



The Study of Exploring the Policy of Seed Management Systems (PSMS)

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RESEARCH ARTICLE

Abstract

The goal of this research is to describe and analyze the Kurdistan Region's seed system development. Also, to examine why and how the formal seed system has been prioritized over other alternatives (farmers' and community-based seed systems). It further illustrates how the growing seed systems development debate generates challenges for policymakers and governments using the KRG case. Seed sector development policies have been formulated and implemented. The reason is to motivate the new seed policy bill and new agenda for future farmer seed production, with the different actors' interests influencing seed policy formulation and implementation. The study was conducted from February to June 2023. Primary data for this study were gathered through focus group discussions (FGDs), which were defined as gatherings of individuals with similar experiences or backgrounds to investigate a specific topic of interest. The extensive utilization method used by qualitative researchers to examine qualitative data is a thematic analysis, which typically consists of descriptive information. These themes encompass various aspects related to seed, including seed origin and seed transparency, sustainable agriculture and food security, cooperation with stakeholders, regulation, and the governance gap.

Keywords: Seed Management system, seed policy, Management Strategy

INTRODUCTION

The seeds are among the most valuable resources in agriculture and a fundamental requirement for crop production significantly influencing the outcome of the harvest is the selection and cultivation of the seed. (Almekinders and Louwaars, 1999). Also, Seeds have are multifaceted roles in agriculture and strategically significant in a variety of including those pertaining to culture, knowledge and technology, rural development and food security, biodiversity, and business development. Although the word 'seed' encompasses various connotations, it is employed exclusively in the context of agriculture and is limited to cereal plants. In this context, the term 'seed' is used to refer to any sowing material designated for cultivation. utilization in the generation of a new plant. (Louwaars and Manicad, 2022). The quality of seeds is a fundamental concern for all producers, encompassing factors such as germination and vitality, health, genetic adaptation to ecological conditions, and desired product qualities. The cereals that we presently consume have been "domesticated" by farmers' continuous selection of seedlings over the last 10,000 years (Harun, 2014), this represents a process of deliberate and inadvertent natural selection within the development of agricultural systems (Louwaars, 2021). Seed is an indispensable and fundamental input that enables agricultural productivity and production to

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increase continuously, given that 90% of food crops are cultivated from seed (Schwinn, 1994). The ability to preserve, propagate, and trade seeds is fundamental to the notion of seed sovereignty, which farmers have been gradually deprived of since the 1930s. (Kloppenburger, 2010). From an agricultural standpoint, an operational seed system ought to provide producers with sustainable access to the seeds of their preference and intended use, which are of optimal quality, at the optimal moment, and priced appropriately from an investment standpoint. Also, it refers to the various ways in which smallholder farmers obtain seed (FAO, 2016). The term "seed system" refers to the collaborative efforts of various stakeholders who utilize plant materials and knowledge in order to provide cultivators with seeds (Cromwell, E.; Wiggins, S.). These include the allocation of duties among multiple operators in a corresponding manner, which encompasses the development and implementation of seed policies. (Louwaars, 2022). Farmer seed systems are predicated on the producers' own seed production. As a result of cultural perceptions regarding, for instance, the product's color and flavor, as well as selection in their specific location and cultivation system, the genetic composition of crops may evolve in directions distinct from those of their neighbors. (Almekinders, Louwaars, 1994). Seed Policy is to provide clear guidelines for the development and promotion of the seed industry in order to raise agricultural productivity through the provision of sustainable, adequate and high quality seeds in order to enhanced appropriate and effective seed regulatory framework, seed quality assurance for better performance of agriculture, established reliable and internationally acceptable seed certification system and growth of the local seed industry to ensure farmers' access to improved varieties and seeds. The problem statement are consist of: seed sector development policies been formulated and implemented, the reason seems to motivate the new seed policy bill and what effects may this agenda have on future farmer seed production. The socio-political and ecological outcomes of the current seed system policies and practices in the country. The aim of this study is about the policy seed system politics and development in Kurdistan Region: to describe and analyze Kurdistan Region's seed system development. It examines why and how the formal seed system has been prioritized over other alternatives (farmers' and community-based seed systems). It further illustrates how the growing seed systems development debate generates challenges for policymakers and governments using the KRG case.

MATERIALS AND METHODS

This investigation was conducted in governorate of Sulaimani, in the Kurdistan Region-Iraq. The Kurdistan Region is located SW of Asia and NE of Iraq, Figure 1, located within the northern part of the Federal Republic of Iraq (Iraqi Constitution, Article 62; Harun, 2014).



