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Policy Provisions and Implementation of Seed Technology Research, and Innovation in Nepal

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Abstract

Favorable policy provisions and their effective implementation are critical in promoting agricultural research innovation and technology development for ensuring food security and livelihood improvement of the farmers. This paper aims to (i) review current policy provisions made for research and innovations in the seed sector; (ii) assess its implementation status as envisaged in the policies and (iii) identify issues and gaps to make recommendations for potential policy solutions. The study employed a three-step process which included listing and review of the policies, followed by an assessment of their implementation status by developing a policy framework. The study showed that most policy documents have emphasized increasing production and productivity in agriculture, but have undermined the importance of research and technology to enhance agricultural productivity. In addition, current challenges such as nutritional security, natural resource management, and climate change have not been given adequate space in policy design. Very few policy documents have focused to develop climate-resilient varieties, breeds and technologies. Policy provisions for investment in agriculture research and innovation are inadequate and fragmented, despite their significant role in achieving a high rate of return in agriculture development. Analysis showed that investment, human resource development and institutional frameworks are weak, but the policy framework sounds relatively good. Therefore, it is urgent to manage human resources and investment as well as develop new provincial and local government agricultural policies and institutional frameworks aligned with federal policy considering the issues and challenges being faced in the present and what may happen in future. Increased investment and capacity development in plant breeding, modern technology, and seed system; facilitating public-private partnership and private sector to attract research investment; participatory and decentralized variety selection, release and recommendation; coordination mechanism for policy formulations and implementation; and provide incentives for research, release and promotion of domestically developed varieties are recommended to strengthen the variety and seed system innovations in Nepal.

Keywords: Agricultural research & innovation, institutional set-up, investment, productivity enhancement, policy gaps, policy implementation.

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1. Introduction

Numerous agriculture and related policies, acts, strategies, visions, directives, procedures, and regulations have already been formulated and implemented to support agricultural development in Nepal. The nation has prioritized agriculture since the first periodic plan (1956-61) (NPC, 1956) and the agriculture sector was emphasized in the fifth five-year plan (1975-80), with the year 1975 being celebrated as agriculture year (NPC, 1975). Nepal adopted liberal economic policies with the advent of multiparty democracy in 1992, which are reflected in the five-year economic development plans formulated since then, including a long-term 20 years Agricultural Perspective Plan in 1995 (GoN, 1994; Gauchan et al. 2002). The main objective of APP was to improve productivity to accelerate the agriculture's growth rate. Agricultural inputs such as irrigation, fertilizer, technology, roads and power were prioritized to achieve the desired goal of agricultural growth that leads to poverty reduction and employment generation. Following the APP objectives Agriculture Policy 2004 was introduced and the Agriculture Development Strategy (2015-35) was formulated post APP, with a major aim of improving production and productivity, increasing commercialization and enhancing the competitiveness of agricultural produce (GoN, 2015). Despite these efforts, the agriculture sector has not been able to improve productivity, ensure food security and enhance the livelihood of people as expected.

Most of the policy documents have focused on increasing production and productivity in agriculture, however, they have undermined the importance of the seed sector. Nepal's formal seed sector development began with the release of short-duration, temperature resilient and nutrient-responsive wheat varieties in the 1960s. The Seed Act 1988 and the National Seed Policy (1999) were developed and implemented, followed by the National Seed Vision (2013-2025). These policies provide the framework to guide or design government programs and projects and influence the investment areas for investors, including the private sector. The policy should be periodically updated to facilitate and strengthen the sector while considering the user's needs.

Developed nations adopt progressive policies to increase productivity and economic growth, emphasizing research and technological innovation (Karasev et al. 2018; Raghupathi & Raghupathi 2019). Different models have been adopted for agricultural development in different periods, such as frontier, conservation, urban-industrial impact (locational), diffusion and the high payoff input have been adopted for agricultural development in different periods (Udemezue & Osegbue, 2018). The frontier model focused on area expansion to increase agricultural production, the

conservation model believed in sustainable intensification of the cropping system, the urban-industrial model aimed to increase production by linking to urban and industrial growth whereas the high pay-off input model emphasized the research investment to make modern high payoff inputs available to farmers. Among them, the high pay-off input model emphasizes research investment to enhance the capacity of research institutions to produce new technological knowledge (Ruttan, 1977). Since research and development are critical aspects of every policy, it has to be reviewed and updated periodically. Evidence shows that planned and organized investment in scientific research and technological innovations gives a higher rate of return (Alston et al., 2000). A strong linkage between research investments, innovation and agriculture productivity growth has been reported (Fuglie & Heisey, 2007). The role of policy provisions and their effective implementation are critical to bringing desired changes in research investments, and innovations and increasing agricultural productivity. However, there is a lack of adequate studies and information bases for this. Available information indicates that targets and provisions made in the existing policies are undermined while designing and implementing the related projects and programs in Nepal. This necessitates the need of identifying the gaps in the policies (e.g., agricultural research and technology innovation), in absence of these, the agriculture sector has not been able to bring desired changes despite the highest priority given to the nation. This research answers the following questions: What are the key agricultural policy documents and their provisions related to variety and seed system research and innovations? Are different agricultural policies sufficiently addressing the priority needs and targeted goals of variety and seed system innovation? and Have seed sector policies been formulated and implemented effectively in Nepal?

