issues	Details	Implications
Sales		
Unmet market demand	• Only open pollinated seeds are prioritized by seed companies • Lack of proper seed production and distribution networks of seed companies • Importers bring in hybrid seeds from India and China	• The huge gap between demand and supply • Farmers need high yielding hybrids, which are supplied by imports • The import of low-quality seed • Low seed replacement rates • Predominance of unregistered varieties with inconsistent supplies over the years
Adoption		
Weak output market linkages for cereals	• Lack of demanded varieties and production lead to poor links with millers and processors	• Huge imports of maize and rice grain for feed production and milling
Farmers use old varieties	• Low seed production of new varieties • Lack of awareness about new varieties	• Low yields in farmers' fields
Low involvement of women in seed production	• Women's lack of awareness about seed production and the poor capacity of managing seed business	• Women's opportunity to earn incomes diminished

The seed sector is also constrained by the enabling environment that hinders business growth. These issues are highlighted in Table 4.2.

Table 4.2: Enabling environment-related challenges faced by Nepal's seed sector actors.

Issues	Description	Implications
Inefficient public sector research	• Limited number of breeders in the national systems • Very limited research on hybrid development • Poor coordination with private seed companies and cooperatives	• Underutilized germplasm collected at the National Gene Bank • The slow release of new high yielding and stress tolerant rice and maize varieties
Slow variety release and registration procedures	• Only NARC conducts varietal trials for registration and release • Long process (8-10 years) for varietal release	• Dominance of old public varieties • The increased import of seeds through formal and informal means
Poor implementation of hybrid seed quality and seed production standards	• Standards to measure seed production and seed quality for domestically produced hybrids not implemented. • Seed producers unable to get their seeds tested and certified	• Seeds sold without certification • Quality of seed may be questionable
Limited availability of seed research and development licenses	• The private sector is not allowed to produce breeder seed • The private sector is not allowed to conduct varietal research and development	• The potential of the private sector to register seed varieties is not clear • The private sector is unable to produce breeder seed • Hybrid seed production without license not recognized

Issues	Description	Implications
Lack of development and application of phytosanitary regulations	• The informal export of locally produced seed at a lower price • Informal seed import	• Potential for transfer of disease and pests.
The adoption of plant variety protection (PVP) and intellectual property rights (IPR)	• Lack of or low incentives for plant breeders to develop new varieties • Low private investment in variety development and promotion	• The dominance of old varieties • Limited choice of farmers' preferred varieties • Slow variety replacement rate
Nepal is not a signatory to the International Union for the Protection of New Varieties of Plants (UPOV)	• Unclear policy about farmers' and breeders' rights	• The slow pace of registering crop varieties • The difficult commercialization of local and farmers varieties
Lack of foreign direct investment (FDI) in the seed industry	• Lack of a clear policy to attract foreign direct investment • Foreign investors face high risks when investing in Nepal's seed industry with no clear policy to protect their investments • Lack of tax and financial incentives to produce hybrid seeds	• Poor investment in the seed sector • Slow growth in custom seed production
Lack of access to advisory services in hybrid seed production	• Lack of technical support to the private sector for seed breeding • Lack of designated seed production areas	• Limited development of Nepali hybrid seed • Private seed companies do not produce and develop hybrid seeds
Lack of zoning for seed production	• Difficult to provide a good seed quality maintenance and extension facility for seed producers	• Substandard seed available in the market • Scattered and inadequate amount of seed production to meet national requirements
Seed subsidies from the government	• Differing seed subsidy and distribution models of local governments • Poor coordination between government agencies in implementing subsidy programs • The government subsidizes old varieties	• The distortion of seed company businesses • The limited amounts of seed stocked by private companies • Seed quality compromised
Policy constraints on marketing	• Poor implementation of seed law to control substandard seed • Poor coordination between government agencies for developing marketing infrastructures such as high-quality grading machines and seed storage structures • The restricted registration of maize varieties constrains business expansion	• Poor efficiency and effectiveness of the existing marketing infrastructure • Illegal to sell seeds in other potential areas of the country.
Policy constraints on the use of varieties	• Poor extension about the benefits and traits of varieties • Poor linkage of pull factors (e.g., mills, industry) with variety users (grain producers)	• Poor and slow adoption of locally produced varieties.

5

Options for Upgrading Cereal Seed Value Chains

5.1. Value Chain Upgrading by Seed Companies

5.1.1. Upgrading in the cereal seed business

Nepal's cereal seed sector faces several constraints related to the various functions of the value chain. These challenges and risks in the value chains and the enabling environment are highlighted in Section 4. The issues faced by actors in their inter-business relations have been discussed under the seed value chain analysis. These challenges need to be mitigated to improve the competitiveness of Nepal's domestic seed system.

