# Multi-Level Analysis of Actors' Interaction in Maize Innovation System in Amhara Region, Ethiopia

***Daniel Nigussie,* Getnet Alemu,** and Million Gebreyes******

## Abstract

Agriculture is a crucial aspect of Ethiopia's economy, and innovations in the field, especially those related to maize production, are vital for improving smallholder farmers' food security. This study examined actors and their interactions at different levels of aggregation in improved maize varieties. To achieve this objective, perspectives on sustainability transition have been integrated into the innovation system, social network perspectives, and a multi-level power framework. Approximately 49 actor organizations were selected at niche, regime and landscape levels through purposive sampling using the snowball technique. Focus group discussions (FGD) with farmers and key informant interviews with selected organizations were used to collect data. The social network analysis approach was employed to analyze actors' interactions and their influences on the generation, dissemination and utilization of improved maize varieties. The findings reveals that agricultural extension service providers and government seed enterprises such as the Regional Bureau of Agriculture and Amhara Seed Enterprise, a regime level actor that influence the generation, dissemination and utilization of improved maize varieties. Given the priority that the Ethiopian government has placed on achieving food security by strengthening private sectors in the promotion of improved maize varieties, the findings of this study may suggest the need to involve/engage private actors at regime level to foster interaction among governmental and non-governmental actors for a sustainable supply of quality improved maize varieties.

**Keywords**: Social network analysis, innovation processes, niches, regime, landscape

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# 1. Introduction

Agriculture is considered central to the Ethiopian economy and agricultural innovations in general, and particularly improved maize varieties are fundamental to enhancing food security of smallholder farmers. Despite recent improvements in the development and dissemination of these improved varieties in the country, the adoption level has been slow. Previous studies indicated that limited public and private investment, unaffordable prices, and limited access to credit were among the key constraints to production (van Dijk et al. 2020). From a systems point of view, however, limited interaction, the fragility of synergies and weak coordination among system actors are considered as key constraints (Tarekegn and Mogiso 2020; Kelemework et al. 2021).

The use of innovations to promote sustainable agriculture requires adjustments in existing system components and their interactions. New approaches are needed to promote close interactions between different actors (Juma, 2015). To unpack the nature of interactions among system actors, the paper used a combination of quantitative and qualitative Social Network Analysis (Schipper and Spekkink 2015; Froehlich, Van Waes, and Schäfer 2020; Li et al. 2021; Gowensmith 2022; Pantic et al. 2023). The novelty of this paper lies in its use of integrated perspectives from innovation systems, sustainable transition theory and multi-level power frameworks, taking innovation system as a point of departure. The overall maize variety innovation system is framed with the integrated structural –functional analysis of the innovation system to identify its core constraints (Kebebe et al. 2015; Mininberg 2015; Gust-Bardon 2015 ; Baharloo, Behzadira, and Miremadi 2018; Boisier et al. 2021;). However, innovations are often socio-technical, and innovation system perspectives need to give close attention to contextual factors. To address this, the paper used perspectives from sustainable transition studies, more specifically the Multi-Level Perspective (MLP) in order to capture the contextual issues that affect adoption processes beyond the elements of integrated structural and functional innovation systems (Lauttamäki and Hyysalo 2019). As indicated in the Multi-Level Perspective literature ( Geels 2019; Hamid El Bilali 2019;; Schiller and Radinger-Peer 2021; Li et al. 2021; Costa et al. 2022; Gaddis and Jeon 2022;

Elsner, Herzig, and Strassner 2023), transitions come about through interactions within and between three levels: niches (micro level; locus of radical innovations); regimes (meso level; locus of established practices and associated rules); and landscape (macro level; exogenous trends). Critics of MLP point out its failure to provide an insight into the role of power at different levels of aggregation ( Geels and Schot 2010; Grin, Rotmans, and Schot 2010; Avelino 2017). Hence, this paper complements this lacuna with an additional insight from multi-level power framework. By combining these insights, the paper aims at providing a novel understanding of the interaction among maize innovation systems actors in Ethiopia, with a nuanced understanding of the multi-level change drivers and power relation among system actors. The objective of the paper is to unpack the nature of the interaction among system actors of improved maize varieties in Ethiopia to unveil barriers that might hinder their dissemination and enhance the food security of smallholder farmers. The study also addresses the following questions: What does the pattern of interaction look like, and who is the most influential actor in the maize innovation system?

## 1.1. Theoretical orientation and conceptual framework

### *1.1.1. Theoretical orientation*

Innovations emerge from the complex interactions among a diverse set of public, private and civil society actors engaged in generating, exchanging and using knowledge. (Hermans et al. 2017). The agricultural innovation system approach sees innovation as a process of networking, interactive learning, and negotiation among a diverse group of actors. It aims to gain a deeper understanding of the innovation processes and views them as multifaceted and intricate interactions between novel and interrelated practices carried out by various stakeholders (Kamara, Lalani, and Dorward 2023; Hermans et al. 2023).

Hence, Wieczorek and Hekkert (2012) developed a framework that integrates structural elements (actors, interactions, institutions and infrastructure) into the function of innovation system to identify systemic problems. Sustainability transition using a multi-level view has been integrated into the functions of the innovation system literature (Sutherland, Peter, and Zagata 2015; El Bilali, 2020). The innovation system and sustainability transition

approach provide a space for interaction of actors at different levels of aggregation. Bringing these actors together in the innovation system provides opportunities for actors to exercise power to change or maintain existing functions ( Scoones, Leach, and Newell 2015, 3; El Bilali et al. 2018 Turner et al. 2020).

According to ( Geels and Schot 2010; Grin, Rotmans, and Schot 2010 Avelino 2017), transition studies overlooked the issues of power in the framework ; failed to provide an insight into the dynamics of change. It only provides a descriptive picture of the situations and the socio- technical changes and describes the system in a static situation, without providing insight into the mechanisms of the system's operations. Findings of Cullen et al. (2014) suggest that innovation system may be influenced by forms of power, highlighting the importance of power issues in order to better assess the strengths and limitations of the innovation system.

Network perspective is powerful way of examining the dynamics of interactions and power among actors (Karasek, van der Veen, and Kamann 1996; Coulon 2005; Johnson, Fortune, and Bromley 2017; Kolleck 2013; Hermans et al. 2017). In explaining organizational performance network theorists do not only examine the characteristics of actors but also the relationship they have with other organizations (Borgatti and Ofem, 2010). The network perspective suggests that the power of individual actors is not an individual attribute but arises from their relations with others. To analyze these network perspectives, the social network analysis framework is used. Social network analysis (SNA) is a process of quantitative and qualitative analysis of a social network. It measures and maps the flow of relationships and relationship changes among actors and considers power as inherently relational. It also allows the generation of in-depth insights into the composition of the network and its effects on the innovation performance related to the structure and functioning of such network. Social network analysis also helps to explore the complexity and multi-dimensionality of innovation processes (Hermans et al. 2017). The metrics of social network analysis illustrate power as occupying advantageous positions in networks of relations. Three basic sources of advantage are high degree, high closeness,

and high betweenness (Hanneman and Riddle 2005; Christopherson and Clark, n.d.).