2. Research Methodology

The study employed a three-step process to the list, review, analze and assess the implementation of agricultural policies through the interpretation of the research outcomes. The first step involved an exhaustive listing of available related policies/strategies/visions (150), and legislations (360). Policies were collected from the official websites of the respective line ministries. Laws were collected from the official website of the Nepal Law Commission. Regulations, directives, and procedures were collected from the official website of the Ministry of Agriculture and Livestock Development (MOALD). Further details are provided in Annex 1.

In the second step, policies, strategies and visions; acts; regulations and directives related to seed system innovations were selected for review and assessment through an interactive discussion of authors with policy experts . Further details are provided in Annex 2 and Annex 3. The objectives of the policies (policies, laws, regulations,

directives, and procedures) reviewed were based on their relevance to the study from the author's perspective. A total of five indicators as provided in Annex 4 were identified from the expert consultation to determine policy provisions regarding variety and seed system research and technology innovations.

In the third step, the effectiveness of the implementation, considering different aspects comprising legal, human resource, organizational and investment were analyzed. International experience, standards and expert consultation were employed to identify the issues and gaps for policy feedback. The conceptual framework of the study is provided in Figure 1.

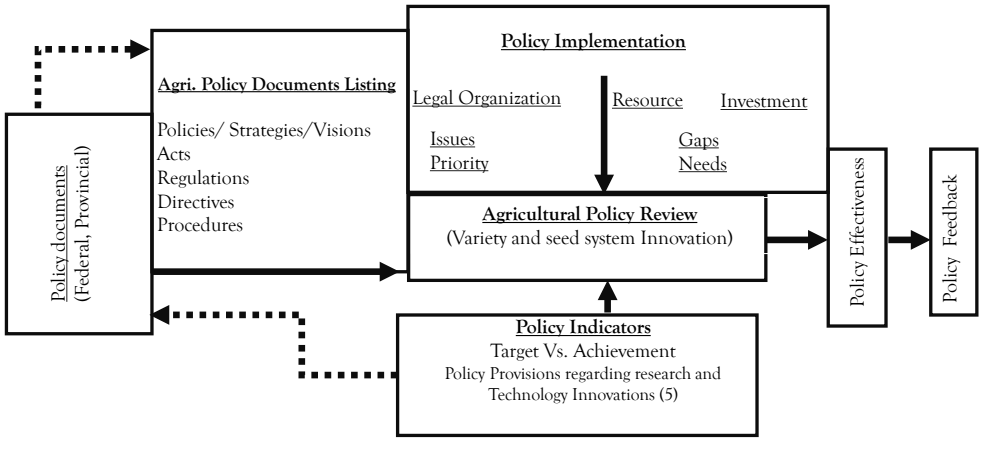

Figure 1: Conceptual framework for Policy Listing, Review and Assessment

3. Results and Discussion

3.1 Policy provisions regarding variety and seed system research and technology innovations

A total of 55 agriculture and related policies, 28 acts, 5 strategies, 2 visions, 39 directives, 44 procedures, and 11 regulations have been already formulated and implemented to support agricultural development in Nepal. In our study, we have reviewed 55 federal and 90 Provincial policies and analyzed the provisions made in these policies for variety and seed system innovations based on their level of explanation (refer to Table 1). Results showed that about 30% of documents have made provisions for variety and seed system innovations but only National Seed Vision (NSV) 2013-2025 was explained clearly with indicators.

Table 1: Detail analysis of variety and seed system innovations in different policy documents

Number of policies Reviewed	Overall provisions of policies on seed system innovation		
	Excellent	Good	Fair
Federal: (55)	1	2	13
Provincial: (90)	0	3	0

Note: 1= Excellent: clearly explained with indicators;2= Good: specifically explained; 3= Fair: broadly explained

Most of the policy documents highlighted increasing the production and productivity in agriculture in a broader perspective but undermined the importance of nutritional security, natural resource management, and the consequences of climate change that have been creating challenges in recent years. Very few policy documents have focused to develop climate-resilient varieties and breeds and technologies, and innovations for modern high-tech agriculture. The key provisions made for variety and seed system innovations are provided in Annex 5.

3.2 Effectiveness of policy implementation

3.2.1 Seed Policy Framework

Several seed policy-related documents such as seed vision (1), seed policy (1), seed act (1), regulation (1) and directives (11) with respect to variety and seed system innovations have been developed and updated. NSV 2013, and Seed Policy (1999) are formulated and implemented. The seed act was developed in 1988 and has already been amended first in 2008 to update the latest provisions and then second in 2022 considering the federal context. The latest second amended act has made key provisions for improving the seed sector through the establishment of a seed board at three tiers of government, encouraging the private sector to invest in the seed business, and providing authority to the Province level to give licenses for producing hybrid seed. Moreover, it has provisions for ownership rights of community-based organizations (groups) for local seed. The documents provided priority for the involvement of private sectors in seed business including hybrid seed production, however, they have to meet the standards (human resource, infrastructure, inbred lines, varietal development plan etc.) as per the provisions. Until now, three private seed companies (SEAN seed, Lumbini seed and Gorkha seed) have taken the license for hybrid seed production in Nepal. Other drafted policies such as National Agriculture Policy (2004-first amendment), agribusiness Promotion and commercialization act (2022) have also given higher priority to variety and seed system innovations. However, there is still missing the