The National Seed Vision set targets for seed sector development in the country to be met by the public and private sectors by 2025. The importation of maize and rice grains into the country is growing, and the government has a priority plan and targets for maize and rice production for three years from June 2020. The maize and rice seed value chains need to be upgraded to enable the meeting of these targets through product, process, functional and interchain upgrading (refer to section I). There is also a need to upgrade the enabling environment to help actors achieve their upgrading targets and vision. Table 5.1 shows the upgrading options for Nepal's private seed companies, while Table 5.2 shows the upgrading options in the enabling environment.

Table 5.1: Upgrading options for Nepalese seed companies in the cereal seed business.

Value chain function	Upgrading Strategies	Actions in maize and rice seed systems	Business performance/ development objectives
Research and Development	Functional upgrading Product upgrading Process upgrading Interchain upgrading	• Introduce and strengthen the research and development function in seed value chains • Conduct hybrid seed production research and seed producibility research • Establish specific R&D centers • Include new hybrid varieties of rice and maize in product portfolios • Develop and produce three-way cross and single-cross hybrids • Introduce new products such as biofortified maize for the food and feed sectors • Maintain parental lines of hybrids • Improve the quality of OPV products by taking up maintenance breeding • Hire trained breeders	New high quality hybrid products for specific market segments Increased seed yield Increased grain yields Increased varietal diversity for various market segments New competitive products available on the market
Seed production	Process upgrading Functional upgrading	• Follow standard operating procedures for producing seed • Identify exclusive seed production areas and pockets for hybrid seed production • Develop contractual seed production systems between seed producers and buyers • Train seed producers in hybrid seed production • Provide access to finance to improve seed production infrastructure and equipment • Promote seed crop insurance schemes to minimize the seed production risks	Increased seed yields Improved quality of seeds Increased seed production Improved seed recovery Increased income of seed producing farmers Seed producing farmers access better services Improved seed company profits
Seed processing	Process upgrading	• Establishment of cold storage chambers in existing or new seed storage buildings • Introduce digital moisture meters, seed counting machines, etc. at seed cooperatives and companies • Improve the technical competency of local government technicians on seed certification • Increase seed processing capabilities such as high-quality seed drying and packaging facilities	High quality seeds Reduced post-harvest losses

Value chain function	Upgrading Strategies	Actions in maize and rice seed systems	Business performance/ development objectives
Marketing	Process upgrading Functional upgrading	• Develop and strengthen the marketing function of seed companies • Develop branding and engage with farmers and marketing channel partners • Develop market research capabilities to nurture and expand market segments • Maintain steady quality and homogenous product standards • Introduce smart product, pricing and packaging strategies based on market segments and customer needs • Develop communication and product promotion approaches including product demonstrations, dealer meetings, seed fairs, farmer clubs and farmer reward programs • Improve logistics for supplying adequate volumes of seed • Diversify product categories for targeting various needs (economies of scope) • Comply with safety, environmental and sustainability standards (such as safe seed treatment practices, product handling standards, soil conservation related information)	Efficient marketing by seed companies Sell competitive Nepalese hybrids in various domains The market share of Nepali varieties increases
Sales	Product upgrading Functional upgrading	• Introduce crop advisory services for farmers • Timely delivery to markets to meet farmer demands • Develop future contracts with agro-dealers and cooperatives • Provide competitive incentives to agro-dealers • Track performance of varieties and address complaints using digital tools	Farmers receive tips to get maximum outputs from varieties Farmers receive high quality seed at affordable prices Agro-dealers push Nepali products

Table 5.2: Upgrading the enabling environment for seed companies.

Services	Activities	Potential Service Providers
Variety testing and release	• Provide R&D licenses to seed companies and experienced cooperatives • Fast track the release and registration of varieties after two seasons of successful testing in multiple locations • Support seed companies by providing breeder seed from the national system	SEAN/SAN SQCC NARC IARCs
Quality assurance in seed production	• Support for maintenance of parental lines • Approve and implement hybrid seed production standards • Recognize private seed inspectors • Establish seed production zones	Private seed companies NARC SQCC
Quality assurance in seed commercialization	• Hybrid seed certification standards • Continue with the Truthful Labelling (TL) system • Labelling seed packets • Support the expansion of domains of seed varieties for expanding markets	SQCC
Financial and business management services	• Support for developing hybrid seed production plans • Support in developing business plans • Access to suitable financial products for matching seed business cycles • Scale-out the vendor financing model in the seed business • Support collateral free loans to seed growers in line with warehouse receipts • Develop agricultural business development services in seed production and postharvest handling, marketing ideas, assistance with business planning and access to credit, advice on how to organize farmers, training, links with suppliers and buyers, and information and research.	NARC Seed companies Financial institutions Private investors
Plant variety protection	• Reward NARC scientists for varieties that are commercialized by the private sector • Enact intellectual property rights for variety owners	MoALD NARC
Seed extension	• Promote information on variety management and seed quality at seed producer and farmer levels	Private seed companies Local governments
Promoting Nepali varieties	• Provide subsidies for new varieties of seed • Promote Nepali hybrid varieties through government programs	PMAMP MoALD Provincial governments Local governments Development projects New investors