Researchers have also found that social network theory can help explain technology adoption and argued that there is a shift in interest towards a more dynamic analysis of social networks (Tscherning, 2011; Borgatti, Everett, and Johnson, 2018). Previous studies ( Spielman et al. 2011b; Mapila et al. 2016; Mittal, Padmaja, and Ajay 2018; Weyori et al. 2018; Teklewold et al. 2019a; Tesfaye et al. 2020b Onumah, Asante, and Osei 2021;) used social network analysis to describe actors' interaction and power in the agricultural innovation system. Other studies (Caniëls and Romijn 2008); (Lopolito, Morone, and Sisto 2011); Falcone, Lopolito, and Sica 2018); F. Hermans et al. 2013),and Giganti and Falcone 2021) also presented methodological conceptualization of niche and suggested an empirical methodology based on a social network analysis to be applied for investigating the relational network of a niche. The approach introduces a new paradigm for innovation research, making innovation understandable and tractable using tools such as computational network analysis and agent-based simulation. The authors attempted to relate niche development and transition towards sustainability by combining strategic niche management and social network analysis. But all these studies focus only on niche formation and development. Nevertheless, the presence of power at the niche level does not guarantee the prompt of the niche development because it also depends on the distribution of power within the network of multi-level actors. Considering this, Grin, Rotmans, and Schot (2010) link the multi-level perspective to an existing multi-level power framework, arguing that the three levels of power distinguished correspond to the three levels in transition dynamics: (1) relational power at the level of niches (abilities of agents to draw on institutions), (2) dispositional power at the level of regimes ('embodied in rules, resources, actor configurations and dominant images') and (3) structural power at the level of landscapes. Earlier works failed to examine the interactions and power among the regime and socio-technical landscape actors. Three ways of conceptualizing power were also found in El Bilali et al.'s (2018) work. The first is a conceptualization situated in the multi-level

perspective (Geels, 2002), emphasizing power by regime actors over non-incumbent actors (Turnera, et al, 2020).

## 1.2. Conceptual Framework

The dissemination and utilization of improved maize varieties require an understanding of the structural and functional dimensions of the innovation system. To analyze innovation and develop useful policy insights, it is important to approach the issue from systemic, transition and network perspectives. This understanding enables a more useful cross-sectoral learning. Currently, it is understood that the performance of innovation systems depends on the interaction among the different actors and institutions responsible for system functions. Considering this, the current study looks at actors' interactions in disseminating improved maize varieties. This helps to diagnose failures in interactions and power influence in the dissemination and utilization of improved maize varieties, and proposes policies that could address them. The line between understanding the structure of an innovation system and the interaction among its key actors is subtle and these two analyses are closely linked. This paper uses social network analysis integrated with a multi-level power framework. The analysis does not merely focus on the actors but also on their interactions at different levels. To understand these interactions, the analysis takes a network- and systems-level approach, given the interactive, multi-actor and non-linear processes that shape the innovation processes. These give a comprehensive analysis of the dissemination of improved maize varieties in the study area.

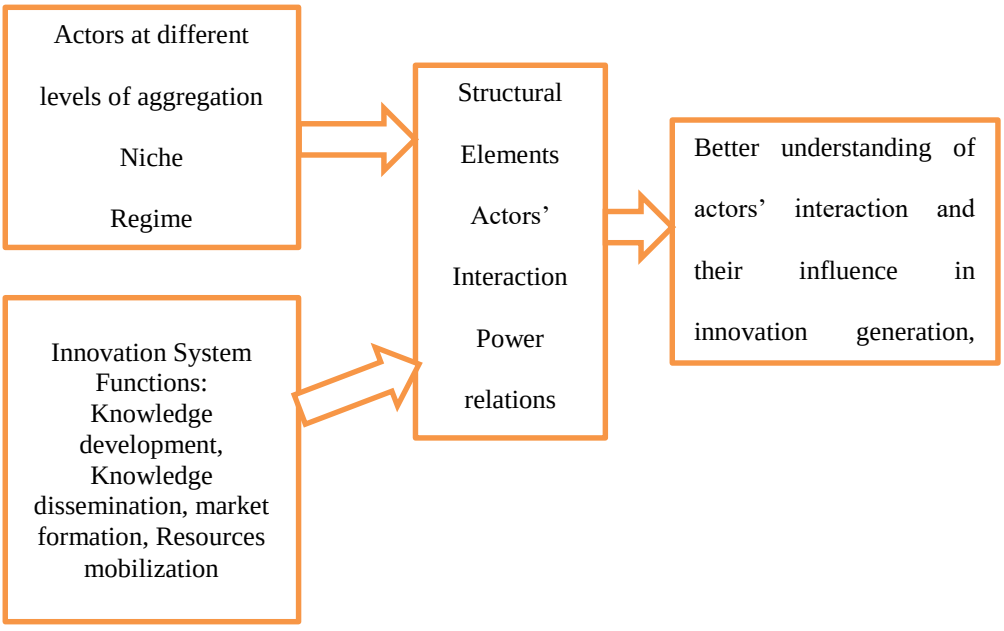


Figure 1. Actor interactions and power relations based on innovation system functions.
*Source: Adapted from the (OECD 2013; Jose 2014; Hillman et al. 2011; Grin, Rotmans, and Schot, 2010).*

## 3. Materials and Methods

### 3.1 Description of the study area

The study was conducted in West Gojjam Zone, North West of Ethiopia. West Gojjam Zone is one of the 11 zones in the Amhara region and lies between 36º 30' to 37º 5' East Longitudes and 10016' to 11054' North Latitudes. Maize is one of the important cereal crops grown in the Zone. The total annual production and productivity exceed all other cereal crops, though it is surpassed by Tef in terms of area coverage. Therefore, considering its importance in terms of wide adaptation, total production and productivity, maize is one of the high priority crops to feed the increasing population of the Zone. Nevertheless, the yield of maize remained very low due to many biotic and abiotic constraints. The area is characterized by flat lying topography with some hilly terrain. This district has different climatic conditions in different seasons. The annual rainfall pattern of the study area varies from

1000 to 2000 mm(Beyene and Ayalew, 2015). The temperature varies from 23ºC to 27ºC. June, July and August are high rainfall months and December, January and February are low rainfall months. High temperature is recorded in March, April and May and low temperature is recorded in November, December and January (Beyene and Ayalew, 2015).

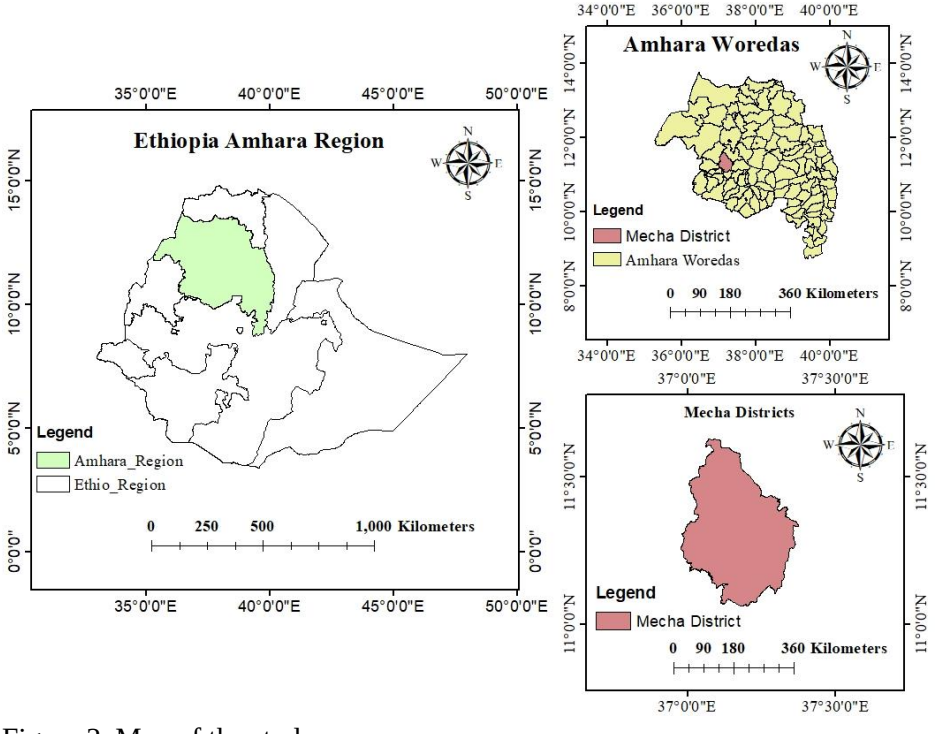


Figure 2. Map of the study area

*Source: ArcGis*

## 3.2. Sampling technique and sample size determination

In this study, all sampling procedures followed non-probability sampling, combining purposive and snowball techniques. Choosing a suitable sample size in qualitative research is an area of conceptual debate and practical uncertainty. The sample size determination for this study is based on data adequacy and saturation.

