

ISSD Africa

Synthesis paper



Access to information on varieties in the public domain

Background

What is the issue?

Information on varieties is available in research reports, databases and variety release records, as well as in national and regional catalogues. However, oftentimes the information on these varieties and their use does not reach seed producers and farmers at the same rate that varieties become available. The more traditional variety release reports are not widespread, very few variety release committees have websites on which released varieties and their characteristics are presented, and there is little use of the more active mechanisms of information and communication technologies (ICT) to disseminate variety information. Furthermore, germplasm characterization and evaluation data from genebanks are not easily available and accessible. Although farmers have limited access to internet and research reports, they do generally have access to radio programmes and, increasingly, to television programmes, short message services (SMS) and social media. Nevertheless,

these contain little information on varieties. At the same time, there is no established forum where farmers can provide feedback on the information they get concerning seed they acquire. Furthermore, the kinds of media that are most commonly available to seed users, such as community radio broadcast programmes, are seldom interactive.

The information value chain regarding varieties involves different functions and actors, both primary and support service actors, all of which form part of a larger national information sub-sector. Elias Bizannes breaks down the activities related to the information value chain for varieties into two components:

- Primary value activities, which relate to aspects of the chain that are the core information product. They are data creation, information generation, and knowledge application.
- Supporting value activities which relate to aspects of the chain that assist the core information product. They are storage, processing, and distribution (Bizannes, 2010).

Table 1. The information value chain for access to variety information

Primary activity	Support services	Variety information	Details
Data creation and collection	Generation and storage services by variety release committees, regional variety release committees, CGIAR centres etc.	Availability of data on varieties (descriptors).	Variety catalogue with basic characteristics (maturity, taste, storage, basic planting instructions, etc.). Germplasm characterization and evaluation data from genebanks. This information is only relevant for seed producers.
Information generation and processing	Processing of data into information, or transformation of information, by information and communication services.	Access of information on varieties combined with where to get (foundation) seed, as well as information on the demand for preferred varieties.	Where to buy the seed variety (for farmers); or the quantities of early generation seed available (for seed producers). Feedback on demand from farmers and their preferences. Markets for the newly released variety (potential and effective markets).
Transformation of information into knowledge application	Distribution and promotion of information by business development and extension services.	Use of the information in enhancing knowledge.	Use of variety information and basic/starter seed in seed production, in different seed systems. Distribution and promotion tailored towards needs of seed producers (small packs, labelling etc.).

Source: Developed by the authors based on Bizannes (2010)

Data creation is about research and data collection, which concerns all the data that are used and needed to release a variety. Information generation is about combining the existing data with other sources of data to make it attractive information, which is in a form that is usable and accessible to the end user. Subsequently, this information needs to be applied as knowledge, requiring dissemination of the information to targeted users, and supporting its application. Important services for each of these primary information chain activities include the storage of the data services (e.g. variety catalogues, genebank databases); processing of the data services (e.g. linking data to needs of different categories of farmers, their interests and socio-economic and agro-ecological conditions); and dissemination and promotion services. One of the key pieces of this puzzle lies in the provision of appropriate and timely information on released varieties for different types of seed producers, which is the subject of this paper.

Focus of this study

The provision of information hinges on supply and demand factors. In terms of supply of information, information on varieties is available in research reports, databases and in variety release records, as well as in national and regional catalogues. Information on local varieties can sometimes be obtained through genebanks, but is largely obtained through informal local channels. Data on varieties are often not accessible for seed producers; for example, if the data has not been transformed into applicable information, or if there are no mechanisms in place for making the information accessible. Traditional and released variety reports are not widespread. Very few variety release committees have functioning websites that list released varieties and their characteristics, and even fewer make use of means such as ICT to reach out to seed producers and farmers. Consequently, the information does not reach seed producers and farmers and thus cannot be applied as knowledge. This latter part of the information value chain requires business and extension services to facilitate the use of the information.

Providing information on varieties to seed producers will not necessarily lead to higher production of quality seed of these varieties, and use of the seed of these new varieties. Variety use requires (farmer) field demonstration to illustrate the superiority of certain new varieties over old varieties. Access to variety information does not eliminate larger, contextual factors (infrastructure, politics, and economy) that affect agricultural development.

Although demand for information on varieties exists (Lion, Rizopoulos and de Boef, 2013), seed producers, particularly small-scale and informal, face several constraints regarding access to this information, which is further



Photo: Dan Kiambi, ABCIC

Farmers in Kenya giving feedback on genebank sorghum materials

compounded by limited access to internet and therefore to relevant catalogues and research reports. The majority of seed producers have access to radio programmes, and a growing number of them also have access to SMS services and television. However, oftentimes the information supply is lacking as little information on publicly released varieties is provided through these channels.

Notwithstanding these constraints, a range of initiatives and case studies on access to information are emerging from which lessons can be learned. In the next section, examples will be presented about innovative variety information practices, followed by some lessons learned and recommendations for scaling up the provision of information.