5.2. Market Development Strategies for Nepali Varieties

Nepal has various cropping systems across its diverse agro-ecological zones. Commercial farmers use seeds based on their experience, knowledge and beliefs that seed meet their preferences in terms of suitability in cropping systems, tolerance to biotic and abiotic stress, end user preferences and affordability. There is also an increasing trend of using hybrid seeds in Nepal. However, all hybrid seeds used in Nepal are imported and Nepal's seed companies face stiff competition from imported varieties from India and China. As Nepali companies embark on producing hybrids and new open pollinated varieties of maize and rice there is a need to develop strategies for promoting these varieties (Figure 5.1). There is also a need for systematic planning for marketing seeds in various market segments of the country. Figure 5.2 highlights the five strategy areas that seed companies need to address to launch their varieties of seed.

Figure 5.1: Market promotion strategies for locally produced varieties.

The appropriate promotional mix (the combination of advertisement, personal selling, the use of social media to promote the product, and other promotional tools) should be selected based on:

- the budget available for promotional activities
- the nature of the market
- the nature and characteristics of Nepali hybrid maize and rice seeds
- the stage of the product life-cycle.

As Nepali hybrid maize seed is at the introductory stage, promotional activities should focus on introducing a new product to the market.

The types of market promotion should be selected based on the following factors:

- The geographic scope of the market – Personal selling may be adequate in small local markets; but advertisements may be a better option as the market broadens geographically.
- Type of customers – Maize-growing farmers (household level), industrial users (feed and livestock industries), or through various market actors (wholesalers, agro-dealers and traders).
- Concentration of the market – The anticipated number of buyers should also be considered as the fewer the potential buyers the more effective personal selling is compared to advertising.

The cereal seed business has two main market segments to sell its products to:

Commercial market segments are areas with good irrigation facilities, market networks, extension facilities and large holdings. The objective of farming in these segments is to maximize profitability by using high yielding varieties (hybrids) together with best management practices; and production is

mainly for the market. These segments lie in both the hills and Terai. Market promotion strategies in this segment should be directed at:

- holding trader and dealer meetings;
- introducing competitive incentive system for dealers;
- competitive product development and branding strategies;
- developing information about the products and deploying it through agro-dealers;
- demonstrating seed products through agro-dealers;
- holding farmer field days led by traders; and
- promoting embedded services such as technology tips, fertilizer sources, access to credit and insurance services to seed buyers.

Subsistence market segments are characterized by rainfed production, poor market networks and transportation facilities, and the dominance of seed subsidies with most farmers being smallholder farmers. Key market development strategies for these markets should be:

- strategic partnerships between local governments, agriculture knowledge centers and cooperatives to target the subsidy market;
- establishing good relationships with government networks to create demand for improved seed;
- popularizing and sharing information about products with local and provincial governments;
- demonstrating new products in strategic locations in partnership with lead farmers, local governments and cooperatives; and
- holding seed fairs in farming communities.

Figure 5.2: Mixed marketing strategies for domestically developed hybrid varieties.

5.3. Promoting Inclusive Seed Systems

5.3.1. Strengthening the informal seed systems

About 83% of seed produced in Nepal is in the informal sector. The National Seed Vision has targeted a seed replacement rate of 25% for cereals by 2025. Many Nepali farmers can increase crop yields and have better food security if they have access to locally produced quality seeds. This calls for strengthening informal seed systems to upgrade to producing quality seeds in collaboration with seed companies and cooperatives for large-scale distribution in rural areas.

The weak position of research systems in generating new varieties and the inefficient extension systems contribute to the low penetration of improved varieties into the informal seed supply system. However, the informal sector can play a crucial role in the diffusion of new varieties to farmers, especially in countries such as Nepal where the formal sector cannot produce adequate seed to meet farmers' needs. The informal sector was a key player in the rapid diffusion of improved varieties in Asia during the Green Revolution in the 1960s. The following actions would strengthen Nepal's informal rice and maize seed sectors.

- Hold seed exchange programs in communities just before cropping seasons.
- Agro-dealers, development partners and government agencies to hold farmer field days and farmer excursion visits to new variety demonstrations.
- Link informal seed users with agriculture extension and the output market.
- Strengthen the output market of informal seed users with industries such as millers.
- Develop linkages between seed producers and NARC centers and seed companies to access source seeds of new varieties.
- Support the adoption of quality control measures to improve crop yields.
- Develop innovative marketing strategies such as small packets, low prices and credit facilities.