Figure 1. Kurdistan Map, which represents small districts of the governorates with border.
Source: Harun (2014)

The study utilized thematic analysis as a method to classify the themes expressed in each of the focus groups.

The process of identifying themes or patterns in qualitative data is known as thematic analysis. Furthermore, it is the initial qualitative technique that warrants investigation due to its ability to impart fundamental skills that are indispensable for conducting a multitude of additional analyses (Cernasev and Axon, 2023). At least in the social sciences, it is considered the most influential method, most likely due to the straightforward and practicable framework it offers for conducting theme analysis (Maguire and Delahun, 2017).

The objective of a thematic analysis is to identify and utilize themes, which are significant or intriguing patterns in the data, to expound upon the study or support a particular viewpoint. An effective thematic analysis goes beyond mere data summarization by providing explanations and clarifications (Maguire and Delahun, 2017). Primary data for this study were gathered through focus group discussions (FGDs), which were defined as gatherings of individuals with similar experiences or backgrounds to investigate a specific topic of interest. An inquiry is made into their perspectives, attitudes, and convictions.

The Focus Group Discussion (FGD) was selected for this study because its flexible format allows the facilitator to explore unanticipated issues and encourages interaction among participants. In a group setting participants provide checks and balances, thus minimizing false or extreme views (USAID, 1996). A focus group comprises a predetermined subset of individuals assembled by researchers with the purpose of discussing and providing insights into the subject matter of the study, drawing from their personal experiences (Powell and Single, 1996). Research can be classified as qualitative research due to its focus on generalizations, and forecasts which can undermine the validity and reliability of findings.

To obtain precise and dependable results, this study collected qualitative data from a variety of respondents that, consisting of academic researchers (scholars) as the first group discussion, Table 1, non-government organizations (NGO) in agriculture as the second group, Table 2, directors and heads of research centers from the government as the third group, Table 3, and seed companies and seed sellers as the last group, Table 4, via focus group discussions (FGDs). To acquire primary data directly from respondents through FGDs who are experiencing the effects of necessity and the background of seed, they were divided into four focus groups.

Table 1. Researcher(scholars) information's and code of the participants

| Researcher codes | Academic title | Workplace | Specialty |
|------------------|-------------------|-------------------------|----------------------------|
| R1 | Professor | University of Sulaimani | Plant Disease |
| R2 | Assist. Professor | University of Sulaimani | Genetics |
| R3 | Assist. Professor | University of Sulaimani | Field Crop |
| R4 | Assist. Professor | University of Sulaimani | Horticulture |
| R5 | Assist. Professor | University of Sulaimani | Covered Agriculture |
| R6 | Lecturer | University of Sulaimani | Plant Breeding and Genetic |
| R7 | Assist. Professor | University of Sulaimani | Plant Breeding and Genetic |

Table 2. Non-Government Organization information's and code of the participants

| Organization codes | Workplace | Name of Organization | Academic Title |
|--------------------|-----------|---|----------------|
| 01 | Sulaimani | Plastic house development association | Bachelor |
| 02 | Sulaimani | AFAO organization | Bachelor |
| 03 | Sulaimani | culture organization for sustainable agricultural development | Bachelor |
| 04 | Garmian | Kurdistan Entrepreneurs Organizations | Primary |
| 05 | Halabja | Kurdistan Entrepreneurs Organizations | Diploma |

Table 3. Local decision makers in the Government information's and code of the participants

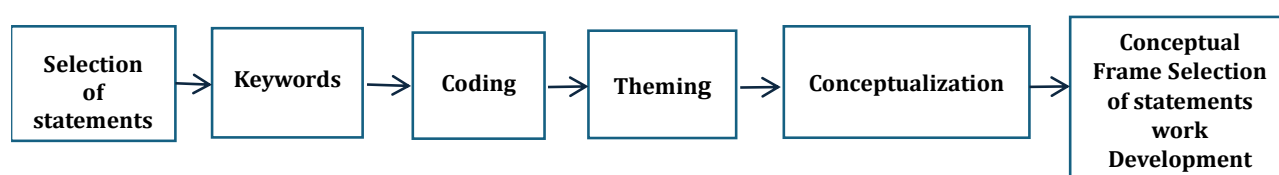
| Governmental expert codes | Workplace | Position | Academic title |
|---------------------------|--|---|------------------------|
| G1 | Director of agricultural research in Suleimani | Director | High Diploma |
| G2 | Halabja agricultural directorate | Head of the foundation department in Halabja | Bachelor of Plant Crop |
| G3 | Director of agricultural research in Sulaimani | Employee | Master of Agriculture |
| G4 | Halabja research directorate | Employee | Master of Agriculture |
| G5 | Director of agricultural research in Sulaimani | Employee | Master of Agriculture |
| G6 | Sulaimani directorate of agriculture | Head of Seed production and approval department | Master of Agriculture |
| G7 | Director of agricultural research in Sulaimani | Head of the agricultural department | Master of Agriculture |