provisions of pre-release seed multiplication in the policy documents. Cooperation and coordination between key stakeholders are required in the formulation and effective implementation of policies with adequate legislative and institutional provisions (Khanal et al., 2020). Article 231 (2) of the Constitution of Nepal (2015), provisioned the inter-governmental relationship among three tiers, between federal-provincial and provincial-local. Accordingly, the provincial government can formulate the agriculture policies, rules, guidelines and norms in agriculture and allied sector for the entire or part of the province. So far, 90 provincial agriculture policies, rules and regulations are formulated by the seven provincial governments. Among them, three policy documents are found related to seed research and innovations. To date, Bagmati province only formulated the provincial seed act in 2019 and other provinces have yet to develop such seed-related policies.

3.2.2 Human Resources Development

The status of human resources available to contribute to variety and seed system innovation seems very weak. About 293 seed specialists envisioned in NSV 2013-2025 to get engaged in seed quality control, inspect the seed production farms, and shall also be the legal and authorized person for monitoring. But the number of specialists is found 18 until December 2022 as 72 specialists were not renewed. Further, the seed quality control center (SQCC) announced its application on 14th November 2022 to provide a license and received 445 applicants. Of them, 184 got selected. Out of 184, around 40% were from the government system which might create the environment to function effectively. But still, there are questions about the expertise and engagement of all seed specialists to maintain the quality of seed. So, there is a need for provisions for the capacity enhancement of the specialist as well as their engagement plan. Similarly, about 71 breeders are expected to increase by 2020 but only 49 breeders (31 from NARC, 6 from the private sector, and 12 from Universities) are working in breeding. Out of which, only 50% of breeders are actively involved in a real breeding program. Few of the senior breeders (5) will be retired within a year. Likewise, in the last five years, about 49% of scientific positions are vacant in NARC, more specifically 75% of the crop breeding positions related to seed research and innovation are vacant. This shows the critical situation to generate sufficient innovations in variety and seed system innovations. Ghimire et al. (2020) reported the decreasing number of breeders and seed technologists working in the research system in Nepal which are required for variety and seed system innovations. Furthermore, the private sector in Nepal is small, weak and constrained by a lack of qualified scientific manpower and infrastructure facilities, although recently it is evolving and emerging as an important factor in seed sector development (Gauchan, 2019). Therefore, engagement of both public and private sectors and positive research

culture need to be established to get innovations in science and technology which can be achieved through regular support and motivation to the researchers (Sherab & Schuelka, 2019)

Table 2: Details of human resource provisions

Provisions	Targets	Achievements
Seed Specialist	293	202 (72*)
Number of breeders	71	49
Scientific positions approved in NARC	423	216

*Source: Seed act 2022; NSV 2013-2025; NARC, 2022; * indicates not renewed*

3.2.3 Infrastructure and Institutional Framework

The policy review showed that NSV 2013-2025 focused on strengthening the existing institutions for the development of the seed sector in Nepal. The development of a hybrid research program/unit was suggested in the NSV, but this has not yet been established and institutionalized. The institutional framework for plant breeding and seed research activities is weak for horticultural, forage and underutilized crops (Gauchan, 2019). After federalization, the seed act (second amendment 2022) envisioned the seed board at the central and provincial levels and the seed management board at the local level. There is also made provision for the involvement of three tiers of govt. for assurance of quality control for seed production, processing, storage, packaging and distribution; establishment of gene bank at central and community seed bank at the provincial level for indigenous seed; establishment of seed laboratory by the Ministry, local govt and private sector/person after meeting the standard set by the Ministry. Until December 2022, SQCC is established only at the federal level except in Bagmati province by making their seed act. DNA (Deoxyribonucleic Acid) fingerprint and agro morphological characterization study for DUS (Distinctness, Uniformity and Stability) testing have been made mandatory by SQCC before releasing crop varieties. Currently, National Seed Research Centre (NSRC) under NARC has done this for mid-hill, and respective commodity programs are doing it for specific commodities. The provincial govt. has also provided authority for variety release and registration, but who will do the trial and other mandatory tasks (DNA fingerprint, DUS test) before registering/releasing of variety at the province level is not clear. Similarly, clear coordination and linkages mechanisms among federal and provincial governments are not spelt out, which creates the possibility of duplication/ overlapping while releasing and registering the varieties at the federal and provincial levels. The government of Nepal (GoN) and the Food and Agriculture Organization

(FAO) (2013) reported that the institutional capacity for implementing the plans and policies is very limited in Nepal. The adoption of a supply-driven approach without the active participation of concerned stakeholders for policy formulation hinders the effective implementation of policy (Khanal et al., 2020). While revising the seed regulation, consideration of the above fact is important. There is a provision for the establishment of a standard seed testing laboratory in the seed act 2022, for which the guidelines for maintaining minimum standards of the lab are also drafted and under discussion.