## 3.3. Data type, sources and method of data collection

Based on the study objectives, the researchers selected 49 organizations at niche, regime and landscape levels that were directly involved in generation, dissemination, and utilization of improved maize varieties. To collect the data, Focus Group Discussion (FGD) with farmers and key informant interviews with selected organizations were conducted. A total of 72 interviews were held at niche, regime and landscape levels with officials and experts from the respective actors involved in generation, dissemination and utilization of improved maize varieties. Face-to-face interviews were conducted based on a structured interview guide with closed and open-ended mixed questions. The interview questions consisted of four main parts. The first part was about respondents' information including type of organization and the activity they are involved in. The second part focused on the activities they performed in different functions and the structural elements (with whom they work, the nature of interactions, the institutions, and infrastructures they have). The third part was about issues related to power. Part four consisted of bottlenecks in the process of generation, dissemination, and utilization of improved maize varieties.

## 3.4 Data analysis methods

In this study, both quantitative and qualitative analytical techniques were employed. Social network analysis was used to examine the patterns, interactions, and power of actors. For this purpose, Gephi software was used as a tool for analysis (Borgatti and Ofem, 2010). Social network analysis characterizes social relationships as networks of nodes, and the ties that describe their relationships and interactions (Jack, 2010). This methodology helps to map and understand the actors' interactions and power relations in a specific social context (Hanneman and Riddle, 2005; Christopherson and Clark, n.d.). In this study, nodes are the individual or institutional actors within the networks, whereas ties are the relationships (commonalities, social relations, interactions or flows) between the actors (Kosorukoff, 2011). In social network analysis, there are many metrics or measurements of networks (Valente et al., 2015). This paper focuses on network centrality measures to analyze the interaction and influence of actors in a network. The results are visualized by network maps and quantified as centrality measures (Degree,

Betweenness, Closeness, and Eigen Vector). An evaluation is also done to identify the key or influential actors in the system. The centrality measures are also integrated with thematic analysis.

Table 1. Metrics in the social network analysis

| Element | Definition |
|---|---|
| **Network size** | Total number of nodes in a network |
| **Network density** | Nodes that are actually tied as a proportion of all possible ties in a network. When density is close to 1.0, the network is said to be dense, otherwise it is sparse. |
| **Centrality** | Measure of the number of ties that a node has relative to the total number of ties existing in the network as a whole; centrality measures include degree, closeness, and betweenness. |
| **Degree** | Total number of ties a node has to other nodes. A node is central when it has the higher number of ties with other nodes. |
| **In-degree centrality** | Number of ties received by the node. The in-degree of an actor is an index of prestige /indicate its importance/. |
| **Out-degree centrality** | Number of ties initiated by the node. The out-degree is usually a measure of how influential the actor may be. |
| **Closeness** | Measure of reciprocal of the geodesic distance (the shortest path connecting two nodes) of node to all other nodes in the network. A node is "close" if it lies at short distance from many other nodes (as in being physically proximate). |
| **Betweenness** | Number of times a node occurs along a geodesic path. It is a node that can play the part of a liaison or broker or gatekeeper with a potential for control over others. |
| **Eigenvector Centrality** | A measure of the importance of an actor in a network. It also measures how well a given actor is linked to other well-linked actors in the network. |

*Source: (Spielman et al. 2011a; Zewdie 2012; Valente et al. 2015; Bojovic et al. 2015)*

# 4. Result and Discussion

## 4.1 Case description

According to Berhanu and Emana (2018), currently, there are twenty-one available maize varieties including sixteen hybrids (BH-660, BH-540, BH-543, BHQPY-545, BH-661, BH-546, BH-547, SPRH-1, AMH760Q, AMH-851(Jibat), AMH-8+53, AMH-854, MH-138Q, OHL HUV, Shone and Limu (P3812W) and five open pollinated varieties (Melkasa-2, Melkasa-4, Melkasa-6Q, Gibe-2 and Morka). The authors collected these data from Bako National Agricultural Research Center. Among these, BH540, BH 546 and P3812W are being utilized in the study area.

BH540, BH546 and BH547 varieties were released by Ethiopian Institute of Agricultural Research, Bako Research Center in collaboration with CYMMIT in 1995 and 2013 respectively. BH540 is a long-aged variety, almost 27 years since its release. Farmers still use this variety. BH546 has a yield advantage of 30% over BH540. Its narrow semi-erect leaves make it desirable for high-density planting and inter-cropping with legumes, a common practice in most maize growing areas of the country. The Ethiopian government, in partnership with Sasakawa Global 2000, played a key role in the popularization and dissemination of BH540. BH546 is a highly stable high-yielding hybrid, tolerant to drought and low nitrogen stresses, as well as major foliar diseases. This variety was developed to substitute BH540 but still farmers are using BH540. BH547 also has a grain yield advantage of 26.4% over BH540 and mean grain yield of 10 tons/ ha. EIAR in collaboration with CIMMYT and the Ministry of Agriculture has begun variety demonstration and popularization to promote the seed delivery system. In terms of its promotion, it is still similar with BH546, not well promoted (Tarekegn and Mogiso 2020; Kelemework et al. 2021).

One of the FGD discussants confirmed that:

> *Farmers are utilizing P3812W and BH540. They are not well informed about BH546 and BH547. According to the discussants, they have some information about the existence of varieties that can substitute P3812W but*

*they are not sure about that. As a result they utilize P3812W and BH540. Their first choice is P3812W.*

P3812W/ locally called Limu, was released by Pioneer Hybrid Seed Ethiopia in 2012. To disseminate this variety, partnership was created between the Ethiopian governments, Pioneer Hybrids Seeds Ethiopia plc and USAID. They all together established a project called Advanced Maize Seed Adoption Program/AMSAP/ under Feed the Future or ACDI VOCA. This helped with the wide dissemination of the variety. This variety is solely generated by a foreign private company. The sources of germplasm or inbred lines are managed and controlled by the company. Pioneer Hybrids Seeds Ethiopia plc. a private company made contractual agreement with large scale private farms like Agri -CEFT for the multiplication of seeds. The inbred line comes from abroad and the multiplication is done in Ethiopia. Distribution of the seed is done by the regional bureau of agriculture through allocation based on the demand of districts.

## 4.2 Actor network- mapping in improved maize seed innovation system

Table 2 indicates actors and their functions. These different functions are performed by different actors, both private and public. Actors can also be categorized based on their functions. In innovation studies, there are different functions like knowledge generation and dissemination, guidance for search, market formation, resource mobilization and creating legitimacy. Based on the findings of this study, the following table indicates the classification of actors based on their function in terms of improved maize seed varieties.