The cases studies and analysis focused on (i) information generation and processing, including the related communication services and mechanisms; and (ii) knowledge application of seed producers involving seed business development services and extension. The latter was also partly tackled by two other sub-themes on agreements for obtaining access to public varieties, and access to foundation seed of the public varieties. The focus was on novel mechanisms, hence traditional forms of providing information on varieties through printed catalogues are not discussed. "Novel" in this context equates to some form of ICT, largely because ICT provides major opportunities to improve access to varietal information. More and more seed producers (including small-scale and informal) are being connected to new forms of ICT.

Action learning method

Research questions

The leading question that needs to be answered is: *What novel mechanisms support the dissemination of information on varieties early and at scale to farmers and seed producers (farming communities, private seed companies and other seed producers), thereby contributing to enhanced access to varieties in the public domain?*

With an integrated seed sector development (ISSD) lens, the action learning component zoomed in on the role of information flows in formal and informal seed systems, as well as in the seed value chains. It also revealed the need for integrative approaches between systems and actors.

The following research questions were formulated based on the analysis provided in an ISSD scoping paper (ISSD Africa, 2015), and on the different functions in the information value chain:

On variety information generation, processing and dissemination

- 1 How effective are the models/mechanisms currently being used to provide information on varieties to seed producers and seed users?
- 2 What are the roles of, and opportunities for, ICT?
- 3 How does information in the seed value chain flow from one actor to another (mechanisms, contents)?

On knowledge application through focused dissemination and promotion

- 4 How do farmers and seed producers provide feedback on the information that they receive? How is variety information used in different seed systems (formal, intermediate and informal)?
- 5 How instrumental are extension services and farmers' organizations in enhancing access to information on varieties?
- 6 What is the relationship between actors in the information value chain (role in platforms; control of information)?

On trends and innovations

- 7 What are the new developments and trends in access to variety information, and what is new and innovative?

The overall synthesis on access to information on varieties in the public domain was based on a number of key inputs, such as background papers (Minneboo, 2015; Kleijn, 2016), action learning reports, synthesis meeting reports, as well as multi-stakeholder country workshops. Two desk studies were conducted to provide an overview of practices concerning access to variety information, to support the findings of this report. The first study outlined different

examples for each of the three steps in the information value chain: data creation, information management and knowledge application (see Table 1) (Minneboo, 2015). The second background paper focused on innovative variety information flows and mechanisms (Kleijn, 2016).

Action learning is about involving relevant stakeholders in project implementation and supporting change. In Kenya, the African Biodiversity Conservation and Innovations Centre (ABCIC), implemented an action learning project in the context of the existing crowdsourcing programme. Emphasis in this study was on a two-way information flow in informal seed systems for sorghum and cowpea. In Zambia, an action learning project was implemented by the International Center for Tropical Agriculture (CIAT) in the context of its regular bean variety improvement programme – the Pan-African Bean Research Alliance (PABRA).

All action learning project coordinators, thematic working group members and national focal points met in Nairobi in December 2015 to analyse the information and develop a synthesis, which is the basis of the current paper. The summary synthesis was subsequently fed back for discussion in national workshops in Zambia, Tanzania, Kenya, Uganda and Mali.

Local stakeholders raised the following research questions for each of the action learning projects:

- **Kenya:** How do different information systems contribute to variety access for smallholders and seed producers? What are the options for institutionalizing the crowdsourcing approach as a way of establishing a two-way information flow for local and released varieties? How can all actors in the seed value chain be involved in the management of variety information?
- **Zambia:** How effective are current models for disseminating information on bean varieties to end users and seed producers of various kinds? What is the role of local organizations in disseminating information on bean varieties? What are the mechanisms used by local institutions to disseminate information on bean varieties? What are linkages between bean variety suppliers and seed producers?

Action learning project in Kenya

This study involved the development of a desk study, which comprised a review of available documents, including published literature in refereed journals, unpublished sources such as technical and annual reports, information available from institution websites, as well as datasets and databases. The details of these publications and sources of information are provided in the reports of the research that was carried out. Field surveys were also conducted, in which both qualitative and quantitative data were collected using

questionnaires and interviews. Background studies focused on the assessment of the sorghum and cowpea seed systems, which were the focus crops of the study.