3.2.4 Investment in Seed Research and Innovation

Review and assessment showed that 30% of NARC annual budget allocation for varietal breeding and maintenance was envisioned in NSV 2013-2025, but the allocation is less than 15%. Similarly, its major share goes to source seed production. In 2020, NARC has allocated 6% of the total budget to source seed production which increased to 9% in 2022. The policy provides for the investment in agriculture research and innovation have been inadequate and fragmented, despite its significant role in achieving a high rate of return in agriculture development. Currently, 0.30 % of Agriculture's Gross Domestic Product (AGDP) is invested in agri-research which needs to increase more. Over the last two decades (2001-2020), the total surplus of rice, maize and wheat was found NRs (Million) 2773, 3390 and 3840 respectively with the internal rate of return (IRR) of 82,87 and 91 per cent for each crop. A higher IRR of more than 80% indicates a higher economic return from investment in major cereals in Nepal (Timsina, 2021). The limited investment in the seed sector is reported by Ghimire et al. (2020). It is also necessary to activate National Agriculture Research Fund (NARF) as envisioned in ADS (2015-2035) to initiate the competitive grant system for quality research and increase resource use efficiency. Provincial allocation in agriculture research and innovations is rare/negligible. The average share of investment in agriculture to the total budget of local government is less than 5% and none of the investment for agriculture research and innovations is found. Therefore, it demands the assurance of the necessary investment in research and innovation and implementation requirements for its successful implementation.

3.2.5 Technology Development and Dissemination

Technology development and dissemination on seed research, technology development and dissemination require the development and dissemination of specific components of innovation on seed systems, germplasm, hybrid technologies, private sector participation and biotechnological approaches which are briefly outlined below.

Seed system

It is seen that the breeder and foundation seeds of major cereals are more than sufficient but improved seed is inadequate. If the proper seed cycle is maintained, the current production of breeder seed of major cereals and lentil are more than enough to use in the total area that has been allocated for major cereals in Nepal (Gairhe et al., 2023a; Timsina, 2021). Prasai (2022) reported that the seed system is heavily dominated by the informal system (78%) even though more than 325 community-based organizations are working on seed multiplication in Nepal (Ghimire et al., 2020). Weak or limited monitoring to maintain the quality of seed is another issue in the field. Farmers and entrepreneurs have poor incentives to produce and market quality seeds due to the unregulated flow of exotic hybrids and spurious quality of open-pollinated variety (OPV) seeds in the urban markets (Gauchan, 2019). The demand for foundation seed is lower than the supply and the demand for breeder seed is more than the requirement, which showed ineffective seed cycle maintenance. Different studies showed the ineffectiveness in the maintenance of the seed cycle in Nepal (Gairhe et al., 2021; 2023a, b). The source seed production of minor cereals is far below than targeted in the NSV which is linked with the limited investment, research, and innovations in minor crops. Ghimire et al. (2020) reported very poor source seed production for millet, barley and legumes in Nepal. The achievement in open-pollinated varieties released is also far below (285) the target set (423) in NSV. The farm-level adoption of crop varieties is an indicator of dissemination of new seed technology but the finding from a rice survey in 2012-13 revealed that only 61% of the market share of the varieties adopted at the farm level was from national release system with an older generation having an average age of 15 years indicating the poor state of dissemination of new varieties (Gauchan, 2017).

Germplasm

Out of 275 released crop varieties (excluding registered ones), 66 varieties are from local origin, 150 are the introduced germplasm, and 59 are from an unknown source (Joshi 2017). Among the introduced lines, those from India, International Rice Research Institute (IRRI), International Maize and Wheat Improvement Center (CIMMYT) etc. are among the significant ones. There is more than 40 lakh of accessions that is accessible to Nepal, however, only 150 accessions are yet to be used in Nepal. Likewise, in addition to introduced germplasms, local germplasm also is an important gene pool. Out of 1000 (Joshi et al 2020), crop genetic resources only 66 are yet being used. Thus, there is still ample opportunity to utilize both those introduced and landraces yet to be explored. A study from rice research and farm-level adoption in 30 districts of Nepal showed that only 5% of the farm-level adopted rice varieties were derived from genes from domestic sources in Nepal (3 % using full

domestic genes and 2% of the varieties had genes from both domestic and exotic sources such as Khumal-4) indicating the poor state of use of domestic agrobiodiversity in agricultural research innovation in Nepal (Gauchan, 2017).

Hybrid seed technology

The target of 40 hybrids (20 vegetables, 12 maize and 8 rice) from the public and 20 hybrids (10 vegetables, 5 maize and 5 rice) from the private sector) was set in NSV. However, only 15 hybrids (10 maize, 3 vegetables and 2 rice) were released, and that was only from the public sector. None of the hybrid varieties has been developed and released by the private sector so far even though there are more than 25 seed companies in Nepal (Ghimire et al., 2020). Hybrid varietal choices and availability are low in Nepal (Prasai, 2022). Ghimire et al. (2020) reported the limited progress on varietal research and development, the market development of new varieties, and the low capacity of public and private sectors on hybrid variety development.

Seed Replacement Rate: The average varietal age of NARC-released varieties of major cereals was found to be more than 20 years for rice and maize whereas it is nearly 15 years for wheat (Timsina, 2021). The seed replacement rate is increasing gradually but is not achieved in the case of maize which requires strong intervention to disseminate certified seeds of newly released varieties. The introduction of an innovative marketing strategy that can promote newly released domestic varieties is important.