5.3.2. Integrating gender and social inclusion concerns

Gender equality and social inclusion (GESI) is important for inclusive seed systems. Various social groups may have different opportunities, constraints, priorities, abilities, and access, and these issues should be analyzed and addressed across the seed value chain. In Nepal, there is an increasing trend of feminization in agriculture due to the migration of males from rural to urban areas within Nepal and abroad. This has resulted in increased responsibility and workload for women farmers, while women farmers are deprived of various government schemes due to limited empowerment and resource possession (e.g., land ownership certificates). Other GESI concerns are the poor reach of improved varieties in marginal areas as private companies do not have much interest in supplying seed to these areas due to the low return on investment, limited agronomic literacy due to lack of access to extension systems and exposure to new practices, and the poor engagement of youth in seed value chains. These issues could be addressed by the following strategies:

- Develop practical training programs and knowledge products oriented to educating readers and using their languages.
- Target and market products to women farmers through demonstrations, marketing campaigns, distributing seeds to women farmers and engaging women extension agents.
- Facilitate access to loans, training and use of digital technology to attract youth to the hybrid seed production business.
- Ensure the participation of youth, disadvantaged ethnic and caste groups and women in seed development activities.
- Foster partnerships between seed companies, local government and cooperatives managed by women and other disadvantaged communities to promote local seed production and distribution systems in marginal areas.

5.4. Capacity Development

The capacity development needs of the seed value chain actors have been prioritized to address the weakest links in the chain of research and development and market development. The capacity development needs for improving the enabling environment are highlighted in Table 5.3.

Table 5.3: Capacity development needs of value chain actors.

Value chain functions	Capacity needs	Potential providers
Research and development	Seed companies: strategic framework for R&D, crop breeding, hybrid variety development; variety maintenance; operation of R&D centers	Development partners, international agriculture research centers, NARC
Seed production	Seed companies, cooperatives and farmer groups, site selection, use of best management practices, quality maintenance, post-harvest management, seed pricing strategies	Development partners, international agriculture research centers, NARC, agriculture knowledge centers
Seed processing and conditioning	Seed companies, cooperatives and farmer groups: types of machinery, their use and operations; strategies to address humidity and temperature issues inside seed storage	Development partners
Seed marketing	Seed companies, cooperatives and farmer groups: contractual seed production approach. market intelligence planning	Development partners, SEAN
Seed use	Product diversification, linking outputs with markets	Agriculture knowledge centers, local governments, development partners

Table 5.4: Capacity development needs of value chain facilitators.

Value chain functions	Capacity needs	Potential providers
Seed Policy	Fast track variety release; implementing seed sector policies Developing and implementing policy on seed zoning	International agriculture research centers
Research and development	Hybrid variety development using modern biotechnological tools, seed producibility research, hybrid variety development and maintenance	International agriculture research centers
Seed production	Quality declared seed during emergencies Evidence on how countries developed and enforced seed zoning concept; advantages and limitations of seed zoning Digital seed certification	
Market development	Bringing in new investors in the seed system Promotional strategies for making Nepal a destination for seed production Public private partnerships for varietal promotion	International agriculture research centers
Seed marketing	Application of digital tools for marketing seed Tools and techniques used in digital seed marketing, Digital seed tracking	International agriculture research centers Digital companies
Seed Sales	Smart subsidies for popularizing new crop varieties Seed security assessment, approaches for popularizing new varieties, linking subsidies with variety promoting strategies	International agriculture research centers

Value chain functions	Capacity needs	Potential providers
Seed use	Popularizing high yielding varieties Developing seed extension systems Business models for women and less favored areas such as the Midhills	International agriculture research centers
Vitalizing seed systems after disasters	Rapid seed security assessment, developing resilient seed systems	International Agriculture Research Centers

5.5. Seed Policy and Governance Under a Federal System

In 2016, the International Food Policy Research Institute (IFPRI) conducted a detailed analysis of policy issues that affect private sector investment in Nepal's seed sector. Studies conducted by FAO in 2015 suggested approaches to develop and implement seed policies and regulations conducive to a diverse, dynamic and integrated seed sector. These studies highlighted that favorable plant breeding and seed systems need i) a variety release system, ii) varietal development and extension, iii) variety maintenance and early generation seed multiplication; and iv) an intellectual property rights system.

The seed industry is influenced by a number of instruments, procedures and international conventions, namely the International Plant Protection Convention (IPPC), the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), the International Union for the Protection of New Varieties of Plants (UPOV), the International Seed Testing Association (ISTA), the Organization for Economic Co-operation and Development (OECD) and the Convention on Biological Diversity (CBD). In order to gain access to germplasm or the global seed trade, nations are obliged to become members of pertinent organizations and ratify necessary conventions.