An analysis was conducted of the prevailing variety information-sharing mechanisms and the actual availability of sorghum and cowpea varieties. The main focus of the analysis was on the crowdsourcing of information and feedback on genetic material of sorghum and cowpea distributed to smallholder farmers and small-scale seed producers in the informal seed system. Farmers were supplied with small amounts of seed of local and improved varieties in order to analyse the performance. Farmers selected some materials they considered to have preferred characteristics for further multiplication, mostly in the informal seed systems. For data collection on crowdsourcing, (i.e. getting feedback from large numbers of farmers), field officers visited the crowdsourcing farms three times during the cropping season i.e. at sowing, at 50% maturity, and at harvesting. Data collected during these visits included: the farmer's name, variety codes, village, gender, education, household composition, age, Global Positioning System (GPS) information, phone number, date of sowing, date of 50% flowering, date of maturity, plant height, yield, ranking, and diseases or pests. Although 1,300 small seed packets were distributed, data were only collected from 1,084 farmers. Of these farmers, 924 (71%) provided complete data feedback, i.e. Hombolo 354/500 (70%), Nyando 238/300 (79%), and Wote 332/500 (66%). The reasons why data could not be collected from 376 (29%) farmers included: failure to plant, lack of rainfall, and lack of cooperation by the farmers.

In the follow-up to the crowdsourcing data collection, a survey was carried out in Nyando and Wote to assess the effectiveness of seed diffusion in the communities through the crowdsourcing approach. A random sample of 100 farmers was taken (50 farmers in each of the two sites),

and interviews were conducted using a questionnaire. In Nyando, representative villages were Kodero, Kokwaro, Kamwana, Koloo and Katuk. In Wote, the representative sites were Kambi ya Mawe, Kathoka, Kavinguni, Mu-vau and Kiumani. An analysis of gender representation reveals that overall more women participated than men in the crowdsourcing activity in the two sites. In Wote, the participation was 58% female and 42% male, while in Nyando participation was 59% female and 41% male. The crowdsourcing dataset was examined using Clim-Mob, a software package for analysing data generated by citizen science or crowdsourcing. Additional analyses were conducted using MS Excel, ArcMap and Google Earth for creating simple summary statistics and graphics (Kiambi, 2016a and 2016b).

Action learning project in Zambia

This project investigated the channels used by farmers and seed producers to access information on bean varieties in the Eastern Province of Zambia, particularly in Chadiza, Chipata, Lundazi and Vubwi districts. A study was carried out by CIAT in collaboration with Zambia Agricultural Research Institute (ZARI) and the Seed Control and Certification Institute (SCCI), as part of the bean programme PABRA. The study collected secondary data from stakeholders and carried out a survey of 300 bean-producing households, selected through stratified random sampling. Two focus group discussions were also conducted with farmers at Chadzombe and Chiwoko agricultural camps, to gain a better understanding of the context of the responses to the questionnaire used in the survey.

The study had three main components for data collection. In the first component, consultative meetings were conducted by two researchers from CIAT with various stakeholders in the bean value chain. In the second component, a questionnaire was used to carry out a survey in three

Table 2. Outputs of activities in Kenya

Activity	Output achieved
1 Assessment of seed systems (or seed value chain) for cowpea and sorghum in Kenya, with emphasis on information chain and flow, and partner analysis	Background paper – Seed systems and value chains in Kenya: case study on sorghum and cowpea (Kiambi and Mugo, 2015)
2 Analysis of variety information-sharing mechanisms	Technical paper – Potential ICT mechanisms for sharing varietal information in Africa (Kiambi, 2015a)
3 Study on accessing material in the public domain, cataloguing varieties and the current status of officially released varieties of cowpea and sorghum	Technical paper – Accessing germplasm from the public domain and processes for development of improved varieties: examples of officially released varieties (sorghum and cowpeas) in Kenya (Kiambi, 2015b)
4 Study on crowdsourcing, including variety (local and released) information process and adoption in Kenya, and follow-up by farmers	Case study report - Crowdsourcing as a novel strategy for seed distribution to farmers: a case study in East Africa (Kiambi, 2016a)
5 Development of final report, focusing on seed delivery mechanism (based on experiences from eastern and western Kenya)	Final report - ALP on information-sharing mechanisms. How farmers get information and provide feedback on varieties in the public domain. Technical paper, May 2016. ABCIC (Kiambi D., 2016b)



Small seed business accessing foundation seed from research to produce QDS of improved sorghum for sale to neighbouring villages at Singida, Tanzania

districts – Chipata, Lundazi and Vubwi – each with two locations (camps). In this study, 50 bean-producing households from each agricultural extension camp were targeted for interviews. A stratified random sampling of willing households was carried out by bean growers, who had themselves been selected from each camp by the agricultural extension camp officer. In total, 300 household interviews were conducted face-to-face. Farmers were made aware beforehand of the objectives of the survey through the agricultural camp extension officers. The interviews were carried out to collect baseline household data about bean production and related activities in the targeted areas prior to the study, in order to achieve a meaningful analysis. The third component of the study comprised two focus group discussions that were conducted with farmers and camp agricultural extension officers in Chadzombe and Chiwoko agricultural extension camps, in Chadiza

and Chipata districts respectively. The discussions aimed to gain a better understanding of the farmers' written responses to the survey, and to generate more information on the subject under investigation. The focus group discussions comprised leading bean farmers and agricultural camp extension officers from the camps at Chadzombe (6 women and 10 men) and Chiwoko (11 women and 25 men). In Chadzombe, the farmers had previously participated in a variety promotion project that was jointly implemented by PABRA (ZARI) and Plan International, between 2000 and 2003. Questions for discussion included: bean types grown by farmers and the reasons for choice, preferences on bean types, and preferred sources of information. During discussions, farmers also had the opportunity to share previous experiences on bean production. These processes of data collection were supported by a review of available literature.

