



SUPPORTING POSTHARVEST TECHNOLOGY DEVELOPMENT AND IMPROVEMENT THROUGH FEEDBACK

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ABSTRACT

The study examined ways of strengthening postharvest technology development and improvement through feedback. Data were obtained through interview schedules supplemented with key informant interviews while a multi-stage sampling procedure was employed in the selection of respondents. Firstly, eighteen (18) States where NSPRI postharvest technologies have been disseminated and adopted were purposively selected. Frequencies, percentages, means and weighted averages were employed in the analysis of data components. Results showed that 70% of respondents have never provided feedback on NSPRI technologies. Executives of various associations were used by 45% of NSK users, 59% of IFB users, and 48% of VPC users to provide feedback while 43% of PSSD users and 40% of HSD users shared opinions through NSPRI extension staff. In general, there exists a strong (NSK: 94% PSSD: 95.2% IFB®: 91% HSD: 88.6% VPC: 74.5%) willingness to recommend technologies among respondents even as they provided positive feedback on use parameters and components of the technologies. However, respondents opined that the roller and chimney (NSK), durability of polypropylene cover (PSSD), draining of thawed ice (IFB®), and bolted ring (HSD) require improvement. It is recommended that more durable material be used for the rollers (NSK) and polypropylene cover (PSSD) while outlet for draining of thawed ice (IFB®) and bolted ring (HSD) are positioned optimally.

Keywords: Review; Innovation; Postharvest; Processing; Research and Development

INTRODUCTION

Feedback, known in innovation management parlance as review is a crucial component of technological development and improvement. It is the information, perceptions, and inputs shared by stakeholders about their experiences with utilization of technologies, products, protocols, or services; it provides insight about overall outcomes, characteristics and/or consequences of technologies, products, protocols, or services disseminated to clientele not leaving out their deficiencies and fixes. It is the process of relating information from end-users back to research after having received or used an innovation (Oyetoro and Akinbode, 2010). Information gathered through feedback are reported to Research and Development (R&D) for making improvement to existing technologies or developing new ones from the scratch. The improvements made to agricultural technologies based on feedback have led to significant enhancement in user's satisfaction (Kimano *et al.*, 2010). Nonetheless, little or no consideration for feedback from end users have led to unrealistic, cost ineffective and sometimes culturally incompatible technologies.

The importance of feedback is heightened by the cavernous information gap existing between Research and Development (R & D), extension, and users of research results impacting negatively on overall agricultural development, especially development of agricultural technologies and practices (Omotayo, 2004). Feedback creates a relationship between research and consumers of agricultural technologies by fostering conversations around



and about agricultural technologies. Feedback could be in the form of commendation (positive) for an innovation or commendation for some component of the innovation, it could also be disapproval (negative) for an innovation or disapproval for some of its components. Commendation gives credence while criticism offers ideas to make improvement to the innovation.

Nigerian Stored Products Research Institute (NSPRI) among others is in the business of delivering improved postharvest technologies to stakeholders in Nigeria. In spite of its contributions to combating food losses, large scale empirical studies (studies with national spread) have not been conducted in recent times at improving on design, production, as well as on increasing efficiency of these through feedback from clientele. Furthermore, all technologies have inadequacies and or become antediluvian at some time, therefore this investigation will be seeking to provide answers to the salient topical question: What are technological paucities and fixes for NSPRI technologies from the standpoint of users of such technologies? Consequently, the fact that the utilization of passé technologies and methods are rife in research and development domain, the need to stem this anomaly calls for an investigation whose objectives are to (i) ascertain the gaps in selected Nigerian Stored Products Research Institute (NSPRI) technologies through feedback from relevant stakeholders, and (ii) generate data that will aid in improving deficient or obsolete NSPRI technologies based on feedback from users of such technologies. Furthermore, the findings would help make recommendations that would contribute to policy.

METHODOLOGY

The research design was cross-sectional. This employed the in-person feedback method. This method is usually done using standardized interview schedules whose intent is to bring to the fore perceptions, experiences, requirements and suggestions of users of a technology, product or service towards its improvement. The study was carried out in 18 states (Kwara, Kogi, Niger, Nassarawa, Osun, Ekiti, Lagos, Ondo, Ogun, Oyo, Delta, Rivers, Akwa Ibom, Edo, Abia, Ebonyi, Kano, and Borno) across the 6 geopolitical zones of the country.