In the context of federalism, the seed sector in Nepal needs to be better aligned with federal policies, and new laws and regulations need promulgating to establish provincial seed systems. The Revised Seed Act (2020) calls for the following actions:

- MoLMAC secretaries to serve as the member secretary of the National Seed Board (NSB) on a rotational basis.
- Provinces can create provincial seed boards by formulating and enforcing provincial seed acts. These boards will be responsible for developing seed regulatory guidelines and policies for seed business promotion and providing strategic guidance to local governments on seed related issues.
- If required, provincial seed boards can take advice from the National Seed Board on formulating seed related policies.
- As per National Seed Board guidelines, standards and requirements, provincial governments can notify and denotify about nationally developed and local varieties suitable for the respective provinces. This should be published in provincial gazettes.
- Provincial governments can assign officer level staff, from MoLMACs and local bodies, who have the experience and qualifications laid out in the Seed Act, as provincial seed inspectors and analysts.
- Seed management committees will be formed at local government level involving representatives from private companies and farmer groups and cooperatives. These committees will be led by local governments agriculture officers. They will provide strategic guidance for seed system strengthening on local seed production, processing, marketing, distribution, seed importation, agrobiodiversity conservation and community seed banks.

- Provincial seed boards can issue licenses for variety development and maintenance, foundation seed production and hybrid seed production in close coordination with the National Seed Board. The enforcement of provincial seed acts is mandatory for this.

5.6. Lessons from COVID-19 in the Cereal Seed Business

The restrictions on travel, trade and market to safeguard against COVID-19 has imposed risks on the availability, accessibility and quality of farmers' preferred crop varieties. Nepal imports over 3000 Mt of cereal and vegetable seeds each year. The COVID-19 lockdown affected domestic seed production and distribution due to restrictions imposed on transportation and distribution. Seed production enterprises were unable to receive the source seed of demanded varieties and could not monitor seed fields to ensure the application of good seed management practices. Research on new hybrid maize and rice varieties was affected due to the lack of regular technical guidance and field visits.

The COVID-19 situation reduced the availability of farmers preferred imported cereal seeds while creating a good market for local seed. In 2020, it was estimated that there was a deficit of about 500 Mt (30% of total demand) of hybrid maize seed for rainy season planting, especially in Dang, Dhading, Nuwakot and Kavre districts. Only 1,500 Mt of the 3,000 Mt demand for hybrid rice seed were available to farmers. Moreover, there was a mismatch between varieties demanded by farmers and available from by traders, and the price of imported rice and maize seeds increased by 10-20%. In the case of locally produced seed, the seed companies and cooperatives easily sold their OPV rice and maize seed in 2020. In the hilly areas of some districts, local governments provided source seed and improved seed of maize varieties on subsidy. Overall, seed companies and cooperatives have gained more confidence in while selling seed in 2020 that should result in higher seed production in 2021.

There is a high-quality risk in locally produced maize seed because maize production locations are often far from seed companies' stations. It was difficult for seed companies to monitor seed production sites due to travel restrictions imposed by government agencies and local government authorities. Some seed companies partnered with local government agriculture offices to conduct quality monitoring. However, it was difficult to implement this approach in many hill areas due to the limited number of such agriculture technicians.

The government plans to address these issues through seed subsidies; but unmanaged seed subsidies might distort private sector seed businesses.

Learning from the present situation, it is imperative for Nepal to develop a resilient seed system that can respond to shocks such as those imposed by the COVID-19 pandemic. The following suggestions should be considered by seed system actors and facilitators:

- Build the capacity of local government agriculture unit personnel and local governments on improved seed production and certification.
- Assess the potential for developing and implementing quality declared seed (QDS) to address forthcoming seed requirements.
- Develop the capacity of seed producers and quality control agencies including registered seed inspectors, migrants and youth in seed production, handling and certification.
- Operationalize digitally enabled seed information systems at various levels of the new federal structure so that the country can plan the production and delivery of quality seed transparently and efficiently.
- Develop multi-stakeholder seed coordination committees at local and province levels by engaging actors from public, private and community sectors that provide strategic guidance for strengthening local seed systems.

- Foster innovations to promote promising local genetic resources by linking seed companies with community seed banks and output (grain) markets.
- License seed companies to maintain and produce breeder and foundation seed.
- Develop the capacity of cooperatives and seed producer groups by linking them with seed companies for quality seed production in remote areas (bridging the last mile).
- Enable the priority sector lending program of the Nepal Rastra Bank to provide low interest loans to seed growers.
- Facilitate insurance schemes for seed growers.

6

References

Audet-Bélanger G, Thijssen MH, Gildemacher P, Subedi A, De Boef WS and Heemskerk W (2013) Seed Value Chain Analysis. ISSD Technical Notes Issue no 2. Centre for Development Innovation Wageningen UR, Wageningen & Royal Tropical Institute, Amsterdam.

Choudhary D, Khanal N, Gautam S, Beshir AbduRahman, Shrestha HK, Dilli KC and Donovan J (2020) Building a viable maize hybrid value chain in Nepal: recent successes and the road ahead. Enterprise Development and Microfinance, 31 (2): 92–112. https://doi.org/10.3362/1755-1986.19-00012

FAO (2015). Voluntary Guide for National Seed Policy Formulation. Food and Agriculture Organization of the United Nations. Rome

Gauchan D, Magar DBT and Gautam S (2016) Rice seed production and marketing practices in Nepal. The Journal of Agriculture and Environment, 17: 111-117.