Table 3. Outputs of activities in Zambia

Activity	Output achieved
1 Inventory of different plant variety communication channels and mechanisms	Feedback from multi-stakeholder consultative meetings
2 Development of a questionnaire/checklist (formal and focus group discussions)	Questionnaire/checklist used in three districts
3 Survey on variety information management	Data sheet
4 Focus group discussions with farmers' groups; and analysis of strengths, weaknesses, opportunities and threats (SWOT analysis)	Report on focus group discussions with farmers and extension staff
5 Data analysis	Database and survey report, with 298 respondents
6 Meeting of the innovation platform – Lundazi Stakeholder Platform (LUASP) – for follow-up action	Involvement of different members of the platform: public extension, seed companies, non-governmental organizations (NGOs), community-based organizations (CBOs) and seed producer organizations
7 Feedback discussions with stakeholders who are not involved in LUASP	Report on number of varieties distributed with information and quality control, presented in national workshop in Zambia
8 Final synthesis	Final report – Access to varieties in the public domain. How do farmers and seed producers get information and provide feedback on varieties in the public domain: the case of common bean in eastern Zambia (Maereka et al., 2016)

Results

Kenya: Two-way information sharing on sorghum and cowpea varieties

The study clearly illustrated that there are diverse mechanisms that have immense potential for providing information on varieties to farmers, and for obtaining feedback on varietal performance. It revealed that the informal seed chain actors comprise NGOs, farmers, farmers' groups and CBOs. They produce seed of local varieties, improved open-pollinated varieties (OPVs) and a mixture of the two. The seed includes farmer-selected and -saved seed, local market grain and farmer-/NGO-/CBO-managed seed production programmes. The actors and the informal system produce seed of OPVs of cereals, grain legumes, and vegetatively propagated crops such as sweet potato and cassava. The informal system and its actors account for over 90% of the seed grown in the arid and semi-arid lands (ASALs) of the eastern and western provinces of Kenya. Because it is based on rain-fed cropping systems, it is highly vulnerable to drought stress, leading to severe shortages of seed. Producers have limited access to breeder and basic seed of improved varieties. However, such seed from the informal system has potential for sustainable production, partly because it is derived from traditional systems and has limited demand for external inputs.

Many actors are part of the different seed systems and, in this case, the sorghum and cowpea seed value chains. One of the main challenges is how information on varieties in the public domain is exchanged between these actors and through which mechanisms. Actor configurations tend to become more complicated when moving down the seed value chain from variety production to variety use. Here below are some examples of how information is exchanged among the various actors in the seed value chains:

- Crop-based networks, which are multi-stakeholder information platforms (also virtual).
- Research for development (R4D) innovation platform, which is a multi-stakeholder platform that fosters change through knowledge application.
- Community-based seed value chain platforms, which include seed and cultural fairs, community-based seed bulking and seed banks.

The information-sharing mechanisms described in the report are mostly suitable for formal seed systems. Although a growing number of ICT-based initiatives provide agricultural extension and advisory services on seed and varieties in Africa, very little in the way of rigorous evidence-based impact evaluation of ICTs in agriculture has been conducted. The available literature reveals that most studies have only looked at impact on markets and prices, and even then the successes are inconclusive. There are scanty reports on the impact of ICT initiatives on

changes in: crop production practices, cropping patterns, the availability of varieties and technology, and variety adoption and productivity. However, studies carried out in several countries in sub-Saharan Africa revealed that innovative rural radio programmes, including drama and radio fora tailored to local communities, are an effective way of communicating agricultural messages.

There is no doubt that the advent of ICT has facilitated the dissemination of knowledge and information, and it is revolutionizing the use of technology in agricultural research, development and marketing. The wide range of ICT platforms have a great potential for increased use in dissemination of information on seed, varieties and their sources as well as information on other agricultural inputs. Nevertheless, there is a need for better integration of information between ICT service providers, the agricultural research and development sector and the private sector, especially private seed companies and agro-dealers.