Table 2. Actors based on function

| Functions | Public | Private |
|---|---|---|
| **Knowledge generation** | Ethiopian Agricultural Research Institute, Bako National Research Center, Amhra Region Agricultural Research Institute, Adet Research Center, Bahir dar University, CYMMIT, | Pioneer HI-Bred International, Pioneer Hi-Bred Seeds Ethiopia Plc, EthoAgri-CEFT,other local private seed multipliers, Local seed enterprises, Farmers based seed multiplication |

| | | |
|---|---|---|
| **Knowledge dissemination** | Bureau of Agriculture, Zone Office of Agriculture, District Office of Agriculture, Kebele Agriculture Office, Sasakawa Africa Association, ATA, | Pioneer HI-Bred International, Pioneer Hi-Bred Seeds Ethiopia Plc, other local private seed multipliers, AMSAP, EthoAgriceft |
| **Market formation** | Amhara Seed Enterprise, Bureau of Agriculture, Cooperatives Promotion Agency, Zone Cooperative Promotion Offices, District Cooperative Promotion Office, | Pioneer Hybrid International, Pioneer Hibred Seeds Ethiopia Plc, other local private seed multipliers, Etho Agri-CEFT Local seed enterprises, private seed dealers, Merawi farmers cooperatives, Weteabaye farmers' cooperative, Merkebe union |
| **Entrepreneurial** | Amhara Seed Enterprise, Bureau of Agriculture, Cooperatives Promotion Agency, Zone Cooperative Promotion Offices, District Cooperative Promotion Office, | local private seed multipliers, EthoAgri-CEFT Local seed enterprises, private seed dealers, Merawi Farmers Cooperatives, Weteabaye Farmers' Cooperative, Merkebe Union |
| **Guidance for search** | Ethiopian Agricultural Research Insttute, Bako National Research Center, Amhara Region Agricultural Research Institute, Adet Research Center, Bahir dar University, CYMMIT, | Pioneer HI-Bred International, Pioneer Hi-Bred Seeds Ethiopia Plc, EthoAgri-CEFT,other local private seed |
| **Resource mobilization** | Amhara Seed Enterprise , Bureau of Agriculture, ATA ,AgroBig | AMSAP (Advanced Maize Seed Adoption Program) |
| **Creating legitimacy** | Ministry of Agriculture, Bureau of Agriculture, Amhara Seed Enterprise, National Seed Quality Directorate, Regional Seed Quality Directorate, | Pioneer Hybrid International, Pioneer Hybrid Seeds Ethiopia Plc, other local private seed multipliers, AGRA, ESA, ISSD, |

*Source: Own survey results, 2020*

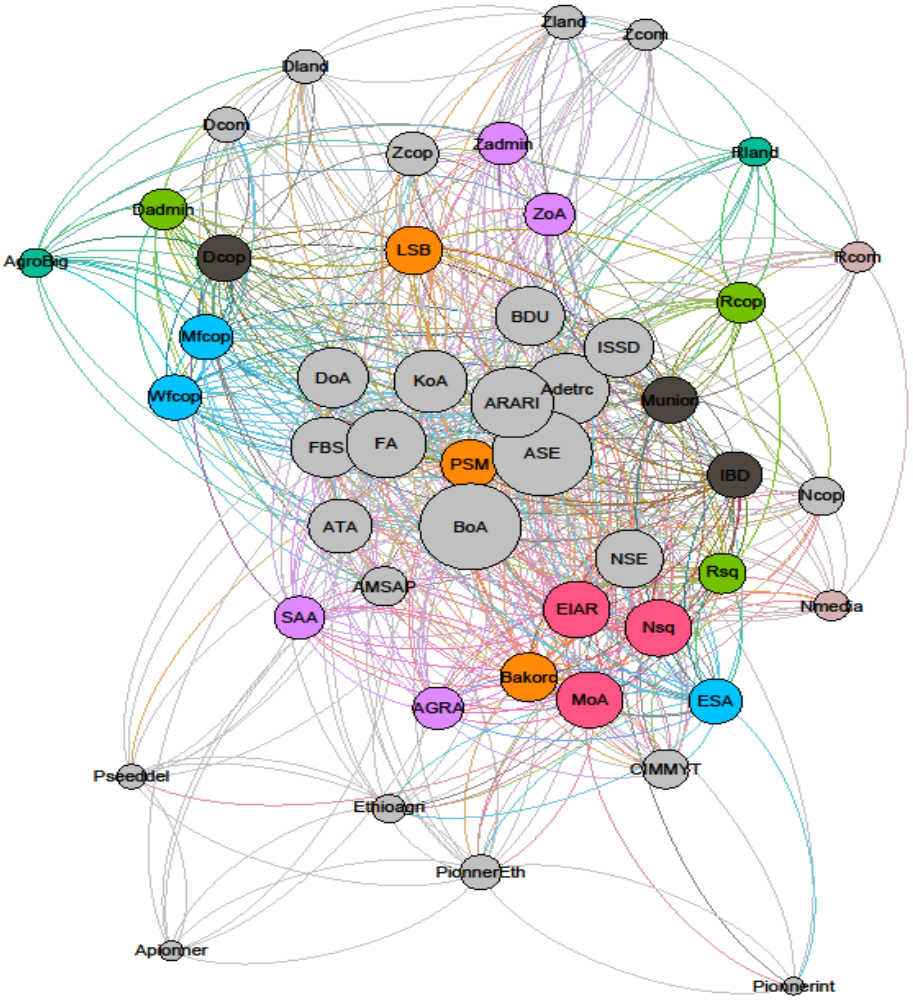


Figure 3. Existing network of actors

*Source: Own survey result, 2020*

The above network mapping shows the network of actors involved in the generation and dissemination of BH540 BH546 and P3812W. These actors are both public and private organizations and located at different levels of aggregation. The network mapping shows the central and the peripheral

actors in the network. As indicated in the network mapping, actors like Kebele Office of Agriculture, District Office of Agriculture, Amhara Regional Bureau of Agriculture, Amhara Seed Enterprise and Adet Agricultural Center are more central in the network whereas actors like Pioneer Hi-Bred Seeds in Ethiopia are peripheral in the network.

In this research, calculating different metrics of the actors' network given in Fig.3 is done and based on these values, the most influential actor is determined. Some of the results are presented in the table below (Table 3 and graphically in Figure 3.

Table 3. Statistical simulated result of the existing network between actors in the maize innovation system