Table 4. Company information's and code of the participants

| Company and retailers' codes | Workplace | Position | Academic Title |
|------------------------------|-----------------------------|----------|----------------|
| C1 | covered agriculture company | seller | Bachelor |
| C2 | ARD company | seller | Bachelor |
| C3 | Roma shop | seller | Bachelor |
| C4 | Dabana company | seller | Bachelor |
| C5 | Awrad company | seller | Bachelor |

Thematic analysis

The extensive utilization method by qualitative researchers to examine qualitative data is a thematic analysis, which typically consists of descriptive information (Ranfagni et al. 2023). The process comprises the following stages: quotation and keyword selection, coding, theming, interpretation, and conceptual model development, Figure 2. The process presents an argument about the importance of observing specific occurrences. Whenever data is initially collected and then refined into possible themes, naming takes place. It frequently generates new comprehensions and concepts. (Boyatzis, 1998; Elliott, 2018; Thomas, 2006). Nevertheless, it is imperative that scholars refrain from allowing their personal biases to disrupt the process of identifying pivotal themes (Morse & Mitcham, 2002; Patton, 2015).

**Figure 2.** Thematic approach (Naeem & Ozuem, 2022a).

RESULTS AND DISCUSSIONS

By employing a participatory approach methodology, this research endeavored to accomplish the four primary objectives and produce a conclusion that addressed the pivotal inquiries, as the following:

Academic Researchers perception of seed policy

These themes encompass various aspects related to agriculture, sustainability, collaboration, governance, and the future of farming and food security are the following Figure 3.