The crowdsourcing approach, which is a form of participatory variety selection (PVS), aims at information sharing, mostly in the informal seed systems, between suppliers of genetic material (research and genebanks) and farmers and informal seed producers. The crowdsourcing approach demonstrates that communal farmers' selection skills can be used as a main entry point in the development of alternative approaches to seed innovations and diversification of varietal portfolios to meet food security and nutritional needs. Although crowdsourcing interventions often target a limited number of farmers, the informal seed and exchange systems allow farmers to share their collective local wisdom, indigenous knowledge and time, to offer new perspectives on varieties. When superior varieties are identified through crowdsourcing, they then spread to other farmers through informal seed diffusion mechanisms. As observed in this study, seed of a good number of varieties was exchanged informally and disseminated in the farmers' production systems. This will eventually contribute to the diversification and broadening of the genetic base of the production systems, making them more resilient to both biotic and abiotic stresses such as diseases and pests, as well as adverse environmental conditions including climate change. The compilation, collation and analysis of data from the crowdsourcing trials allows researchers to develop a shortlist of elite varieties based on a combination of the feedback from farmers and variety-specific data previously collected from on-farm or on-station trials. Arrangements can then be made to multiply the seed of these elite varieties, allowing wider access to both the seed and the pertinent information for farmers and seed producers.

The methodology tested in this project serves as a "proof-of-concept", which illustrates that a combination of socio-economic processes, scientific methods and participatory



Farmers providing feedback to researcher on genebank material

varietal selection is needed for the development of an effective two-way varietal information delivery mechanism. The crowdsourcing approach provides information that is useful to both farmers and seed and input suppliers. More research may be needed to develop the approach into a platform that serves the two-sided market for agricultural technology (Minneboo, 2015). The study has clearly demonstrated that the crowdsourcing approach is practical and largely effective in the dissemination and diffusion of varieties (through seed) in local communities. The crowdsourcing approach and the practice of distributing seed packets could be suitable for both the formal and informal seed systems.

Zambia: Access to information on bean varieties for smallholders and seed producers

The study revealed that the cropping systems in the districts surveyed were diverse: the 300 bean-producing households cultivated a wide range of crops, including maize (87%) groundnut (66%), soybean (61%) and sunflower (57%), suggesting an interest in oil crops. The farmers planted two types of beans – local varieties and improved varieties – under rain-fed and irrigated wetland conditions. The majority of respondents (88%) planted local varieties, while only 6% planted improved varieties. Only 6% reported planting both local and improved varieties, while just 1% of the respondents did not know whether they had planted local varieties or improved varieties. Most farmers (65%) indicated that high yield is a top priority when selecting both local landraces and improved varieties of beans, while good taste and short cooking time followed in distant second and third respectively. Interestingly, one of the varieties perceived to be fast cooking, ‘Kapika balesi’, was the least preferred bean type for relish. ‘Red Lundazi’ was the most preferred bean type for relish (42%), followed by ‘Kalima’ (18%) and ‘White’ (17%).

Currently, 31 bean varieties are registered in Zambia, and of these 21 are available in the market. Eight varieties were developed by the private sector, the rest were developed by ZARI and SCCI, often working in collaboration with international partners. ZARI released ten improved bean varieties between 2004 and 2014, but the survey results showed very

low levels of awareness on these improved varieties among farmers. Farming communities interviewed in the Vubwi, Lundazi and Chipata districts of the Eastern Province were often completely unaware of the existence of these varieties. The most well-known improved bean variety of the ten released was ‘Kabulangeti’, with 69% of farmers aware of this variety. Farmers who were aware of the improved varieties cited the lack of available seed as the main reason for not growing those varieties. Other reasons included low grain price on the local market (19%), the high cost of seed (4%), and lack of knowledge or insufficient information on the varieties. Survey data showed that the main seed sources were intermediate or informal and not the formal seed system. Of the bean seed planted, 51% was obtained from local grain markets followed by 21% from farmer-to-farmer (F2F) seed exchanges. In sharp contrast, these markets only supplied information on varieties to 4% of the respondents in this study.

Farmers received information on improved bean varieties through informal contacts (29%), agricultural extension area (camp) meetings (19%), and agricultural shows (14%), while information on local varieties was only obtained through informal contacts. Several extension systems exist, but the Ministry of Agriculture was recognized by respondents as the main source of information (notably on improved varieties) and skills, followed by cooperatives, such as Zambia National Farmers’ Union (ZNFU).

Varieties developed by the formal sector were multiplied and distributed informally, but without sufficient information. Results of the study reflected the need for a rethink on the use of print materials, as most respondents expressed dissatisfaction with publications about information on improved bean varieties. On the other hand, informal contacts were considered satisfactory, but respondents lamented the inconsistency of the information flow. More effort is required to use information options that facilitate direct contact with the varieties, including on-farm demonstrations, agricultural shows and field training sessions of a longer duration. Television and radio continue to be desirable channels of information among farmers. However, a two-way system that allows farmers to give feedback is preferable.

Bean varieties are largely accessed by farmers as quality seed through the informal seed systems (farmer-to-farmer seed transactions), as well as through quality-declared seed (QDS) systems for new varieties. Farmers themselves stated their most preferred method to access information on bean varieties is through interaction with other farmers (ZNFU lead farmers, F2F extension, field days and on-farm demonstrations), and through extension and SCCI-facilitated meetings (seed training, seed fairs and agricultural shows). These meetings provide a forum for seed producers and agro-dealers to interact.