| Label | In degree | Out degree | Degree | Eigen centrality | Closeness centrality | Betweenness centrality |
|---|---|---|---|---|---|---|
| **FBS** | 33 | 11 | 44 | 0.88519 | 0.534091 | 107.4637 |
| **FA** | 42 | 9 | 51 | 1 | 0.465347 | 70.35988 |
| **KoA** | 40 | 6 | 46 | 0.996149 | 0.431193 | 18.90408 |
| **DoA** | 33 | 11 | 44 | 0.879844 | 0.456311 | 42.14063 |
| **Dcop** | 20 | 12 | 32 | 0.55602 | 0.474747 | 21.53374 |
| **Mfcop** | 20 | 11 | 31 | 0.615483 | 0.566265 | 39.62222 |
| **Wfcop** | 20 | 11 | 31 | 0.615483 | 0.566265 | 39.62222 |
| **Rsq** | 19 | 8 | 27 | 0.47408 | 0.52809 | 12.90128 |
| **Adetrc** | 17 | 37 | 54 | 0.436055 | 0.810345 | 87.37804 |
| **LSB** | 13 | 21 | 34 | 0.502255 | 0.643836 | 93.4909 |
| **Ethioagri** | 11 | 5 | 16 | 0.281474 | 0.505376 | 7.22089 |
| **Pseeddel** | 6 | 7 | 13 | 0.202809 | 0.522222 | 18.48103 |
| **PSM** | 17 | 17 | 34 | 0.428112 | 0.602564 | 40.47015 |
| **Dcom** | 12 | 10 | 22 | 0.284524 | 0.439252 | 6.809485 |
| **Dadmin** | 17 | 10 | 27 | 0.43262 | 0.435185 | 6.813656 |
| **Dland** | 13 | 8 | 21 | 0.336679 | 0.412281 | 4.960185 |
| **ZoA** | 19 | 10 | 29 | 0.452857 | 0.552941 | 26.26377 |
| **Zcop** | 17 | 13 | 30 | 0.378014 | 0.546512 | 26.57397 |
| **Munion** | 19 | 13 | 32 | 0.445207 | 0.580247 | 70.49116 |
| **Zcom** | 11 | 8 | 19 | 0.255659 | 0.443396 | 10.48145 |
| **Zadmin** | 20 | 9 | 29 | 0.436755 | 0.546512 | 34.28112 |
| **Zland** | 13 | 8 | 21 | 0.311845 | 0.427273 | 11.94771 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **BoA** | 31 | 36 | 67 | 0.661152 | 0.810345 | 341.2903 |
| **ASE** | 26 | 40 | 66 | 0.625045 | 0.87037 | 233.262 |
| **Apionner** | 4 | 5 | 9 | 0.068203 | 0.51087 | 2.394004 |
| **AMSAP** | 4 | 22 | 26 | 0.064231 | 0.652778 | 26.38618 |
| **PionnerEth** | 8 | 14 | 22 | 0.143865 | 0.566265 | 27.22663 |
| **Rcop** | 14 | 13 | 27 | 0.323035 | 0.580247 | 15.41746 |
| **Rcom** | 10 | 8 | 18 | 0.221876 | 0.52809 | 9.904793 |
| **Rland** | 9 | 8 | 17 | 0.227062 | 0.522222 | 7.931673 |
| **ATA** | 10 | 29 | 39 | 0.233448 | 0.723077 | 25.36914 |
| **MoA** | 18 | 23 | 41 | 0.344415 | 0.661972 | 59.95956 |
| **SAA** | 12 | 17 | 29 | 0.306001 | 0.61039 | 4.104211 |
| **CIMMYT** | 12 | 14 | 26 | 0.308655 | 0.5875 | 2.857212 |
| **BDU** | 10 | 33 | 43 | 0.270178 | 0.770492 | 18.24424 |
| **ISSD** | 12 | 31 | 43 | 0.316863 | 0.746032 | 30.18984 |
| **NSE** | 20 | 22 | 42 | 0.468156 | 0.652778 | 29.51602 |
| **Nsq** | 19 | 22 | 41 | 0.439777 | 0.643836 | 29.56251 |
| **EIAR** | 17 | 24 | 41 | 0.38875 | 0.671429 | 14.02083 |
| **Bakorc** | 18 | 16 | 34 | 0.393717 | 0.573171 | 7.332183 |
| **ARARI** | 16 | 37 | 53 | 0.36929 | 0.824561 | 45.91115 |
| **Nmedia** | 14 | 4 | 18 | 0.296534 | 0.376 | 0.918492 |
| **AGRA** | 11 | 18 | 29 | 0.260692 | 0.618421 | 3.605977 |
| **IBD** | 12 | 20 | 32 | 0.312022 | 0.635135 | 8.155184 |
| **AgroBig** | 2 | 15 | 17 | 0.055991 | 0.573171 | 0.973766 |
| **Pionnerint** | 4 | 3 | 7 | 0.06809 | 0.451923 | 0.598214 |
| **Ncop** | 10 | 15 | 25 | 0.218214 | 0.580247 | 7.208783 |
| **ESA** | 10 | 21 | 31 | 0.239152 | 0.643836 | 28.44829 |

*Source: Own survey result 2020*

### 4.3 Analysis of actors' interactions and power relations in the generation, dissemination and utilization of improved maize varieties based on different SNA metrics measures

**Node Degree**: In this study, the networking of actors is a directed one and the in-degree and out-degree of each actor is shown in the network using an arrow. The finding of the study indicates farmers and Kebele office of agriculture have highs in-degree which indicates that many of the actors' in

the network are trying to partner with this part of the industry. Farmers are users of improved maize varieties and Kebele office of agriculture is one of the actors that performs dissemination function. But as it is indicated in the diagram of actor networking (Fig.1), the collaboration of the actors with these organizations is not in an organized way and this is affecting the performance in disseminating improved maize seed varieties.AgroBig, Agents of Pioneer Hi-Bred Seeds Ethiopia Plc, AMSAP, and Pioneer HI-Bred International, have the lowest in-degree.

In case of out-degree, Amhara Seed Enterprise, Adet Research Center, Amhara Region Agricultural Research Center and Amhara Region Bureau of Agriculture have the highest out-degree and it indicates that these actors are more central in reaching many actors, and they are powerful. These actors are leveled as regime actors, and this indicates that they affect the governance of the system. Adet Research Center is one of the actors that performs innovation generation functions and located at niche level. The Regional Bureau of Agriculture again performs dissemination function and Amhara Seed Enterprise is a public enterprise engaged in entrepreneurial promotion and market formation functions. All the actors who have high in-degree and high out–degree are public organizations, and this affects the involvement of private actors in the generation, dissemination and market formation function of the system.

Therefore, our findings support previous works by (Onumah, Asante, and Osei 2021), which argue that centrality measures revealed that extension actors had the highest out-degree score, with farmer-based organizations having the highest in-degree score. This implies that extension service providers in the cocoa network are the most powerful. Another study conducted by Tesfaye et al. (2020a) also supported the finding of this study, The Ethio-Wetlands and Natural Resources Association had the greatest out-degree centrality and they leveled this actor as the most influential actor in the network in terms of its ability to communicate climate services directly with other actors across the network. In addition, the authors argued that the National Metrology Agency, Ministry of Agriculture, Agricultural Transformation Agency and Bureau of Agriculture of Amhara region had relatively the maximum in-degree of points. According to the authors, actors

who have received information from many sources are powerful. They considered these actors to be key and influential.

As a farmer in Kudmie kebele highlighted:

> *Farmers have high demand for P3812W, which is developed by Pioneer Hi-Bred Seeds Ethiopia Plc. But farmers are facing serious challenges in accessing this variety. When faced with a challenge of accessing it through formal means, farmers are forced to resort to accessing it through contraband, with a huge risk of adulteration. The Amhara Seed Enterprise wants to sell their seeds to the farmers and as a result the Enterprise limits the dissemination of P3812W.*

As indicated in the above findings, it is easy to understand that the public actors influence the dissemination of improved maize varieties developed by the private actors. This affects the interest of private seed companies in the production and supply of high-quality seed to small-scale farmers. The relationship between Amhara Seed Enterprise, Adet Research Center and Pioneer Hi-Bred Seeds Ethiopia Plc is competitive but not supplementary and is an example of antibiotic rather than symbiotic relationship between the public and private sector. The public and private actors excrete different power. The public extension and seed enterprise restrict and resist the dissemination of improved maize varieties. There is power antagonism between the public and the private actors in the dissemination of improved maize varieties innovation system. They disrupt one another.

In general, as the out-degree result reveals, regime actors are powerful in the study area. Regional Bureau of Agriculture, Amhara Seed Enterprise and Adet Research Center exert a relational dispositional and structural power in the dissemination of improved maize varieties. This means that they are powerful in terms of embodying rules, resources, and actor configurations. They are the dominant images in the system. The power of the regime actors affect the wide dissemination of improved maize varieties generated by the private companies like Pioneer Hi-Bred Seeds Ethiopia Plc.

The board chair of Ethiopian Seed Association highlighted that:

> *"The association was formed to support the interest of private companies in the production and supply of high-quality seed to small farmers in collaboration with regional, national, and international bodies. However, collaboration is limited, and government seed enterprises and regional agricultural bureau dominate the market formation activity through the*

> *principle of seed allocation. Currently, there is no liberal seed marketing scheme in the country and private companies distribute their seeds through the Regional Bureau of Agriculture to farmers' cooperatives. In addition, the issue of land and foreign currency discourages the involvement of private companies in the sector."*

In figure 3 above, it was noted that ATA, AMSAP, MoA and Pioneer Hi-Bred Seeds Ethiopia plc have the highest out-degree. These actors are powerful in the generation and dissemination of P3812W. AMSAP is a public –private partnership program established for enhancing the dissemination of P3812W. There are missing actors in the generation function like research and higher learning institutes. Localization of this variety is a big challenge for sustainable supply of the innovation. In addition, one of the market formation actors (Amhara Seed Enterprise) considers these actors as a competitor as indicated in the above discussion.