Private Sector Participation

The limited participation of the private sector in varietal and technological development and their involvement mainly in the trade of foreign seed create gaps to meet the target set for the private sector. Participation in the private sector is currently weak due to a lack of adequate incentives and a favourable environment to invest in Research & Development (R& D). The legal incentives that promote private sector investment in R&D such as Plant Variety Protection and Biosafety laws are not in place yet (Gauchan, 2019). Private sectors also lack adequate incentives in subsidies, tax breaks and technical support in developing seed enterprises. As a result, the NSV targets of establishing 4 mega seed companies in four developmental regions to meet the domestic seed needs of the country through private sector participation proposed in four regions of Nepal are not yet initiated. Thus, there should be policy provisions and incentive mechanisms to attract the private sector for variety release, maintenance and source seed production.

Biotechnology

It is important to strengthen biotechnology, prepare our human and technical strengths to not be left behind on international scenarios of developing modern technologies such as marker-assisted selection, transgenics, gene editing etc, and introduce nuclear technology emphasizing modern fast-track breeding to release farmers preferred high yield varieties is urgent. Moreover, our policy document (seed policy 1988) has also provided an avenue to initiate research on GMOs which could be an important area in future. Despite, the use of biotechnology, is almost none in varietal development. The details of the policy indicator targets and their achievements are given in Table 3.

Table 3: Other indicators set in different policy documents regarding variety and seed innovations

Indicators and Source	Target (2020)	Achievement (2020)
Cereals Breeder Seeds- Mt	58 (88)	95.5
Minor Cereals Breeder Seeds- Mt	0.908 (1.63)	0.61
Cereals Foundation Seeds- Mt	1186	1034
Minor Cereals Foundation Seeds- Mt	12.85 (22.74)	3.14
Hybrid by Public Sector-Number	(40)	15
Hybrid by Private Sector-Number	(20)	0
Total OP –Number	(423)	285
Cereals SRR (%)	18 (25)	19

Note: Figures in parentheses are the targets by 2025 proposed in National Seed Vision (2013-25)

These above indicators indicate that except for breeder seed production in cereals, all of the targets proposed in the National Seed Vision (2013-2025) are not achieved. The most important target of hybrid variety development from the private sector is nil so far which indicates that especially incentives and enabling environment need to be created for private sector investment in hybrid R&D.

4. Conclusions and Policy Recommendations

A large number of agriculture and related policies, legislations and regulations, have already been formulated and implemented to support agricultural research and development in Nepal. However, the agriculture sector has not been able to improve its productivity, provide food security and enhance the livelihood of the people. From the

analysis of different policies, appropriate investment, institutional framework, and human resource development aspects look weak. But the policy framework related to seed sector development sounds favourable and updated recently even in the federal context (such as the Seed Act amended in 2022). However, most of the required institutional set-up and legal requirements have also not yet been developed at the provincial and local levels to implement the policy effectively. There is an absence of policy documents regarding agriculture research and innovation formulated in the context of the current three-tier federal governance system, though recent some initiatives are made in this aspect. In this context, it is urgent to revise policy documents in the federal context as well as develop new provincial and local government agricultural policies and institutional frameworks aligned with federal policy considering the issues and challenges being faced in the present and what may happen in future. A further study considering other policy provisions like provisions of crop management technologies; post-harvest, value addition and market research innovations; and institutions and governance are suggested as this study could not assess during the study period. Moreover, it is further suggested to assess empirically the diverse perception and knowledge of different policy stakeholders in different agro-ecologies as well as at the provincial and local level based representative sample surveys on the specific provisions, gaps and issues related to agricultural policies and suggests possible policy measures for improving agricultural productivity and prosperity of the country. However, from the findings of this study following recommendations are made.

- Increased investment and capacity development in plant breeding, modern technology and seed system through strengthening NARS and NARF (as per ADS provision) to reduce dependency and promote minor crops.
- Facilitating private sector participation in hybrid seed research and innovation (eg. Providing licenses, intellectual property rights and other incentives etc.) by attracting them to research & development investment, hybrid development and large-scale marketing (hybrid seed production) through ensuring proper regulation mechanisms from public sector
- Participatory and decentralized variety selection, release and recommendation for the specific domain through adopting fast-track breeding and variety release and registration procedures
- Coordination mechanism for policy formulations and implementation on variety registration, release, and promotion including seed quality regulation and monitoring at three tiers of government.
- Incentives for research, release and promotion of domestically developed varieties utilizing own genetic resources and agrobiodiversity.

Author Contribution Statement

Krishna Prasad Timsina: Conceiving ideas; formulation of overarching research goals and aims; design of methodology; application of study framework; conducting a research and investigation process, drafting and finalization of manuscript.

Devendra Gauchan: Conceiving ideas; formulation of overarching research goals and aims; design of methodology; application of study framework; conducting a research and investigation process, drafting and finalization of manuscript.

Sabin Basi: Design of methodology; application of study framework; conducting a research and investigation process, drafting and finalization of manuscript.

Mahesh Jaishi: Design of methodology; application of study framework; conducting a research and investigation process, finalization of manuscript.

Sunita Pandey: formulation of overarching research goals and aims; design of methodology; application of study framework; conducting a research and investigation process, finalization of manuscript.

Confilct of Interest

The authors declare no conflict of interest.