Lessons learned

General

The focus of this analysis has been on access to information on varieties for seed producers. Farmers need to be informed about varieties before seed producers can react to farmers' demands and interest; farmers are also seed producers in informal seed systems. Often service providers combine different functions in the information seed value chain, but for the sake of clarity the main functions have been presented separately. Many information mechanisms, and communication and knowledge application services, focus on the formal seed systems only. This in itself is a constraint, considering the fact that farmers not only rely heavily on seed information from informal seed systems, but also learn mainly through interaction with other farmers. There is a strong need to integrate communication and advisory services in the formal seed systems with well appreciated services in the informal seed system. Such services in the informal system include farmers' meetings on seed and varieties (seed fairs, agricultural shows, etc.), combined with on-farm demonstrations; and the active facilitation of F2F extension, as implemented in a pluralistic extension system in which public, private and civil society actors work with lead farmers. Bridging gaps in information sharing between formal and informal seed systems requires the sharing of information on local varieties and improved varieties by seed producers (farmers and seed companies) and service providers (lead farmers and extension).

Information data creation and collection

Information on released varieties is in principle available through national seed catalogues, which are sometimes accessible online. Seed catalogues of the Regional Economic Communities, including seed catalogues of the Southern African Development Community (SADC) and of the Common Market for Eastern and Southern Africa (COMESA), are also being made available online¹. Such catalogues serve not only as a means of obtaining information, but also as a way of securing official, registered seed to support international seed trade. The Economic Community of West African States (ECOWAS), for example, developed the West African Catalogue of Plant Species and Varieties². The member states were also obliged to publish a national catalogue (an easy tool for member countries to see which varieties are listed in which country) and establish national seed and variety release committees. Only varieties registered in these national catalogues are authorized to be commercialized in the territory of ECOWAS. The abovementioned catalogues of public (and private) varieties consist of data for the key descriptors.

Some of the databases also have a selection function (albeit rarely) that provides contact details of where the seed of the described variety can be obtained.

Many of the varieties in catalogues, however, are not easily available. This can be attributed to different reasons. A variety can become obsolete but remain listed in the catalogue, or a variety may have been released but is not produced due to a lack of initial interest in breeder seed. Variety catalogues and databases of released varieties and other genetic material (genebank databases) may not be accessible because they are not available online, or often they are not understandable (formats, type of information or language), or they have not been updated. Major opportunities in ICT exist to improve this situation.

Information generation, processing and dissemination

A database (catalogue) of varieties or other genetic material on its own does not suffice, as it needs to be matched with other information before seed producers in the formal and informal seed systems can be convinced to start multiplication of the seed. Seed producers need information on where to get (foundation) seed, and information on the demand for varieties preferred by farmers.

A number of examples exist in which information on varieties is matched with information on the availability, source and price of (foundation) seed, as well as specific information on matching with different agro-ecologies, farmers' preferences and demands, and possible information on corresponding demand for produce. There are many examples of successful (ICT-based) variety information platforms including the following:

- Malawi's Airtel 321 mobile platform facilitates access to information on where to get seed of specific varieties.
- Mbegu Choice is a virtual platform, which was set up by Agri Experience Ltd in collaboration with the Kenya Agricultural and Livestock Research Organization (KALRO) and Kenya Plant Health Inspectorate Service (KEPHIS) in collaboration with several Kenyan seed companies.³
- West Africa Seed Information Exchange, WASIX, is an information platform that was set up by the West African Seed Programme (WASP) for seed producers to exchange information in seven WASP countries⁴.

ICT has offered new opportunities for providing access to information on varieties, as well as additional information on their use (including prices); for example:

- E-vouchers (on mobile phones), which are used for the payment of lead farmers (in Zambia) but also for the distribution of subsidized seed that

¹ Available at <http://sadcseedcentre.org/index.php/catalog> and <https://varietycatalogue.comesa.int/web/varietycatalogue>; accessed 28 January 2017.

² Available at <http://www.fao.org/docrep/010/i0062e/i0062e00.htm>, accessed 28 January 2017.

³ Available at www.mbeguchoice.org, accessed 8 February 2017 and at www.agri-experience.com.

⁴ Available in two languages at www.wasix.net, accessed 9 February 2017.

is obtained through agro-dealers (e.g. in Zambia, Mozambique, and WASP countries).

- E-vouchers can also be provided in small amounts to stimulate farmers to get smaller quantities of seed at seed fairs and from agro-dealers; for example, through Mawa's Diversity for Nutrition and Enhanced Resilience (DiNER) project in eastern Zambia.
- Farmers can be provided with access to mobile platforms for receiving text messages or linking up with (community) radio programmes on varieties and seed, a process supported by extension, e.g. in Zambia with the ZNFU.