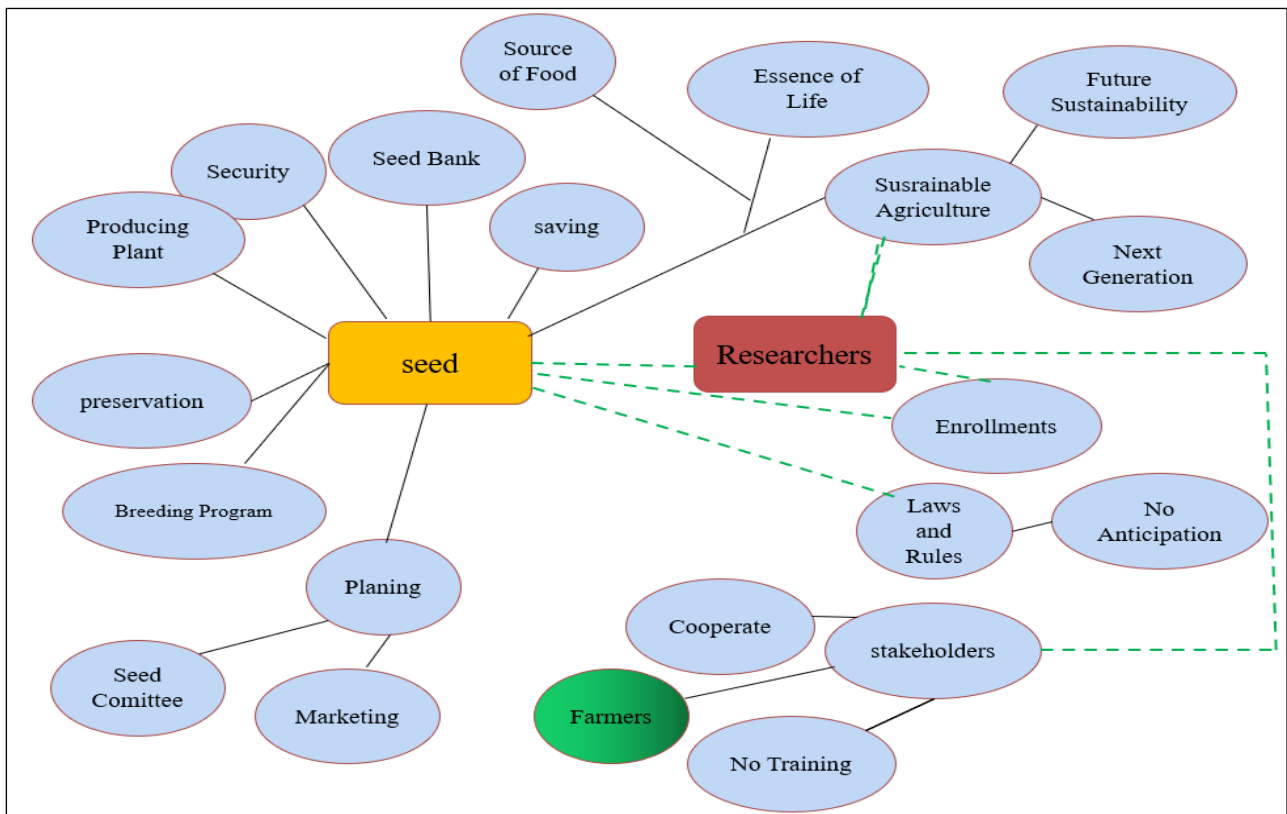


Figure 3. Interpretation map of thematic analysis via (Academic Researchers perception of seed policy)

Sustainable Agriculture and Food Security

The reference to sustainable agriculture as the essence of life aligns with academic discussions emphasizing the vital role of sustainable farming practices in maintaining ecological balance, biodiversity, and the overall health of the planet. Academic literature explores sustainable agriculture as a holistic approach that considers environmental, economic, and social factors. Describing agriculture as a source of food is a fundamental acknowledgment of its primary purpose. Academic research delves into the complexities of food production, addressing issues such as crop diversity, yield optimization, and the role of agricultural practices in ensuring global food security. The intersection of sustainable agriculture and food security is a central theme in academic studies. To speak about reproducing plants in the discussions especially plant breeding, genetic diversity, and the significance of keeping traditional varieties. Academic literature explores the role of plant reproduction in maintaining agricultural resilience, adapting to climate change, and the availability of crop diversity. To save and keep seeds in the discussions on seed conservation and the importance of seed banks also how to be maintaining it. Academic studies dive into the role of seed banks in preserving and protecting genetic resources against crop failures. The support of biodiversity conservation is the establishment of seed banks, in the point of view from academic researchers, as a strategic measure for future agricultural sustainability. The breeding program is a suggestion which focuses on genetic improvement and innovation regarding agriculture. Academic researchers explored breeding programs as a vital component of agricultural research, showing challenges such as disease resistance, climate adaptability, and improving crop yields through selective breeding.

The Stakeholder’s engagement and collaboration

To speak about cooperating with investors means the intersection of financial support and agricultural initiatives. Academic researchers explore the role of investors in agricultural development, examining the potential benefits, challenges, and ethical considerations related with investor engagement in the agricultural sector. They explore how important to make collaboration between researchers and industry stakeholders in order to drive the

agricultural innovation. Effective engagement with researchers is crucial for bridging the gap between scientific knowledge and practical agricultural applications. The training courses for farmers came with the broader discourse on capacity building in agriculture is one of the recommendations such as sustainable farming practices, technological adoption, and resilience-building strategies and workshops and training sessions in fostering for the government, for better understanding of agricultural challenges, policies, and strategies. They referenced that the seed committee underscores the role of collaborative decision-making in seed governance, then the structure and functions is effective of seed committees in facilitating communication and coordination among diverse stakeholders in the seed industry.

The Governance and Regulation

The new regulation and law are signed on legal frameworks in agriculture. The impact of regulatory changes on the agricultural sector, analyzing issues such as compliance, enforcement, and the overall effectiveness of regulations in promoting sustainable agricultural practices is one of their observations. The enrollments of administrative processes linked with new regulations or governance structures in terms of the administrative aspects of agricultural regulations, addressing issues such as enrollment procedures, record-keeping, and the role of bureaucratic processes in governing agricultural activities. There are no anticipation highlights potential gaps in foresight or preparedness within regulatory frameworks.

Sustainability for the next generation

The next generation of farmers, aligns with discussions on intergenerational sustainability in agriculture beyond immediate benefits, considering the long-term implications of farming practices on future generations, ecosystems, and food security.

These themes make the multiple dimensions of agriculture, including sustainability, collaboration, governance, and future considerations.

Government perception of seed policy

These themes capture the various aspects related to the role of government in ensuring seed security and agriculture development, also to seed policy, regulation, research planning and training, Figure 4.