Pioneer Hi-Bred Seeds Ethiopia Plc. is a foreign private company performing good in the dissemination of P3812W. This happens through a project called AMSAP, a partnership created by USAID, ATA, Pioneer Hi-Bred Seeds Ethiopia Plc. and the Ministry of Agriculture. This partnership helps the company to disseminate its innovations to the small holder farmers. Regional Bureau of Agriculture, District Office of Agriculture and Kebele Office of Agriculture also involve in the dissemination of P3812W. But they have poor link in other functions.

The major findings of this study are also consistent with findings from some previous studies (Tarekegn and Mogiso 2020; Kelemework et al. 2021). These authors indicated the fragility of synergies- weak coordination and integration between systems actors- as the major constraints contributing to the low level of improved variety use in the country.

**Closeness Centrality**: measures how close a node is to all other nodes and can be calculated as the inverse of the sum of the shortest distance to all other nodes. Closeness centrality indicates the average distance between a given node and all other nodes in the network. Therefore, the more central a node is, the closer it is to all other nodes. Moreover, closeness centrality is a way of detecting nodes/actor that can spread information very efficiently through

graph. The findings of this study showed that Amhara Seed Enterprise, the Bureau of Agriculture, and the Adet Research Center have the highest closeness centrality in the network. This implies that these actors are more influential in the network's information flow. They have the shortest distances to all other nodes and they are in a favorable position to monitor and acquire vital information and resources within the system. This indicates that public actors, who perform the generation and dissemination of improved maize variety are closer than the private once. Amhara Seed Enterprise is another public actor engaged in entrepreneurial and market formation function, and it is closer to all other nodes. The closeness centrality measure of private actors like Pioneer Hi-Bred Seeds Ethiopia Plc., Agri-CEFT and other private companies have the lowest closeness centrality measure. This finding is against the work of Juma (2015), which argues institutions, both private and public institutes, with key functions such as research, teaching, extension, and commercialization need to be much more closely integrated. Private seed companies like Pioneer Hi-Bred Seeds Ethiopia Plc. as a knowledge development actor, is placed on the periphery in the network. However, ATA, AMSAP and Pioneer Hi-Bred Seeds Ethiopia Plc. have the highest centrality degree in the dissemination of P3812W as indicated in Table 3 Though it is good to have a good partnership with private and NGOs, the public actors are missed. This affects the sustainable knowledge generation function and dissemination of improved maize varieties.

**Betweenness centrality**: represents the degree of which nodes stand between each other. It is a way to detect how much influence a node has over the flow of information in a graph/network. Betweenness centrality quantifies the number of times a node acts as a bridge along the shortest path between two other nodes. Nodes that are more frequently on these shorter paths will have a higher centrality score. In the case of improved maize seed varieties, actors' analysis showed that the Bureau of Agriculture, Amhara Seed Enterprise and farmers-based seed multiplication scheme have the highest betweenness centrality and they are considered as the bridge stakeholders in the network.

A development agent in Abyot Fana kebele highlighted that:

> *"Farmers prefer P3812W as compared to other varieties. But as extension workers, we are not well informed about how this variety was developed and*

> *disseminated. We have no linkage with the owner of the variety. We send our request to the district office of agriculture and the office sent to regional bureau and then the regional bureau allocates to farmers' cooperatives. It would be better if the owner of the variety has a linkage with us to supply this variety as per farmers' demand."*

The public actors control the communication between different actors in improved maize varieties dissemination. This shows that these actors are 'bridges' between nodes in the network. The finding of this study is also supported by (Onumah, Asante, and Osei 2021) who reported extension (bridging domain) and research actors (supply domain) also formed the core of the cocoa innovation system. Similarly, (Teklewold et al. 2019b) identified the regional livestock agencies/bureaus, research centers and the regional animal health laboratories to have higher values serving as a bridge to connect other actors. Interdependent nodes/players tend to be social media innovators and brokers.

As indicated in Figure 3 and Table 3, the Bureau of Agriculture and AMSAP have the highest betweenness centrality. These two actors are serving as a bridge to the dissemination of P3812W. They combine different perspectives, transfer ideas between groups, and derive power from their ability to present and pull strings. But betweenness centrality assumes that all communication between nodes happens along the shortest path and with the same frequency, which is not the case practically. Therefore, it does not give us a perfect view of the most influential nodes in a graph, but rather a good representation.

**Eigenvector centrality**: In graph theory, eigenvector centrality (also called self-centrality) is a measure of the influence of a node in a network. It assigns scores to all nodes in the network based on the concept it connects to high-scoring nodes contribute more to that node's score than equal connections to low-scoring nodes. It is one method of computing approximate importance of each node/actor in a social network. This measure helps to find the most central actors, that is, those actors with the smallest farness from others in the network. Higher eigenvector scores indicate that actors are more central to the main pattern of distances among all the actors. Lower values indicate that actors are more peripheral than others in the network. The finding of this study indicates, Kebele office of agriculture, farmers-based seed

multiplication scheme and district office of agriculture have the highest eigenvector centrality than the other actors in the network. The result of Eigenvector centrality measure in table 3 revealed that niche level actors are more important or influential for sustainable generation, dissemination, and utilization of improved maize varieties. As a result, both public and private actors need to work closely with these actors. In addition, these actors have relational power at the level of niches (abilities of agents to draw on institutions). The finding of (Tesfaye et al. 2020a) also indicated actors with the strongest link having highest Eigen value are most central actors with the smallest farness from others in the network. In the present study, agents such as Pioneer Hi-Bred Seeds Ethiopia Plc and other private companies have the lowest Eigen values indicating these actors are more peripheral in the network. This also has an implication on their relational and power exercise for the generation and other functions of improved maize varieties.

## 5. Conclusion

This paper analyzed the functions, interactions, and power relations of actors in generating, disseminating and utilizing improved maize varieties. Understanding network relations and the power and characteristics of the different actors is needed to understand the functions of the system. Most of the functions in improved maize varieties were largely performed by the public organizations, which offered few opportunities for private actors. The conventional top-down and supply-driven approaches to extension are still used to disseminate improved maize varieties in the country. With respect to maize varieties developed by a private company, Pioneer Hi-Bred Seeds Ethiopia Plc has made a significant progress with the development of several varieties that are appropriate to farmers' needs. However, the ultimate availability of these varieties remains limited due to asymmetric power relation between the private and the public actors involved in the functioning of the system.

Evidence suggests that private sector involvement in technology development in Ethiopia is on the rise, particularly with respect to the production and distribution of improved maize varieties. However, this limits the participation of the public sector like research institutes and universities in

collaborative seed multiplication process. Promoting greater private investment in the production of improved maize varieties and in the establishment of independent distribution and marketing channels to farmers is one of the major recommendations of pervious research works (Tarekegn and Mogiso 2020; Kelemework et al. 2021). In this study, the dominant supply of innovation by the public sector was noted. This implies that public actors are more influential in the network's information flow, which affects the sustainable generation of improved maize varieties. Kebele and District offices of agriculture are the closest actors to each other in the sense that they share membership in all three cliques. However, innovation source actors (private actors) do not share any membership with these actors, indicating that private innovation generators are relatively unconnected to other network actors. The implications of the findings to improved maize variety innovations in the study area are (1) public service providers particularly regime actors are key nodes with respect to the function of improved maize varieties, and (2) private improved maize variety generators are largely peripheral. The findings suggest that the network may be insufficiently configured to provide farmers with ties to the innovation generators or knowledge developers. As a result, farmers operate with little access to the innovation developed by the private sector.