Ghimire R, Wen-chi R and Shrestha RB (2015) Factors affecting adoption of improved rice varieties among rural farm households in central Nepal. Rice Science, 22(1): 35–43.

Joshi G and Bauer S (2006) Farmers' choice of modern rice varieties in the rain fed ecosystem of Nepal. Journal of Agriculture and Rural Development in the Tropics and Subtropics, 107 (2): 129–138.

Kafle B, Paudel MN and Ghimire RC (2012) Assessing current status of rice varieties in river basin area of Nepal: concern for diffusion. International Journal of Agriculture: Research and Review, 2 (2): 59-61.

Kaplinsky R and Morris M (2001) Trade and industrialisation in Africa: SMEs, manufacturing and cluster dynamics. University of Sussex, Sussex, UK 2 School of Economics, University of Cape Town, Rondebosch, South Africa. DOI: https://doi.org/10.2991/jat.k.190812.001; ISSN 2214-8515; eISSN 2214-8523

Khanal NP and Maharjan KL (2010) Sustainability of community-based seed production enterprises in Nepal: Institutional issues. Nepal Agriculture Research J., 10: 33-40.

MoAD (2013) National Seed Vision 2013-2025. Seed Quality Control Centre. Ministry of Agricultural Development. Government of Nepal. Kathmandu.

MoAD 2014. Agriculture Development Strategy 2015-2035. Ministry of Agricultural Development. Government of Nepal. Kathmandu.

MoAD (2017) Seed replacement study of cereals and vegetables in the program districts. Ministry of Agricultural Development. Kisankalagi Unnat Biu-Bijan Karyakram (KUBK-ISFP) Program Kathmandu, Nepal.

MoALD (2020) Statistical information of Nepalese Agriculture. Ministry of Agriculture and Livestock Development, Kathmandu, Nepal

Prasad SK, Pullabhotla H and Ganesh-Kumar A (2011) Supply and demand of cereals in Nepal (2010-2030). IFPRI Discussion Paper 01120. Environment and production technology division, New Delhi.

Riisgaard L, Bolwig S, Ponte S, du Toit A, Halberg N and Matose F (2010) Integrating poverty and environmental concerns into value-chain analysis: A Strategic Framework and Practical Guide. Development Policy Review, 28 (2): 195-216. Rutsaert P, Donovan J, and Kimenju S (2021). Demand-side challenges to increase sales of new maize hybrids in Kenya. Technology in society, 66, 101630. https://doi.org/10.1016/j.techsoc.2021.101630

SQCC (2016) Directive for seed certification. Seed Quality Control Centre. Ministry of Agriculture and Livestock Development, Kathmandu, Nepal.

SQCC (2020) Annual Report. Seed Quality Control Centre. Ministry of Agriculture and Livestock Development, Kathmandu, Nepal.

TEPC (2019) Annual Report. Trade and Export Promotion Centre. Ministry of Industry, Commerce and Supplies, Nepal.

Tripp R (2001) Provision of seed for agricultural development. Retrieved April 22, 2011, from mcknight.ccrp.cornell.edu/program_docs/litlists/Rach_Biblio_Seed%20Syst_18may06.pdf.World bank (2020) Nepal development update. Retrieved April 22, 2011, from https://www.worldbank.org/en/country/nepal/publication/nepaldevelopmentupdate

Annex 1: Details of the market Clusters

Cluster	Districts
1	Kailali, Kanchanpur, Dadeldhura-Doti-Baitadi
2	Banke, Bardiya, Surkhet, Dailekh, Jajarkot
3	Dang, Salyan, Rolpa, Pyuthan, Rukum
4	Rupandehi, Palpa, Gulmi, Arghakanchi, Syangja
5	Bara, Parsa, Chitwan, Dhading, Nuwakot, Kavre
6	Rautahat, Sarlahi, Sindhuli, Udayapur, Khotang
7	Sunsari, Morang, Dhankuta, Terhathum, Sankhuwasava
8	Jhapa, Ilam, Panchthar, Taplejung
9	Tanahun, Gorkha, Lamjung, Kaski

Cluster 1: Kailali, Kanchanpur, Dadeldhura, Doti, Baitadi – All the districts in this cluster are in Sudurpashchim province (far-western region). Kailali and Kanchanpur lie mostly in the Terai, while Dadeldhura, Doti and Baitadi are in the Midhills. Dhangadhi and Mahendranagar are major Terai-based trading centers. Rice and lentil seed production is focused in the Terai while maize seed is produced in the hills.