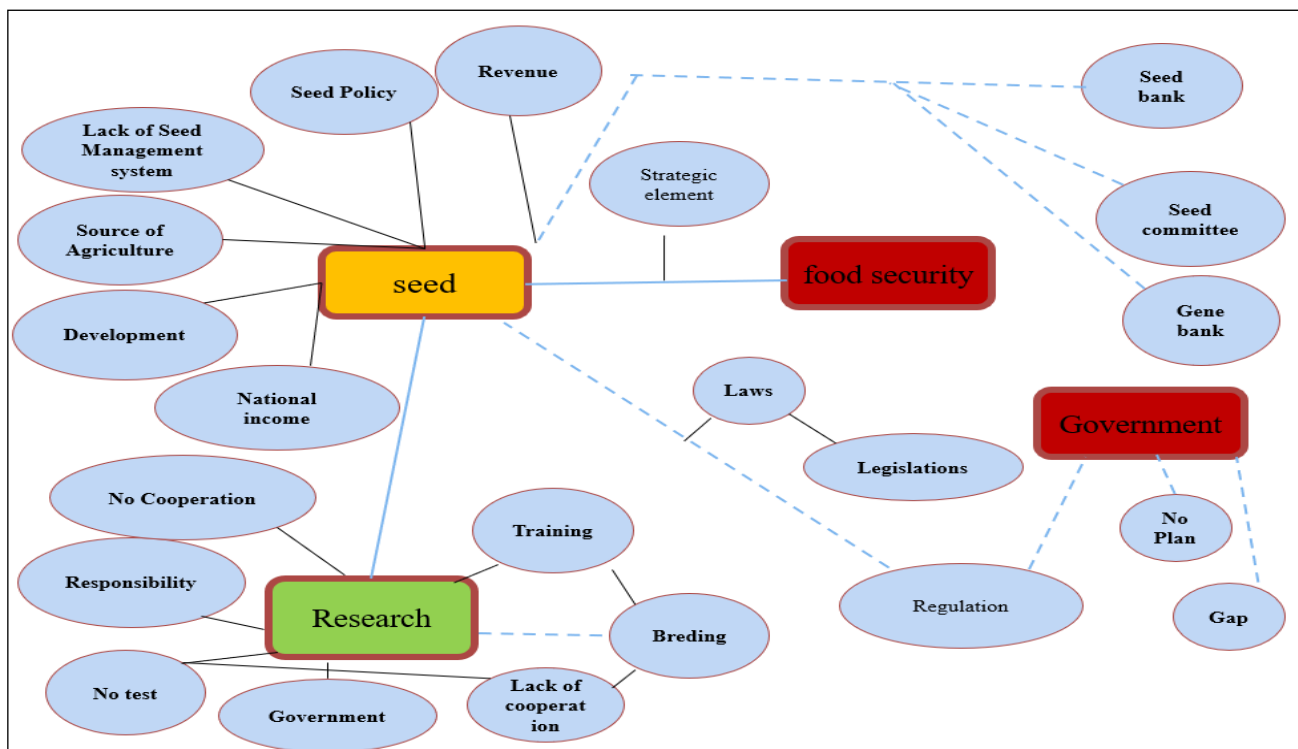


Figure 4. Interpretation map of thematic analysis via (Government perception of seed policy)

The importance of the Strategic seed policy

Seed policy is a foundational element in agricultural governance that shaping the rules and frameworks as the guidance to seed activities. Academic researchers dive into the formulation, implementation, and impact of seed policies, examining how these policies influence seed accessibility, quality, and overall agricultural development. To recognize seed policy as a strategic tool for food security came with the broader discourse on the critical role of seeds in ensuring food sovereignty. Seed policies contribute to the resilience of agricultural systems which committed by research, then affecting the availability of diverse and high-quality seeds essential for sustaining food production. The consideration of seeds as a source of national income and revenue counted the economics of the seed sector. The economic implications of seed policies, market dynamics, trade, and the potential contribution of the seed industry to national income. Consequently, the necessity and need for seed policies underscores their fundamental importance, the rationale behind the urgency of comprehensive seed policies, it's the potential consequences of inadequate policies on food security, economic stability, and sustainable agriculture.

Gap in Planning and Regulation

The absence of technical and strategic planning for seeds generally raises concerns about the lack of foresight and systematic approaches in seed management. The implications of planning gaps, discussing how strategic planning contributes to the resilience of seed systems, adaptation to climate change, and overall agricultural sustainability. Nowadays, no proper laws for highlights the regulatory challenges within the contemporary seed landscape with the legal frameworks governing seeds, analyzing their adequacy, enforcement mechanisms, and alignment with emerging agricultural challenges. Recommendations for law modification may stem from such analyses. The call for rearranging laws reflects an awareness of the need for legal reforms to address improving challenges in seed management to balance between profit motives and the broader societal goals of seed and food security and production.