The findings of the paper suggest that despite the changing dynamics of the maize sector, innovation tends to follow a linear path of supply-driven technology dissemination through the public or private sector without full engagement of relevant actors involved in the functions of improved maize varieties. These are some of the challenges limiting maize production and its potential towards ensuring food security of smallholder farm families in Ethiopia. Hence, the paper suggests the need to further explore policies that create more space for interaction between private and public actors for the sustainable supply of quality improved maize varieties.

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13. In addition to the regular issues, CoDS may publish special issues of the EJDR that will be devoted to specific themes or programmes selected by the editors.
14. All articles submitted to the EJDR will be acknowledged, and status communicated to authors, but those not accepted for publication will not be returned to the authors.
15. Authors of published articles will receive two copies of the particular issue and five off-prints of their articles.
16. The copyright on all the contributions published in EJDR is retained by the College of Development Studies, Addis Ababa University.
17. CDS shall consider requests of authors to reprint their contributions elsewhere provided that the request is made in writing and the conditions stated in the copyright agreement are fulfilled.
18. Plagiarism, including self-plagiarism and reproducing once-own work, is a serious academic dishonesty; and therefore, CoDS is opposed to it. Committing such an offence shall entail litigations leading to a series of severe consequences, including loss of all rights resulting from the plagiarized work, compensations for the harm caused to the original sources, compensations for the image damage caused to EJDR and the costs incurred in producing and disseminating that particular issue of the Journal.
19. For non-commercial purposes, such as research and teaching, articles can be reproduced and used with due acknowledgement.
20. Authors are required to strictly adhere to the Editorial Policy of the Journal.

# *Ethiopian Journal of Development Research (EJDR)*

# Language and Style Guides

## I. General

Contributors are encouraged to submit good scientific papers, which should:

- present an accurate account of the research investigation;
- be clearly written and easily understood;
- follow the particular style of the scientific discipline;
- be free of jargon and local slang;
- have appropriate, relevant and adequate illustrative material;
- not contain any plagiarized material (plagiarism is a serious offence and is a serious charge against an author).

**Length:** the manuscript should

- be double spaced on A4 paper size with 2.5cm margins on all sides (left, right, top and bottom).
- be 20–30 pages (for articles); 7-10 pages (for critical reviews and feature articles/commentaries); up to 3 pages (for book reviews and short communications).
- contain proportional and adequate presentation of the major sections of an article.
- contain well-balanced graphics (tables, graphs, illustrations) and textual elements.

Before submitting the manuscripts for publication in EJDR, authors are required to follow the following styles and formats, which are widely used in academic journals in development studies and the social sciences.

**Structure:** articles should follow the TAIMRAD(C/R) format, where the acronym stands for: 1) Title page; 2) Abstract; 3) Introduction; 4) Materials and Methods; 5) Results and Discussion (either harmonised together or presented as subsequent sections); and 6) Conclusions/Recommendations, followed by the References section.

## II. Specific Details

### 1. Title Page

1.1. The Title Page shall contain the following shall details:

a. full title of the article, which should:
   - contain not more than 250 words;
   - avoid abbreviations, formulas and jargon;
   - specify the study period (for articles based on longitudinal and historical data);

b. name(s) of the author(s);

c. the titles(s), academic position(s), address (institutions of their affiliation, postal address, telephone, e-mail etc., for correspondence) of the author(s) footnoted at the bottom of the page with the use of asterisks;

d. other relevant information such as name and address of a corresponding author, if the paper was presented at a meeting or is part of a series study, should be noted at the end of the manuscript.

1.2. Information on authorship and degree of authors' contribution. It is the responsibility of the authors to list their names according to the degree of contribution made by each of them, in a decreasing order of contribution. Normally, the following rules apply:

- ☞ Equal contribution is presumed when the names are written in alphabetical order; or
- ☞ The degree of contribution shall be determined by the order in which the names appear, unless indications are given by the authors to the contrary.

1.3. All correspondences will be made with the author whose name appears first (unless otherwise specified).

### 2. Abstract

The manuscript should have an abstract:

- not exceeding 250 words;
- that briefly introduces the problem, research gaps and the study area;

- that outlines the methodology, mainly the study design, approaches, sampling strategies, materials used and methods of data collection and analysis;
- containing the key findings of the study, their implications and conclusions or key recommendations.

**3. Introduction**

In this section, the author(s) should:

- give background to the study problem and the rationales;
- present statements of the problem, setting the contexts, the nature and extent of the problem studied;
- indicate the study area and objectives of the research;
- introduce the research questions or hypotheses;
- present adequate review of the literature (both conceptual —including theoretical and conceptual frameworks— and empirical) related to the research;
- do all these in no more than five pages.

**4. Materials and Methods**

In here, authors are required to present clear account of:

4.1. the philosophical underpinnings, study design, approaches, sampling strategies, and methods of data collection and analysis. In so doing,

- ☞ standard methods need only be mentioned, or may be described by reference to the literature as long as it is readily available.
- ☞ modifications of standard techniques should be described.
- ☞ if the method is new, it should be described in detail.

4.2. design of the experiment, including the number of replications (if the article results from experimental or quasi-experimental research);

4.3. materials used, including:

- ☞ chemicals, laboratory equipment with the necessary technical specifications; standard units of measurement;
- ☞ any plants or animals involved, with exact descriptions of genus, species, strain, cultivar, line, etc.);

4.4. justifications as to why the materials and methods used were chosen over others.

## 5. Results and Discussion

Depending on the craft and choice of authors, as well as on what the subject matter warrants, results and discussion can be either intertwined together or presented under separate sections. In any case,

- present only results that add new insights to existing knowledge;
- only results based on data and information scientifically-drawn from sources, but free from authors' personal dispositions and biases.
- results should be simply and clearly stated;
- reduce large masses of data to means, along with the standard error or standard deviation;
- include only tables, figures and graphs that are necessary, clear and worthy reproducing;
- repeat in the text only the most important findings shown in tables and graphs;
- refer in the text each table and figure by its number;
- include negative data—what was not found— if they affect the interpretation of results;
- give only data that relate to the subject of the paper (in other terms, include concomitant/related findings only if they are important);
- provide adequate answers to all the research questions or pursue all the hypotheses/assumptions made at start of the study.

## 6. Interpretation of the Results

This section, which should preferably be embedded with the 'Discussion' section, should:

- not repeat what has already been said in the review of literature;
- show significance of the results;
- relate the results to the initially-stated objectives and research questions or hypotheses that were set out in the introduction;
- show how the results and their interpretations relate to (agree or disagree with) previous findings and their interpretations.

## 7. Conclusion and Implications/or Recommendation

This is the section where,

- the author(s) draw, based on the findings and discussions of their implications, logical conclusions about each research question or hypothesis;
- nothing (methods, observations or results) should come as a surprise (should not be mentioned for the first time);
- authors should avoid unnecessary detail or repetition from preceding sections;
- show implications for theory, policy, practice, and/or further research to follow up the results.

## 8. Citation and Referencing

8.1. All materials, referred to or quoted must be acknowledged properly. Plagiarism is a serious academic dishonesty, which is unethical and illegal.

8.2. EJDR uses the *author-date* system of citations in all of its publications. Thus, authors have to ensure that author-date citations in the text agree exactly with corresponding entries in the reference list and that all publication details are accurate.

8.3. Citation and referencing should be complete according to this Style Guide, which is adapted with modifications from the Chicago Manual of Style 16th Edition.

The author-date citation in a running text or at the end of a block quotation consists of the author's/editor's last name, and the year of publication. Examples:

- Author, year, page no.: (Johnson 1987: 22–25).
- Two sources, with one author having two works: (Sen 1999; Jenden 1978a&b).
- More than three authors/editors: (Kassoguè *et al.* 1996).
- Organisation, year, volume, page no.: (World Bank 1988, 2:47).