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Annex 1: Sources of Policy documents

Ministries	Website
Ministry of Agriculture and Livestock Development	MOALD
Ministry of Home Affairs	MOHA
Ministry of Federal Affairs & General Administration	MOFAGA
Ministry of Education, Science and Technology	MOE
Ministry of Energy, Water Resources, and Irrigation	MOEWRI
Ministry of Health and Population	MOHP
Ministry of Industry, Commerce and Supplies	MOICS
Ministry of Culture, Tourism and Civil Aviation	MOCTCA
Ministry of Forests and Environment	MOFE
Ministry of Labor, Employment and Social Security	MOLESS
Ministry of Finance	MOF
Ministry of Communications and Information Technology	MOCIT
Ministry of Youth and Sports	MOYS
Ministry of Land Management, Cooperatives and Poverty Alleviation	MOLCPA
Ministry of Urban Development	MOUD
Ministry of Women, Children and Senior Citizen	MOWCSC
Nepal Law Commission	NLC

Note: Authors compilation

Annex 2: Reviewed agricultural policies, strategies and visions

SN	Policies	Date	SN	Policies	Date
1.	Foreign Investment and one-window policy	1992	29.	Agricultural Mechanization Policy	2014
2.	National Seed Policy	1999	30.	National Employment Policy	2014
3.	National Tea Policy	2000	31.	Foreign Investment Policy	2014
4.	National Fertilizer Policy	2002	32.	Agriculture Development Strategy	2015-2035
5.	Foreign Aid Policy	2002	33.	Constitution of Nepal	2015

SN	Policies	Date	SN	Policies	Date
6.	National coffee Policy	2003	34.	Land Use Policy	2015
7.	Rural Water Supply and Sanitation National Strategy	2004	35.	National Youth Policy	2015
8.	Rural Water Supply and Sanitation National Policy	2004	36.	Commercial Policy	2015
9.	Irrigation Policy	2004	37.	Public Private Partnership Policy	2015
10.	National Nutrition Policy and Strategy	2004	38.	Rural Energy Policy	2016
11.	National Agricultural Policy	2004	39.	Bee-keeping Promotion policy	2016
12.	Herbs and non-timber forest products development policy	2004	40.	National Intellectual Property Policy	2017
13.	Labor and Employment Policy	2005	41.	National Food Security Policy	2018
14.	Agro-Biodiversity Policy	2006	42.	National Food Safety Policy	2018
15.	Agricultural Genetic Policy	2006	43.	National Food Hygiene Policy	2018
16.	Biotechnology Policy	2006	44.	National Land Policy	2019
17.	Agribusiness Promotion Policy	2006	45.	International Development Cooperation Policy	2019
18.	Dairy Development Policy	2007	46.	National Environment Policy	2019
19.	Tourism Policy	2008	47.	Poverty Alleviation policy	2019
20.	International Development Assistance Operational Policy	2011	48.	National Agro-Forestry Policy	2019
21.	Industrial Policy	2011	49.	The Fifteenth Plan	2019-2024
22.	Poultry Policy	2011	50.	National Science, Technology, and Innovation Policy	2019

SN	Policies	Date	SN	Policies	Date
23.	NARC Vision (yet to be approved)	2011-2030	51.	Climate change Policy	2019
24.	Rangeland Policy	2012	52.	Monetary Policy	2021
25.	Supply Policy	2012	53.	National Livestock Breeding Policy	2021
26.	National Cooperative Policy	2013	54.	National Animal Health Policy	2021
27.	Floriculture Promotion Policy	2013	55.	National Fisheries Development Policy	2022
28.	Seed Vision	2013-2025			

Annex 3: Summary of policy documents regarding seed in Nepal

Act (1)	Regulation (1)	Directives (11)
Seed Act 2045 (1988), second amend-ment 2022	Seed Regulation 2069 (2013)	Registration, genetic improvement and source seed production of Indigenous and local varieties 2079 (2022) drafted
		Seed Production, supply and management directory, 2078 (2021)
		Technical test guide for seed production, 2075 (2018)
		Seed Business and monitoring directory 2075 (2018)
		Seed certification 2074 (2017)
		Seed Entrepreneurs' Registration and Monitoring 2073 (2016)
		Appointment of Seed inspector, seed sample collector and analyst, provisions of licensing and monitoring 2073 (2016)
		Compensation due to seed use 2073 (2016)
		Seed monitoring and destruction of confiscated Seed 2073 (2016)
		Seed sample selection 2073 (2016)

Act (1)	Regulation (1)	Directives (11)
		Private sector seed Production and Management 2073 (2016)

Annex 4: Variety and seed system innovations related indicators used in the analysis

Policy provisions /indicators
Technology development (Variety development, release, registration, and variety maintenance)
Climate resilience/adaptation and nutrition enhancement research and innovations
Production of source seeds, breeds and other planting materials
Application of biotechnology/nano-technology in breeding research
Conservation and utilization of indigenous/local resources/materials through both participatory and conventional breeding

Annex 5: Policy provisions regarding variety and seed system innovations in different agri. policy documents

S.N	Policies+++	Variety and seed system innovations related provisions
1.	National Seed Policy 1999	• The system of producing nucleus, breeder, and foundation, certified and improved seeds will be continued. • The institutional capacity of Government agencies, involved in seed research and seed production will be strengthened. • The involvement of non-governmental organizations (NGOs) and the private sector to perform the varietal development and maintenance work will be carried forward. • Study and research will be carried out on biotechnology or genetic engineering for the genetically modified organism (GMO), transgenic plants, and tissue culture. • Private sector participation in the seed business and quality declared seed system adopted to control the quality of seeds. • The involvement of agencies engaged in varietal development shall be ensured only after providing the details of infrastructure and needs.

