

their study conducted in Mbeere South County, Kenya, reported that Gadam and Serena had been adopted by farmers while Seredo and KARI Mtama 1 are adopted by very few farmers. Gadam is reported to perform well in the drier lowlands of Machakos, Kitui, Mwingi, Makueni, Tharaka, Mbeere, Kilifi, Tanariver, Marsabit, Moyale, Homa-bay and Kajiado.

Farmers using Decision Support Systems

This section sought to find out if the sorghum farmers used any mobile applications for decision making before, during and after for their sorghum production. Farmers interviewed, majority, (80%) did not use DSS while (20%) used different DSS to access sorghum information as shown in Figure 4. The number of sorghum farmers using mobile apps was observed to be very low as shown below.

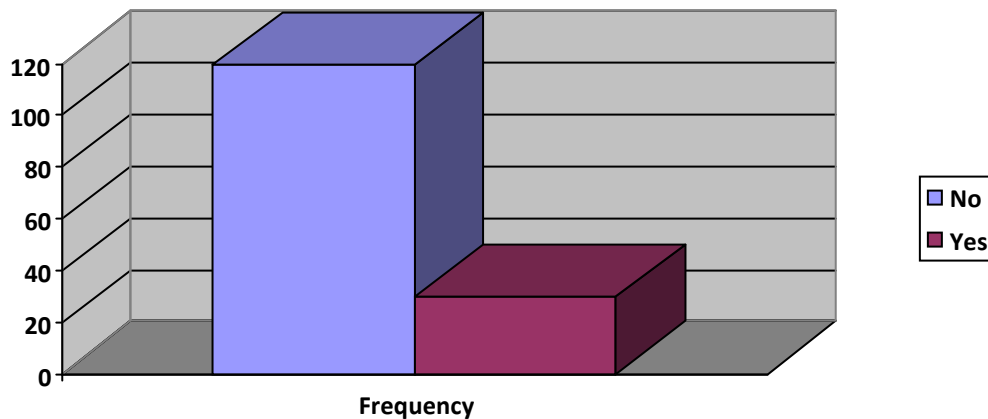


Figure 4: Farmers using DSS for sorghum information

The farmers using the DSS are few probably because when developing the system, the developers do not have the user's needs in mind and therefore there is high chance of farmers being unable to interact with the system. The findings are in line with [25] research on DSS where he noted the underutilization and ineffectiveness of DSS. In addition, the AgriDSS are poorly adapted to farmers' needs and practices hence lack of use to their fullest potential ([26]; [27]; [28]). In recent times, the DSS have been re-developed by involving stakeholders. For example, DSS by [29] for improved communication; [30] with minimal data requirement.

An Improved Decision Support System

Respondents were asked whether they would like a new decision support system to be developed. 80.9% farmers would like the development of an improved decision support system while 19.1% were not for the idea (Table 4).

Table 4: Development of an Improved or New Decision Support System

	Frequency	Percent
No	28	19.1
Yes	122	80.9

Majority of the farmers would consider using a new DSS for entire sorghum value chain with information being disseminated in a simpler or vernacular language. For instance, the sorghum names to be standardized by using images and local names. This finding tallied with [31] research where test users would like a new application of a crop cycle with a language that farmers are more comfortable with. [32] Recommends that an AgriDSS must therefore be in line with the farmers' practice as well as farmers' needs, knowledge or experience for it to function properly.

Reasons for not using Mobile Applications

Application usage depended on the affordability, availability of network, interactivity, usability and awareness. Results in Table 5 that majority of farmers did not have any idea was 52% (78), expensive handset was 20% (30), interactivity was 9.3% (14), insufficient information was 7.3% (11), poor network connection was % (3), language complexity and expensive had 4.7% (7) each.

Table 5: Reasons for not using Mobile Applications

Reasons for not using Apps	Frequency	Percentage
Interactivity	14	9.3
Poor network connection	3	2.0
Expensive handsets	30	20.0
Insufficient Information	11	7.3
Language complexity	7	4.7
No idea	78	52.0
Expensive	7	4.7

Farmers have depended mostly on accessing agronomic information and other services through making calls and SMS. The SMS application bridges the information gap between sources (fellow farmers, researchers, and agrovets) and the targets. Through SMS, information on particular sorghum variety, from land preparation to production, harvesting, to harvest handling, value addition, markets and prices can be accessed. The SMS and calling were found to be ‘easily accessible’ for the mobile phone enabled services unlike other applications like Internet, Youtube, Whatsap and Facebook. Through SMSes, farmers are able to get instant alerts for commodities and markets and also for real time alerts.

Conclusions and Recommendations

From the survey, the low adoption of technology by sorghum farmers has contributed to the poor crop productivity and food insecurity in the Homa Bay County. This has been attributed by lack of awareness and training on the latest technologies that could help in proper and appropriate decision making process on sorghum production. The education level attained by the few sorghum farmers was significant in influencing the use of mobile-based applications like SMS and calls. Therefore, the information being relayed to farmers should be interactive and simple. Despite the numerous information sources, farmers are not informed of latest and available mobile apps that

could be used to access timely information hence the low sorghum productivity. More awareness and sensitization on the use of apps should be done through campaigns by the relevant authorities. Female farmers were noted to lag behind in the mobile-based usage yet they are the food providers. It is therefore, paramount that they are involved in the DSS development from farmers' needs assessment to the last stage of development.

On a new or improved DSS, sorghum information mainly on sorghum seed varieties selection, market pricing and available market, crop disease prevention and controls, need to be incorporated. The seed variety DSS tool will need to provide suggestions about seed varieties based on their agro-ecological zones. The DSS tool should have both Audio visual tool so that farmers who are physically challenged are also able to access information.

The young people must be encouraged to form Startups and AgTechagribusinesses. These mobile apps could be developed to provide farm-to-market advisory services, training, sharing topical information and keeping them informed of upcoming products, services and events.

The study recommends that any policy intervention on sorghum production, the national and county governments should provide the appropriate sorghum seeds acceptable to the farmers and suitable for agro-ecological zones.

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Conflict of Interest

This research paper has no conflict of interest.

Author Contributions

Conceptualization – Susan Mbanda; methodology – Susan Mbanda; formal analysis – Susan Mbanda; writing and draft preparation – Susan Mbanda; review and editing – Hillary Nyanganga, Evans Chimoita and Phoebe Ong’alo. All co-authors mentioned have contributed substantially to this work.

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