The seed enterprises in this cluster have the following comparative advantages for producing and selling cereal seed:

- this region is better for quality seed production than the east as the weather is less humid;
- labor costs are comparatively cheaper;
- there is a large demand for cereal seed;
- the cereal seed production season starts one month earlier than in the eastern region, which provides more time for seed companies to sell their products than eastern markets; and
- many seed-related research and development projects are focused in the west of the country, which provides good opportunities to promote seed companies' products.

Cluster 2: Banke, Bardiya, Surkhet, Dailekh, Jajarkot – This cluster includes the districts that were in the Mid-Western Development Region. It covers both Lumbini (Banke and Bardiya) and Karnali (Surkhet, Dailekh and Jajarkot) provinces. Banke and Bardiya lie in the Terai region while the other three are in the Midhills. Nepalgunj is the major trading hub of this region. Banke and Bardiya are traditionally important rice and wheat seed growing areas, while in recent years maize seed production has started in some areas with Surkhet and Dailekh popular for OPV maize seed production. Maize seed produced in these are sold in many areas of the country including in the eastern region.

The seed enterprises in this cluster have the following comparative advantages for producing and selling cereal seed:

- this region is better for quality seed production than the east as the weather is less humid;
- labor costs are comparatively cheaper;
- there is a large demand for cereal seed; and
- many seed-related research and development projects are focused in the west of the country, which provides good opportunities to promote seed companies' products.

Cluster 3: Dang, Salyan, Rolpa, Pyuthan, Rukum – The five districts in this cluster lie in Lumbini and Karnali provinces with Dang as the major business hub. Dang district is famous for hybrid rice and maize production. New seed companies and feed mills are being established in this area because of the good availability of irrigated land and agriculture machinery services. PMAMP's Dang maize Super Zone supports farmers and maize value chain actors for the commercialization of the maize sector. The hilly districts of Pyuthan, Rukum, Rolpa and Salyan are famous for vegetable seed production. Seed companies based in Dang and other parts of the country contract farmers and farmer groups and cooperatives in these hill districts to produce vegetable seed production.

Cluster 4: Rupandehi, Palpa, Gulmi, Arghakanchi, Syangja – This cluster includes parts of Lumbini and Gandaki provinces. Rupandehi is located in the Terai while the other four districts are in the Midhills. Bhairahawa and Butwal are the major business hubs and are industrials centers with rice, wheat and pulse processing industries. This cluster is famous for crop seed production. Nine of the 28 seed companies/cooperatives that have taken foundation seed production licenses from SQCC are located in this cluster (28% of all such companies). Most of the rice and wheat consumed in the cluster is produced in Rupandehi and Kapilvastu. OPV maize seed production is well developed in Gulmi and Arghakhanchi districts by seed cooperatives and farmers groups. The seed companies located in the Terai also produce maize seed under contractual arrangement with hill farmers. PMAMP's Kapilvastu Rice Super Zone and Gulmi Maize Zone are located in this cluster.

Cluster 5: Tanahun, Gorkha, Lamjung, Kaski – This cluster is located in Gandaki province and all four districts are hill districts. Pokhara is the major business hub. Seed production activities are not well-developed in this cluster. Most of the rice seed consumed in this cluster is supplied from Chitwan. There are a few maize and rice seed production cooperatives in Lamjung, Tanahun, Lamjung and Kaski districts. The seed produced by these cooperatives is consumed locally. NARC's Regional Agriculture Research Station and the Agriculture College at Sundarbazaar, Lamjung are also located in this cluster.

Cluster 6: Bara, Parsa, Chitwan, Dhading, Nuwakot,Kavre – This cluster covers parts of Madhesh and Bagmati provinces. Birgunj and Narayangarh are the major business hubs and Birgunj is a major import/export point. The six districts are Nepal's major commercial hybrid rice and maize production area. About 50% of the hybrid maize seed and 38% of all hybrid rice seed sold in Nepal through formal channels is sold in this cluster. Seventy percent of the 104 feed mills registered with the National Feed Association (NFA) are located here while 50% of registered rice mills lie in this cluster, especially in Bara and Parsa districts. Bara is the hybrid maize production hub with most of its maize grain sold to feed mills. There are a number of well-developed seed companies in Chitwan, which are mainly engaged in rice and wheat seed production. Some seed companies produce maize seed in hilly districts of other clusters under contractual arrangements. The Hybrid Maize Mission Program was implemented in this cluster by the government in 2009 and 2010. All the districts have good road networks and communication facilities as well as supporting organization banks, fertilizer cooperatives and agrovets which supports the widespread more commercialized farming in this area.