There is a special demand for national and international genebanks to provide information on local varieties and other genetic material, which could be useful with regards to the resilience of seed systems in the context of climate change challenges. A two-way information process is principally needed, as has been demonstrated in the learning activity on crowdsourcing. For many of the commodities that are important to smallholders, seed is sourced through informal seed systems, hence the need for farmer seed producers to have access to seed banks as well as to sources of improved varieties. Again, crowdsourcing as practiced by ABCIC (Kenya) provides a scenario of how this would work. However, this practice requires genebanks to maintain large quantities of seed of varieties that are identified as interesting through the crowdsourcing approach. The specific example provided of crowdsourcing for getting information to and from farmers is a good example of this two-way communication, leading to the following recommendations based on lessons learned:

- Consider using the approach for released varieties as well as for local varieties, bridging systems information gaps.
- Consider the effectiveness of the approach vis-a-vis other information-sharing approaches, such as participatory variety selection.
- Follow-up by making varieties available to all farmers in a particular agro-ecology, as in the informal seed system.

In general, two-directional information chains can assist in the improvement of information exchange by communication services and mechanisms. This would have to include questions relating to: farmers' information needs; feedback mechanisms of information provided to farmers; farmers' descriptors; quality record keeping by farmers and seed producers; and collaboration between radio communication and extension services.

There is an urgent need to match information on varieties with information about their demand and sources of the seed including foundation seed (e.g. through Mbegu Choice in Kenya). ICT can improve access to information if it is interactive with a feedback loop, hence the need

to integrate different sources of information (varieties, demand, farmer feedback etc.) into more accessible information and through affordable communication mechanisms. These are often organized by commodity and value chain organizations; for example, the seed platform, WASIX; the telephone databases of agro-dealers in Tanzania, which comprise 3,000 bean farmers; or the seed potato portal of the National Potato Council of Kenya (NPCK).

Knowledge application

Active distribution of information on varieties or promotion of varieties is crucial for applying that information as knowledge for seed producers and farmers. Services that are instrumental in this process are extension services for farmers and users of varieties, such as seed and business development services (private, public, NGOs and seed sector development projects). For the formal seed systems, business development service providers assist in developing successful business models for sales of certified and QDS of newly released public varieties. Sometimes these services are provided or subsidized through projects, such as AGRA's Program for Africa's Seed Systems (PASS) and Scaling Seeds and Technology Partnership (SSTP), and WASP. For informal seed systems, regular public and private extension services play a role in developing demand for seed of new varieties, and supporting farmers and communities in producing quality seed of these varieties.

Pluralistic seed extension systems. The role of extension services in the information value chain involves several challenges, such as: (i) coordinating and managing pluralistic extension systems; (ii) addressing diverse needs of different seed systems and services; and (iii) dealing with conflicts of interests between actors who provide embedded services (e.g. agro-dealers).

The coordination and management of pluralistic extension systems is a major challenge in seed sector development in general and in knowledge application in particular, due to the diverse needs of seed producers and farmers in the different seed value chains and seed systems. The diversity of service providers requires the alignment of extension strategies and messages across service providers (public and private, as well as civil society), notably on the recognition of different quality types of seed accessed by farmers and the related seed systems. Coordination can be extended to different types of services providers, such as communication services (e.g. community radio, mobile phone service providers) and extension services (public and private). The Zambian and Kenyan studies support a general finding on the importance of the informal seed systems and the role of farmer-to-farmer extension, such as working with lead

farmers (especially women), and participating in field days and on-farm demonstrations. In this way, the studies revealed the need to close the information gap between formal and informal seed systems. Key challenges here are the incentives for these farmers e.g. local seed production (Kenya), or payment in seed vouchers (Zambia).

Seed is increasingly becoming a private good, and so it is not surprising that private service providers (small- and larger-scale) are combining advisory services with the sale of quality seed. Examples exist from Malawi, where individuals provide information on varieties and nutrition and are paid by the community⁵; and from Kenya, where the Farm Input Promotions Africa (FIPS-Africa) project facilitates the provision of information and sale of quality seed of improved varieties⁶. Moreover, agro-dealers (registered, as well as community agents) combine the supply of seed with extension services. This can potentially lead to conflicts of interest in variety service delivery. Seed companies, seed traders and agro-dealers are important suppliers of seed of different varieties. Whether the information they provide is unbiased or reliable needs to be closely scrutinized as they have different interests. In this context, a number of suggestions have been made on coordination and transparency. Extension service providers (public or private) could conduct additional checking or play the fall-back role (farmer x agro-dealer x extension agent 'triangle'). Other mechanisms could be mobile phone access to independent sources of information (as pioneered by the Syngenta Foundation for Sustainable Agriculture in Mali), and multi-stakeholder seed platforms for information on quality control. In many countries, the national seed authority responsible for seed quality control (certified and QDS) also inspects agro-dealers, while in other cases this accreditation is carried out by the ministry of trade. The question arises as to whether this agro-dealer accreditation process can be used to institutionalize some sort of code of conduct for agro-dealers on how information on varieties is provided (not only proper seed storage, but also communication and advice protocol on varieties). Training of agro-dealers' associations is another option, but solid organizations are rare due to trade secret interferences. An example is the certification by the Seed Trade Association of Malawi (STAM) of member agro-dealers, who then display their STAM licenses or accreditation in their shop.