The seed Research and Testing Requirements

The recommendation that seeds should be tested in research centers before sharing emphasizes the importance of research in seed quality assurance. The role of research centers in seed testing, exploring the methodologies, standards, and criteria used to assess seed quality. The assistance of research to seed improvement and innovation is a recurring theme, there is some trial reflects an awareness of outstanding research efforts. Evaluating the effectiveness of existing research initiatives leads to a nuanced understanding of the research in seed management. The assertiveness that the government should be responsible aligns with discussions on the role of government in facilitating and funding seed-related research. Also, the contributions of governmental research agencies, funding bodies, and policies in supporting research activities aimed at improving seed quality, resilience, and adaptability. At the same time, the lack of training raises issues related to capacity building in the seed sector because the role of training programs in enhancing the knowledge and skills of seed professionals, farmers, and other stakeholders make develop the seed management in terms of training needs and designing the effective capacity-building of academic interest.

Governmental Role and Infrastructure

Meeting for the government to have a seed bank reflects discussions on the role of government in preserving seed diversity. The establishment and management of seed banks, talking about and importance their functions, biodiversity conservation, and contributions to ensuring seed security in the face of environmental changes. Also, pointed out of a gene bank favors with discussions on genetic resources preservation, because the role of gene banks in safeguarding genetic diversity, exploring their importance in breeding programs, research, and the development of resilient crop varieties for next ages. They mention that a seed committee suggests a collaborative and consultative approach in seed governance, with this discourse; may examine the composition, functions, and effectiveness of seed committees in providing recommendations, guidance, and oversight in seed-related activities. These themes reflect the nature of seed management (encompassing policy, planning, regulation, research, training, and the pivotal role of government in ensuring seed security and agriculture development).

Non-Government Organization perception of seed policy

These themes represent different directions of the challenges and opportunities in the agricultural sector, with a focus on seeds and their significance for farmers. To conduct a thematic analysis based on these themes that were taken from respondents, can help in obtaining deeper insights into the issues faced by farmers and the agricultural industry, Figure 5.

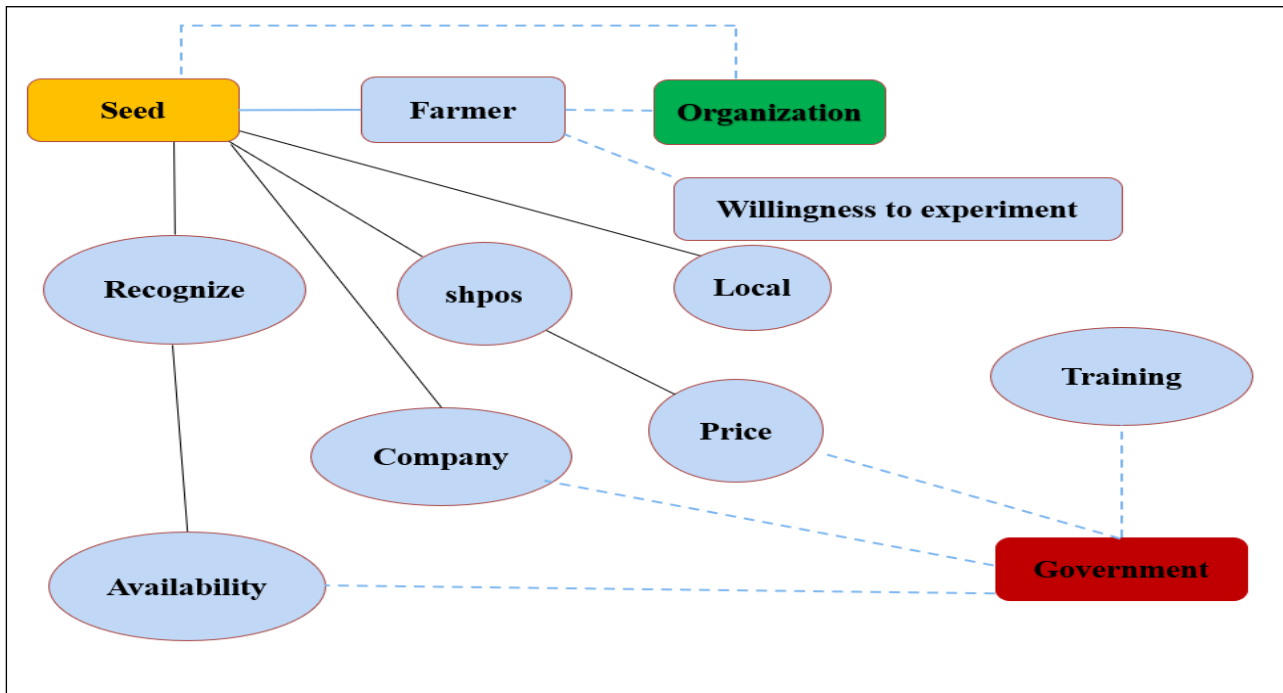


Figure 5. Interpretation map of thematic analysis via (Non-Government Organization perception of seed policy)