S.N	Policies+++	Variety and seed system innovations related provisions
2.	National Agricultural Policy 2004	• Increase agricultural production and productivity. • The production and use of hybrid seeds and improved breeds shall be encouraged. • The local production, sale, and distribution of improved agricultural inputs (seeds, plants, saplings, breeds, fingerlings etc.) shall be regulated, and quality shall be maintained in their supply. • The use of genetically modified organisms shall be regulated. • Priority to Indigenous varieties while releasing new varieties+ • Provide a subsidy to seed buyers (farmers) after developing standard guidelines+ • Regulation of the seed sector for quality control+ • Source seed production priority based on national demand+ • Restructuring of research and extension organization for effective delivery of agri. inputs including seed considering federal system+ • Establishment of the laboratory at three tiers of govt and ensure manpower to provide quality services+
3.	Agro-Biodiversity Policy 2006	• Traditional seeds distribution between farmers will be strengthened. • Equitable distribution of agriculture genetic materials/ resources and traditional knowledge • Emphasis shall be given to surveying, research, investment, technology development and transfer for Ex-situ conservation of agriculture genetic resources
4.	Agricultural Genetic Policy 2006	• Climate resilient variety will be developed. • Traditional ways of production and distribution of seeds will be preserved and improved.
5.	Biotechnology Policy 2006	• Research to use biotechnology in tissue culture, forest, agriculture and food grains, herbs, mushroom production, and processing system including animal and human health systems will be encouraged.

S.N	Policies+++	Variety and seed system innovations related provisions
		• Promote participation of the private sector and give high priority to research, development, and expansion of biotechnology. • The infrastructure of existing biotechnology-based research shall gradually be strengthened. • Technologies relating to genetic engineering or cell culture, microbiology, biochemistry, molecular biology, and tissue culture will be used.
6.	Agribusiness Promotion Policy 2006	• Enhance import and export of seeds and crops along with the agricultural item.
7.	Industrial Policy 2011	• Encouragement shall be given to engaging in research and development in the areas of industrial information and communication, appropriate technology, and biotechnology.
8.	NARC Vision 2011-2030 (yet to be approved)	• Development of suitable high-yielding varieties of major food crops such as rice, wheat, and maize and minor crops such as millets, barley, and buckwheat through selection and hybridization to ensure food security. • Variety improvement of cash crops such as tea, coffee, cardamom, sugarcane, ginger, and jute through selection and hybridization for enhancing quality production and productivity • Development of suitable high-yielding varieties to raise the productivity of irrigated and rainfed rice • Development of high-yielding rice varieties for warm and cool temperate zones with a major emphasis on tolerance to drought and cold based on the need of each domain • Development of high-yielding wheat varieties for improving wheat productivity and sustainability in terai, inner terai, and foothills of Nepal • Development of high-yielding finger millet, barley, and buckwheat varieties with early maturity and other desirable traits for different production environments in the mid and high hills.

S.N	Policies+++	Variety and seed system innovations related provisions
		• Development of high-yielding desirable winter and summer legumes for different production environments with an emphasis on tolerance to drought and other stresses. • Develop new varieties of fruits (citrus, apple, and mango) and vegetables (tomato, cauliflower, cabbage, beans, cucumber, and chilly) through conventional and modern breeding techniques to address climate change and food crises. • Improve and strengthen the tea sector by developing Nepalese tea varieties suitable to different production environments. • Development of crop varieties/hybrids to address biotic and abiotic stress as well as quality. • Supply of source seed including livestock and fish and technical backstopping to private seed producers to ensure quality seed to end users. • Variety improvement of sugarcane, coffee, ginger, and jute crops through selection and hybridization for enhancing quality production and productivity • Characterize crop species/varieties at a molecular level for better utilization in a breeding program. • Marker Assisted Selection (MAS) in crop improvement for resistance to biotic and abiotic stresses. • Application of molecular markers toward the improvement of maize varieties for hybrid vigour • Construction and facilitation of biotechnology laboratories with the installation of modern biotechnological equipment
9.	Rangeland Policy 2012	• The awareness of stakeholders, including producers and consumers, will be increased about the production, collection, and processing of grass seeds, animal products, herbs, and non-timber forest products. • Arrangements shall be made for grass seed production, conservation, collection, storage, and distribution.