Diverse needs of seed producers and farmers. Extension service providers require different variety promotion strategies for different seed systems. The type of extension service required can be clearly determined by these diverse needs. Private service providers can be very active in the provision of paid services to seed producers and farmers in the formal seed systems, and are becoming more and

more involved in quality control as a result of the opening up of seed quality services in the public sector. Communication and extension services in the formal seed system can be developed along the lines of the market information systems (MIS) and early warning systems (EWS), with an important ICT component.

In the informal seed systems, one often finds a mix of informal information and extension systems, such as farmer-to-farmer extension, examples of which can be seen in Kenya and Zambia. In such systems, interaction with community radio services becomes more important. In the intermediate or QDS systems, special information is required for locally adapted varieties of locally relevant commercial (food) crops. There is also a greater demand for training on local seed production and the organization of meetings and seed fairs for interaction and communication between farmers.

Provision of information and knowledge services at local markets and seed fairs. Most of the seed used by small-holders is purchased in the local market. It is bought at grain prices at planting time (often twice the harvesting-time price) and used as seed. An important challenge is how to use this system for access to information on new and existing varieties. The seed fair experience (e.g. the Mawa project in eastern Zambia) proved to be crucial in accessing information on varieties, as well as linking farmers to agro-dealers who supply these varieties as quality seed (certified and QDS in the case of Zambia).

The general, cross-cutting lessons learned include the need for a combination of extension and communication approaches (ICT, extension, radio, feedback mechanisms, and farmer-to-farmer extension) for the promotion of varieties as well as seed production. Multi-stakeholder information platforms (communication oriented with an ICT emphasis), as well as innovation platforms oriented towards knowledge application of seed value chain actors, are also important for interactive and two-way communication and seed quality control (e.g. LUASP in Zambia, facilitated by the Ministry of Agriculture). Decentralized and on-farm implementation of demonstration plots of improved varieties and local varieties remains an effective way of promoting varieties for different conditions, and farmer ownership over quality seed production.

Two-way communication for learning. It is important to use the most accurate and **reliable information** as a starting point when planning for seed demand and supply, and involve the **farming community** in participatory variety selection (and breeding) at an early stage in order to use farmers' information and feedback in the pre- and post-variety release process.

⁵ See Spencer et al. (under review) for further details.

⁶ See, for more details, <http://fipsafrica.org/>, accessed 15 February 2017.

Next

The desk studies and action learning projects have illustrated that access to varietal information varies greatly across countries, seed value chains and seed systems. This leads to an overall recommendation to learn from these experiences by aiming to close the gaps between systems, and make access to information on varieties in the public domain more inclusive.

The ISSD Africa stakeholder community of practice meeting held in Nairobi in 2016, and the ISSD national synthesis workshops in 2016, suggested therefore to support:

- Interactive learning between countries on how information on seed demand is used for seed multiplication.
- Innovative combinations of communication and extension systems for intermediate and informal seed systems involving farmer-to-farmer extension and learning.
- Technical aspects of interactive ICT-based variety communication platforms and services.

- Regional variety information systems, as in value adding to the regional variety catalogues.

Key partners in such activities, and also represented in the ISSD platform meeting in Nairobi and in national meetings, include:

- Regional Economic Communities, including COMESA, the East African Community (EAC), SADC, ECOWAS, etc.
- CGIAR networks, the Forum for Agricultural Research in Africa (FARA) and sub-regional research organizations, such as the Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA), the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), and the West and Central African Council for Agricultural Research and Development (CORAF/WECARD).
- Many national actors in platforms including seed trade associations and seed producer organizations.
- Media – radio, television and community radio, as well as social media.

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ISSD Africa is a community of practice that unites African seed experts, seed programmes and associated organizations, and which aims to increase farmers' access to quality seed through the development of a market-oriented, pluralistic and vibrant seed sector in Africa.

The ISSD approach is a farmer-focused and demand-driven seed sector development approach, which caters for the diversity of seed demands. Through this approach interventions are designed that are tailored to specific crops, value

chains and seed systems. It is a seed sector-wide and inclusive approach.

ISSD Africa is coordinated by a consortium of Wageningen Centre of Development Innovation (CDI) of Wageningen University & Research, the Royal Tropical Institute (KIT), the Future Agricultures Consortium and Tegemeo Institute of Agricultural Policy and Development in Nairobi Kenya.

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