Cluster 7: Rautahat-Sarlahi-Sindhuli-Udayapur-Khotang – This cluster covers parts of Province 1 and Madhesh province. Rautahat and Sarlahi lie in the Terai region while Sarlahi, Sindhuli, Udayapur and Khotang are in the Midhills region. Bardibas and Gaur are the major business hubs. Rice is the main food commodity in the Terai and maize in the hilly region. The two Rautahat-based seed

companies are mainly engaged in rice and wheat seed production. Rautahat and Sarlahi are also popular for hybrid maize production, which is mainly grown during the winter and sold to feed industries based in Birgunj. Maize is the major food crop in the hilly areas. Some seed production cooperatives and farmers groups produce OPV maize seed and supply to farmers. PMAMP has a maize production zone in Khotang district.

Cluster 8: Sunsari, Morang, Dhankuta, Terhathum, Sankhuwasava – This cluster covers part of Province 1 and is one of Nepal's major rice production areas with Morang being the largest rice producer district in Nepal. Biratnagar and Inaruwa are the major business hubs. There are no established seed companies in this cluster, but seed production cooperatives and farmers groups are engaged in rice and wheat seed production in Sunsari and Morang and maize seed production in Dhankuta, Terhathum and Sankhuwasava districts. There is also an emerging trend of hybrid maize production in Morang and Sunsari districts in recent years.

Cluster 9: Jhapa, Ilam,Taplejung, Panchthar – This cluster lies in the most eastern part of Nepal and in Province 1. Jhapa is famous for rice seed and hybrid maize grain production. This district consumes the most hybrid maize seed of any district (200 Mt/yr). Birtamod is the major market center. PMAMP's Jhapa Rice Super Zone and Chandragadhi seed production farm, Jhapa lie in this cluster. Ilam and the other hill districts are famous for spice farming including tea and cardamom. OPV maize seed is produced in the cluster's hill districts by a few farmer groups and cooperatives. However, there is no established seed company in this cluster.

Annex 2: Laboratory standards for open pollinated (OP) rice seed (SQCC 2016)

Categories	Standards	Figures
Minimum physical purity (%)	Foundation and Certified	98
Maximum inert materials (%)	Foundation and Certified	2
Maximum other crop seed (no./kg)	Foundation	10
	Certified	20
Maximum noxious weed seed (no./kg)	Foundation	2
	Certified	5
Identifiable seed of other varieties of same crop (no./kg)	Foundation	10
	Certified	20
Minimum germination (%)	Foundation and Certified	80
Maximum moisture during storage in normal sack (%)	Foundation and Certified	13
Maximum moisture during storage in airtight sack (%)	Foundation and Certified	8
Minimum physical purity (%)	Improved	97
Minimum germination (%)	Improved	80

Field standards: Seed production fields should be free from volunteer plants, rogueing should be done twice in each cropping period, one after full heading or before flowering and another towards crop maturity just before harvesting. An isolation distance of 3m should be maintained between plots with different varieties for both breeder and foundation seed. In case of foundation seed, off-type, diseased, and wild rice should not be more than 0.05%, 0.2% and 0.05%, respectively. However, in certified seed, the maximum threshold figure are 0.2% (off-type), 0.5% (diseased seed) and 0.1% (wild rice seed), respectively. Wild rice (*Oryza sativa* L. var fatuaprain) is considered as a designated weed in rice. Fields having blast disease must be rejected.

Source: SQCC 2016

ANNEX 3: Laboratory standars for open pollinated (OP) maize seed (SQCC 2016)

Categories	Standard	Figures
Minimum physical purity (%)	Foundation and Certified	98
Maximum inert materials (%)	Foundation and Certified	2
Maximum numbers of other crop seed (no./kg)	Foundation	5
	Certified	10
Identifiable seed of other varieties of the same crop (no./kg)	Foundation	10
	Certified	20
Minimum germination (%)	Foundation and Certified	85
Maximum moisture while stored in a normal sack (%)	Foundation and Certified	12
Maximum moisture while stored in an airtight sack (%)	Foundation and Certified	8
Maximum weed seed	Foundation and Certified	0
Minimum physical purity (%)	Improved	97
Minimum germination (%)	Improved	85

Field standards: Seed production fields should be free from volunteer plants, rogueing should be done at least twice in each cropping period, first before tasseling and second after full emergence of tassels and silks. An isolation distance should be maintained of at least 300m and 200m between plots of different varieties or the same class or variety without varietal purity for foundation and certified seed, respectively. If such space isolation distance is not maintained, the flowering time difference between two varieties should be at least 15 days.

In case of foundation and certified seed, the off-type plants should not be more than 1.0% and 2.0% respectively if 5 or more than 5 % silks are at a stage of pollen receiving from other pollen shedding varieties in the same or neighboring field. In addition, the cobs are also inspected after harvesting in threshing floor or stores. The varietal or colour (in the same variety) difference should not be more than 1%, otherwise the cobs should be removed from the seed lot.

Source: SQCC 2016

Notes:

Notes:

Notes:

CGIAR

CIMMYT MR
International Maize and Wheat Improvement Center

Cereal Seed Value Chains in Nepal: Current functions, changing context, and opportunities for upgrading