Seed Availability and Sources

Seeds as a vital source of food aligns with the foundational role of seeds in global food production. The participants explored their significance as the starting point for crop cultivation and emphasized the centrality of seeds in agriculture. Also explained that seeds, as a source of life, are integral to ensuring food security, and the factors influencing seed availability for farmers. Their concern about regional seed sources is limited in terms of local seed options because of lack of local seed availability. Thus, this consideration makes issues such as crop adaptability, biodiversity, and the challenges faced by farmers in accessing diverse and locally adapted seed varieties. Farmers' willingness to experiment is new trend; new seed varieties is a subject of interest in agricultural innovation, while new seeds studied and investigated can be factors influencing farmers' adoption unless benefits, risks, and the role of extension services. By this way, to understand the farmers' attitudes toward experimentation contributes to discussions on agricultural resilience and adaptability in the future of agriculture.

Seed Prices and Accessibility

One of the economic Challenges are seed prices within the seed market. The factors contributing to seed price variations, comprising the role of seed companies in terms of production costs and market dynamics. The effect of high seed prices on farmers be repeated theme, with potential consequences on farmers' livelihoods and decision-making, ultimately on agricultural sustainability. The discussion about lack of government support in seed pricing points was one of the issues, which make government policies in not make shaping seed market dynamics, see Figure 5. To Evaluate the effectiveness measurements of government support, provide intuition into the economic ways of seed availability and the impact of high seed prices on farmers needs a checkup of the socio-economic consequences.

Concerns regarding quality and forged seeds

Fake seed are brought up by the mentioning of these issues by participants, which highlight the difficulties in determining which seeds are legitimate in the marketplace. Concerns about originality and quality in the seed industry are crucial for sustainable agriculture. Thus, there are techniques for evaluating seed quality, carefully examine the function of testing facilities, certification procedures, and the comprehensive integrity of seed supply chains. The agricultural maintenance results and avoiding destructive effects on farmers' source of income depend heavily on ensuring seed quality.

Agricultural Training and Support

The role of NGOs in providing training and support to farmers high points of the importance of non-governmental organizations in agricultural development. The effectiveness of NGO-led initiatives, examining the

impact of training programs, extension services, and capacity-building efforts on farmers' knowledge and practices. The government's lack of support for farmers is a critical theme in agricultural policy analysis. Regarding the factors which influence government support, directing issues such as budget allocations, policy frameworks, and the government priorities arrangement of the needs of farmers.

Companies' perception regarding the seed policy

These themes captured are the key issues and considerations related to (seed origins, local seeds availability, government involvement, lack of trust in seed sources, and organizational and policy initiatives), to address challenges in the seed market. Thematic analysis can help to identify and connections among these themes for a deeper understanding of the topic as follow Figure 6.