S.N	Policies+++	Variety and seed system innovations related provisions
10.	Supply Policy 2012	• Centralizing food sovereignty jurisdiction: Ensured quality, and weight of seeds and seedlings. • Ensure to provide seed to farmers before cropping seasons++ • Provide cash back to farmers if they brought quality to improve seed from licensed suppliers++
11.	Floriculture Promotion Policy 2013	• Markets with modern equipment will be developed and expanded in major places in the country to manage the purchase and sale of flower seeds and produced products.
12.	Seed Vision 2013-2025	• Improve the system for source seed production and seed multiplication with active participation from the private sector and government collaboration. • Support in implementing a devolved seed production system including quality assurance. • Strengthen commodity research programs in a variety of development and maintenance breeding both in the public and private sectors. • Enhance access to new seeds and information to households and individuals through participatory breeding and the use of local genetic resources. • Develop and strengthen seed networks, seed dealers, and seed supply channels in the public and private sectors. • Strengthen varietal development, release, and maintenance breeding, using a diverse gene pool both from local and exotic sources at different agroecological zones. • Support public, community, and private enterprises in source seed production, seed multiplication, processing, and conditioning through efficient seed quality services. • Facilitate the development of local plans and policies in breeding better and climate-resilient varieties. • Support regional and local governments and private institutions in the development, maintenance, and release of location-specific crop varieties.

S.N	Policies+++	Variety and seed system innovations related provisions
		• Develop policies, mechanisms and procedures for a prompt popularization of seeds of new varieties to farmers. • Increase the number of breeders (71), seed specialists (293), cereals breeder seeds production (88mt), minor cereals foundation seeds production (23 mt), hybrid variety release (60) etc
13.	Agriculture Development Strategy 2015-2035	• Promote the production of hybrids and establish an information system on seed demand and supply. • Promote open-pollinated, improved, and local seed production systems to address seed sovereignty. • Promote private and cooperative sector and community-based seed production; Promote partnerships with relevant public, private, and cooperative organizations, farms, and nurseries to produce quality planting materials. • Promoting public and private sectors to produce breeder, foundation, and hybrid seeds. • Encouraging local hybrid seed production within Government organizations, private and cooperative sectors, and in partnership with foreign companies. • Implement integrated water resource management. • Build resilience for farmers to climate change, disasters, price volatility, and idiosyncratic shocks through the adoption of the stress-tolerant crop. • Research on stress-tolerant varieties and breeds.
14.	The Fifteenth Plan 2019-2024	• Given the legal basis for food sovereignty, arrangements shall be made for the supply of seeds and fertilizers adhering to agreed standards, quality, and weight. • Production of seeds will be oriented towards self-reliance by developing improved and hybrid varieties through strengthening research as well as capacity building of the private sector, and farmers • Resilient technologies will be developed and expanded to mitigate the effects of climate change in coordination and collaboration with education, research, and communication agencies.

S.N	Policies+++	Variety and seed system innovations related provisions
		• The development and utilization of bio-fortified crops and other products will be expanded.
15.	National Science, Technology, and Innovation Policy 2019	• Assistance shall be provided for the development and utilization of bio, nano, and nuclear technology for agricultural sector development.
16.	Climate Change Policy 2019	• Crops suitable for dry and water-logged areas will be identified and promoted.
17	Seed Act 1988, second amendment 2022	• Seed board at three tiers of government • Encourage the private sector to invest in the seed business. • Producing source seed and hybrid by taking a license at the Province level • Patent rights of community-based organizations (groups) for local seed • Giving license to produce hybrid from Provincial government. • Involvement of three tiers of govt. for assurance of quality control for seed production, processing, storage, packaging and distribution • Establishment of gene banks at central and community seed banks at the Provincial level for indigenous seed • Establishment of seed laboratory by the ministry, local govt, private sector/person following a standard set by the ministry
18	Seed Regulation 2012	• Variety release, registration and approval sub-committee led by the Director General (DG) of the Department of Agriculture (DoA) • Quality standards and management sub-committee led by the Executive Director (ED) of the Nepal Agricultural Research Council (NARC) • Training will be provided to seed entrepreneurs, seed inspectors and other private sectors by SQCC.

S.N	Policies+++	Variety and seed system innovations related provisions
		• Seed type by truthful (breeder, source seed, labelled seed and improved seed) is made compulsory. • Seed type by certification (Breeder, foundation, certified and improved) is made voluntary. • Six months' time for quality seed after inspection if stored safely can be extended 6 months more after inspection by seed analyst.
19	Private sector seed production and management directive 2016	• Provision of getting licensing of variety development and maintenance (R&D sites with MSc breeder, BSc agronomist, crop wise agronomist; infrastructure and processing facilities; assurance of inbreed line acquisition and variety development plan • Provision of getting license hybrid seed production (production sites with MSc breeder, BSc agronomist, crop wise agronomist; infrastructure and processing facilities; inbreed line acquisition mechanism and training) • Provision of getting a license to be a producer of foundation seed (B.Sc. (agronomist) and JTs with infrastructure and processing facilities) • Provision of getting a license to be a producer of improved seed (training with infrastructure and processing facilities)
20	Agribusiness Promotion and Commercialization Act 2022 (drafted, yet to be finalized)	• Guaranteed to provide agri. inputs (including seeds) to farmers. • Provide a subsidy to farmers based on farmers' identity cards. • Develop standards/protocols for agri. inputs delivery including seeds and laboratory services. • Provide incentives to private sectors for delivering quality agri. inputs to users. • Involvement of private sectors in agri. research and technology development after developing legal standards (licensing to the private sector)

Note: + provisions made in drafted (first amendment of 2004) National Agriculture Policy 2020; ++ provisions made in drafted (first amendment of 2012) Supply Policy 2022; +++ seed related act, legislation, directives are also included; Authors compilation 2023.

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