8.4. Direct quotations should be as short as possible and all details should be reproduced exactly (spelling, punctuation and paragraphing).

- ☞ Short quotes should be placed in quotation marks.
- ☞ Long quotations should appear indented and centered in the text without quotation marks.

8.5. References in the text should read as follows:

* Brown (1975: 63) has argued that the ...

OR

* One economist (Brown 1975: 63) has argued that...

Use "*et al.*" when citing work by more than two authors. Example: A new treaty (Goody *et al.* 1976) suggests...

The letters a, b, c, and so on should be used to distinguish citations of different works by the same author in the same year. Example: Brown (1985a, 1985c) insist that...

8.6. Essential additional notes should be indicated by consecutive superscript numbers in the text and collected on a separate page at the end of the text, titled *End Notes* and placed before the 'References'.

Numbered notes should be used to denote clarifications about the references used, to include points left out in the text, to add some items which readers may want to know. If the citations or references in the text are too long, or consist of more than three names, it may be advisable to put them in the ***Notes*** at the end.

8.7. All references cited in the text and other supporting material should be listed alphabetically by author in a section titled References. Ethiopian authors should be listed alphabetically by first name first. Shiferaw Bekele, for example, should be listed under S and not under B. The same holds for Chinese names. Write out Ethiopian names in full in the Reference list (i.e., first and second names) as they are given in the publications cited. Do not abbreviate, for instance, as Shiferaw B. In the text, references may use first names only, or full names. Avoid, as much as possible, using honorific titles, such as Ato, Wzro, Dr., etc., in citations or references.

The following are examples of presenting bibliographical details of different entries

☞ ***Articles in Journals***

Alemayegu Lirenso. 1988. Food Aid and Agricultural Production in Ethiopia. *Ethiopian Journal of Development Research,* 10 (1): 59–90. (The last parts of the Journal can also be given as *Ethiopian Journal of Development Research,* Vol. 10, No 1, pp. 59–90.)

Cowley, R. 1967. The Standardization of Amharic Spelling. *Journal of Ethiopian Studies,* V. 2: 1–8.

***Note:*** The volume and issue numbers should be entered as they are given in the journals cited, i.e., if the numbers are in Roman or Arabic numerals, they should not be changed.

☞ ***Books***

Bahru Zewude. 1991. *A History of Modern Ethiopia, 1955–1974*. London: James Curry.

Clapham, C. 1988. *Transformation and Continuity in Revolutionary Ethiopia*. Cambridge: Cambridge University Press.

Donham, D. and Wendy James (Eds.). 1096. *The Southern Marches of Imperial Ethiopia*. Cambridge: Cambridge University Press.

Listing of several works by the same author should be by year of publication, the earlier work preceding the recent. example:

Levine, Donald. 1965. *Wax and Gold: Tradition and Innovation in Ethiopian Culture*. Chicago: University of Chicago Press.

_____. 1974. *Greater Ethiopia: The Evolution of Multiethnic Society*. Chicago: University of Chicago Press.

☞ ***Book chapters and other contributions in books***

Wood, A.P. 1982. Spontaneous Agricultural Resettlement in Ethiopia, 1950–1974. ***In***: J. Clarks and L. Konsinski (Eds.), *Redistribution of Population in Africa,* pp. 1150–82. London: Heinemann.

☞ ***Contributions in proceedings***

Taddesse Tamirat. 1984. Feudalism in Heaven and on Earth: Ideology and Political Structure in Mediaeval Ethiopia. ***In:*** *Proceedings of the Seventh International Conference of Ethiopian Studies, University of Lund 26-29 April 1982*, pp. 195–200, Edited by S. Rubenson. Addis Ababa: Institute of Ethiopian Studies.

☞ ***Conference papers***

Hyden, H. 1990. 'Ideology and the Social Sciences: The African Experience'. Paper presented at the OSSREA Social Science Conference, 8–10 May, Kampala, Uganda.

☞ ***Unpublished works***

Messing, S. 1957. 'The Highland-Plateau Amhara of Ethiopia'. Ph.D. dissertation, University of Pennsylvania.

Alula Abate, *et al.* [these should be listed]. 1986. Evaluation of the Impact of UNICEF-Assisted Water Supply Projects in Bale, Harerge, Shewa and Wello- Ethiopia. Programme Cycle 1980–1983. *Research Report No. 30*, Institute of Development Research, Addis Ababa University, Addis Ababa.

☞ ***Official publications***

Central Statistical Office. 1975. *Results of the National Sample Survey Second Round, Vol. V. Land Area and Utilization*. Addis Ababa: CSA.

World Bank. 1973. 'Agricultural Sector Survey, Vol. I, The General Report. Report no. PA-143a.' Washington: World Bank.

_____. 1989. *Sub-Saharan Africa: From Crisis to Sustainable Growth*. Washington: World Bank.

☞ ***Online sources***

Further to the details in the above categories, include the date of access and the URL of the site whereat the material was accessed.

## 9. Format

A4 paper size with 2.5cm margins shall be the standard page size.

### 9.1. Title

Titles should be set in title case, NOT in all caps and should not contain acronyms and abbreviations.

### 9.2. Endnotes

Authors are advised to use endnotes instead of footnotes.

Endnotes should be numbered consecutively throughout each chapter or article, and placed at the end of a work, in a section titled "Notes", after any appendix and before the reference list.

### 9.3. Acknowledgements

These should be placed at the end of the text next to the appendix but before the endnotes.

### 9.4. Headings

Major chapter headings must be in Title Case and centered on the page. Sub-headings must also be in Title Case but aligned with the left margins. A manuscript with subsections should be presented as follows:

| | | | |
|---|---|---|---|
| **10.** | 1. | 2. | 3. |
| 1.1 | 2.1 | 3.1 | |
| 1.2 | 2.2 | 3.2 | |

However, authors are advised to avoid using more than three levels of subheadings unless the complexity of the argument warrants it. Preceded by the decimal notations indicated above.

- 1st level titles should be set in Times New Roman 14pts, bold;
- 2nd level titles should be set in Times New Roman 12pts, bold;
- 3rd level titles should be set in Times New Roman 12pts, bold-italics, run-on with text.

### 10.1. Text

Text should be set in Times New Roman, 12pt font size, double-spaced. Block quotes should be indented from both sides and set in 11pt font.

### 10.2. Tables and Figures

- Tables should be used only where the data requires at least 2 rows/columns by 3 rows/columns. Shorter details shall be presented in text form.

- All tables and figures should be consecutively numbered and referred at the right place in the text.
- Titles of tables and figures should short and not in form.
- Each column and row of a table should have a proper title.
- All footnotes to, and sources of tables and figures, should be placed below them.
- Captions to figures should be placed immediately below the figures, followed by source information and Notes (if any) on some variables in the tables/figures.
- Keys to the different components of figures or graphs shall be placed at upper right corner within the boundary of the figure.
- Tables and figures should be used to present details and thus they should not be duplicated in text form. Unnecessary and lengthy tables and figures should be avoided, or, if important, should be annexed.

### 10.3. Abbreviations

Avoid use of dots in all familiar abbreviations, such as CSA, EEC, FAO, UNESCO, USA. However, dots should be placed at the end of the followings: e.g., etc., *et al.*, and other similar entries.

### 10.4. Language

- English is the medium of the Journal. Use one form of spelling, preferably the UK English (English English), throughout the article. Do not mix or switch between the two forms.
- All authors must avoid gender-biased and racist language.
- Use of discriminatory, inflammatory, and unethical expressions (derogatory, inciting, defamatory, etc. language) is unacceptable.

## 11. Copyright

The copyright on articles that would be published in EJDR would be relinquished to and retained by CoDS, AAU.