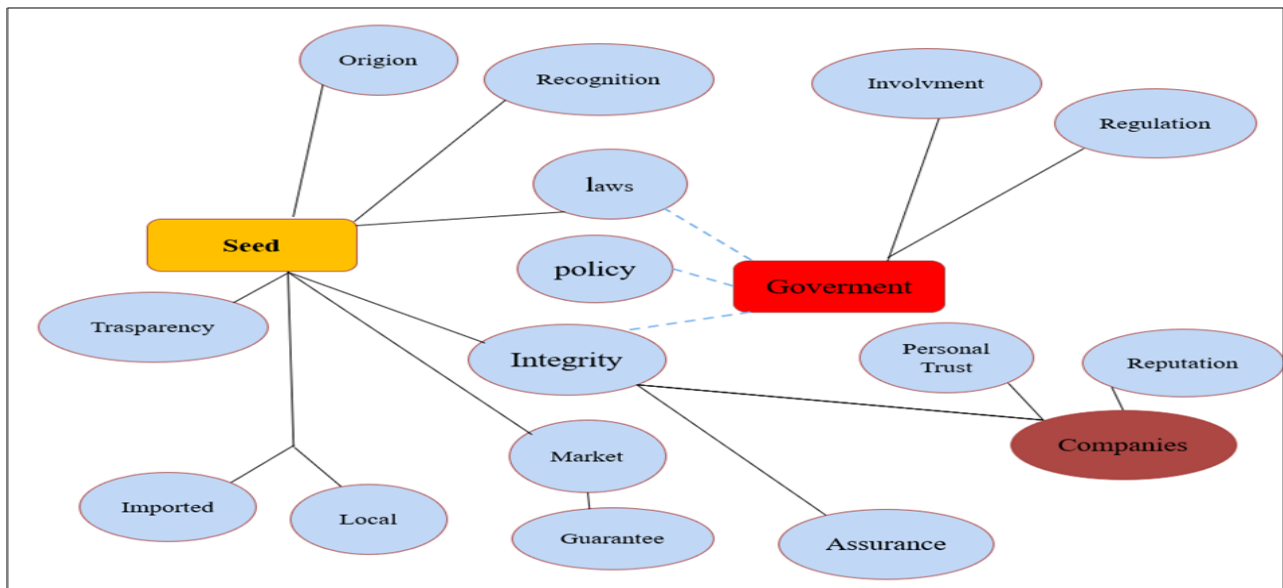


Figure 6. Interpretation map of thematic analysis via (Companies' perception regarding the seed policy)

Seed Origin and Transparency

The significance of seed origin is the critical role of transparency in the seed market, because ensuring quality of the seed origins is essential for traceability, and adherence to specific agricultural practices. Transparent information about seed origins let farmers to make informed decisions regarding the suitability and adaptability of seeds to local conditions, contributing to agricultural sustainability. However, seed origin recognition depends on the principles of informed consumer choice, also facilitates market differentiation, letting for fair competition and equitable representation of seed sources diversification. The companies do not have local seeds while some shops do, and the availability of seeds abroad make the complexities of seed sourcing. At the same time, the nature of seed markets and the challenges linked to balancing the demand for local varieties with the availability of foreign seeds.

Government and Regulatory Gap

The participants from the companies insisted that there is an absence of government in the seed market which makes concerns regarding regulatory supervision. They emphasize the essential role of government in creating and enforcing regulations that ensure seed quality, fair competition, and consumer protection. The lack of government monitoring can lead to challenges such as the proliferation of substandard (fake) seeds, market misrepresentations and reduced confidence among farmers in the seed market. They mentioned that there is no monitoring from the government underscores the potential risks connected to unregulated seed markets. The participants suggest that government monitoring is the effective role for preventing fraudulent practices related seed markets, to ensuring the commitments to quality standards, and promoting the overall integrity of the seed industry. Also, the regulatory frameworks and mechanisms of monitoring are critical items for the establishment of a reliable and trustworthy seed market. The seed laws and policy are the best parts of the need for comprehensive regulatory frameworks. Thus, well-defined seed laws and policies provide a legal benchmark for ensuring seed quality, promoting fair competition, and safeguarding the interests of both producers and consumers. A vigorous regulation frame framework leads to the establishment of a transparent and accountable seed market.

Market Integrity and Assurance

The participants from seed companies call that; to establish agencies dedicated to the seed market guarantee. They suggested that industry-wide organizations play an important role in ensuring market integrity, fostering collaboration, and addressing shared challenges. Such agencies can establish standards to promote best practices and contribute to the overall assurance reliability of seed quality. The seed market guarantee pointed out the need for mechanisms of assurance to implant confidence among stakeholders, these indications that a guaranteed system to agency or industry bodies can provide farmers with the assurance of seed quality, origin, and to commitment regulatory standards. These mechanisms come up with building trust in the seed market and promoting the adoption of quality seeds.

CONCLUSIONS

The principal conclusions regarding the perceptions of local decision makers, academic researchers, non-government organizations in agriculture, and seed companies and the clarification of the seed policy management system in the Kurdistan Regional Government. The participants insisted that the governmental role and infrastructure start with regulations and laws that are signed into legal frameworks in agriculture. In contrast, there is a gap in government regulation and a lack of initiative and systematic approaches to seed management (McGuire and Sperling, 2016). In this process, companies' participants and non-government organizations mention that to implement the new seed policy management system, the government should organize and monitor seed sources, origins, and availability in the region, then accomplish seed availability and market prices with integrity and transparency. The local policymakers and academic scholars showed that strategic seed policy is a pillar for sustainable agriculture and food security (Devika et al. 2021); thus, stakeholders' engagement and collaboration provide a facility for agricultural training and support by non-government organizations in agriculture and companies to examine seed testing through research. Farmers willingness to require original seeds increases, and they are less concerned with quality and forged seeds (Sperling et al. 1993; Louwaars and Manicad, 2022). Ultimately, seed management systems are about designing better, more sustainable agriculture for the next generation.

Author Contributions: D.H.L. analyzed the collected data and wrote the draft of the manuscript. R.H. and K.A. idealized the work. D.H.L performed the FGDs with local decision makers, academic researchers, agricultural NGOs, and seed companies gathered the data. D.H.L, R.H. and K.A. write and revise the manuscript. All authors read and approved the final manuscript.

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Conflicts of Interest

The authors declare that they do not have any conflict of interest.

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