Sampling Procedure and Sample Size

Multi stage sampling procedure were used for the study. At the first stage, eighteen (18) States where improved NSPRI postharvest technologies have been adequately disseminated and adopted in the past were purposively selected. The technologies of interest for this study were NSPRI Smoking Kiln (NSK), Parabolic-shaped Solar Dryer (PSSD), Ice Fish Box® (IFB®), Hermetic Steel Drum (HSD) and Ventilated Plastic Crate (VPC). Secondly, users of improved NSPRI postharvest technologies were selected from diverse locations within the eighteen (18) States earlier selected. Non-probabilistic techniques especially snowballing were also employed at this stage. Similarly, Agricultural Development Project (ADP), and local resource persons in selected seventeen (17) states, and the Agro Processing, Productivity Enhancement and Livelihood Improvement Support (APPEALS) project in Kano State assisted in survey mapping and enumeration. Essentially, past and present users of improved NSPRI postharvest technologies identified via previous NSPRI empowerment and popularization programmes were the focus of this investigation. Members of groups earlier empowered in Kwara, Kogi, Niger, Osun, Lagos, Ogun, Oyo, Delta, Rivers, Akwa Ibom, Edo, Abia, Ebonyi States were interviewed on utilization and feedback for these technologies: Fish Smoking Kiln, Ice Fish Box®, Ventilated Plastic Crate, Hermetic Drum and Parabolic-shaped Solar Dryer. Ekiti, Ondo and Nassarawa States: Parabolic-shaped Solar Dryer. Kano State: Hermetic Drums and Parabolic-shaped Solar Dryer; Borno State: Fish Smoking Kiln, Ice Fish Box®, and Hermetic Drum. A total of 4,500 interview schedules were sent out (250 per State) across



NSPRI technologies and along women and youth divide based on the data sheets of users of improved NSPRI postharvest technologies obtained from NSPRI, ADPs and APPEALS, 3,017 were returned (67% return rate). For this investigation, total valid responses retrieved was 2,202.

Pre-Testing of Survey Instrument

Face and content validity of the instrument was carried out by an assortment of experts from Department of Sociology, University of Ilorin, Nigeria. Using the Test-retest method, Pearson Product Moment Correlation was used to ascertain reliability of the survey instrument. The instrument was considered consistent as a reliability coefficient of 0.71 was obtained.

Data Collection and Analysis

Data was majorly collected through key informant interview. The data obtained were in nominal, ordinal, and interval levels. Feedback from respondents on postharvest technologies was obtained by means of a Likert-type scale and analyzed using the weighted average.

RESULTS AND DISCUSSION

Demographics of the Respondents

Table 1a shows the distribution of stakeholder along sex divide (a reflection of the focus of previous NSPRI empowerment programmes); male 36.5, female 63.5 (disaggregated: NSK; male 37.1, female 62.9; PSSD; male 25.5, female 74.5; IFB®; male 31.7, female 68.3; HSD male; 44.7, female 55.3; VPC; male 43.6, female 56.4). The mean age of users of these technologies is estimated at 44 years (disaggregated: NSK; 44; PSSD; 46; IFB®; 43; HSD; 45; VPC; 40), showing that respondents are relatively young. Across the technology divide, majority of the respondents are married. Marriage exerts influence on stakeholders to embrace improved technologies (Ajala *et al.*, 2017). Users of NSK, PSSD, IFB®, HSD and VPC have fish processing, grain processing and storage, fish retailing, grain processing and storage, and fruit & vegetable farming and processing as their major enterprises respectively.

Aggregated mean household size (Table 1b) is 6 (disaggregated household size for user of: NSK; 7, PSSD; 6, IFB®; 6, HSD; 7, VPC; 6). Majority of users of PSSD, IFB®, HSD, and VPC are secondary school graduates. While majority (33.3%) of NSK users are recipients of primary school education. Across board, respondents are educated; education influences the decision to utilize improved technologies (Namara *et al.*, 2013). A large majority of respondents belong to a group, membership of this is however skewed towards cooperative society.

Among users of these technologies (Table 1c), an estimated 65% do not have access to credit facilities while majority of those that do rely chiefly on non-institutional sources. That said, access to credit is a key to rural development as it is essential for promoting small and medium Enterprise (Attah *et al.*, 2018), non-access however decreases income by inhibiting productive investments (Akinlo, 2014). Table 1c also shows the aggregated average years of experience in the enterprise to be 12 (disaggregated years of experience: NSK; 11, PSSD; 12, IFB®; 12, HSD; 13, VPC; 11) implying that respondents are relatively well experienced. Add to the aforementioned, experienced users would have a lower level of uncertainty about technology performance (Adegbola, 2019). Also, Table 1c shows an overwhelming majority of respondents received technologies from government (NSPRI empowerment and popularization projects).

As shown in Table 1d, the pre-eminent mode of technology utilization for IFB® and VPC (transportation and handling technologies) is personal. For the first the least mode of utilization is personal and group (i.e. both) while group mode of utilization is the least for the



other. The lowest mode of technology utilization for NSK and PSSD (processing technologies) is personal. For the former the most prominent mode of utilization is personal and group (i.e. both) while group mode of utilization is foremost for the latter. For HSD, given its peculiarity as a low to medium storage technology, the principal mode of utilization is personal. Apart from VPC that is principally used at commercial level, respondents majorly utilized technologies for both subsistence and commercial purposes (i.e. both). Public extension system represents the most common source of information for stakeholders in Nigeria (Adegbola, 2019). Put in perspective, majority of respondents have had contact(s) with extension agents in the past 12 months with an estimated average of 3 contacts. Most users of NSK and PSSD (processing technologies) live in rural areas, however majority of respondents who use the IFB®, HSD and VPC live in suburbs. Finally, all respondent categories except users of PSSD have their business in the suburban.



Table 1a: Socio-Economics Information of Respondents

	NSK			PSSD			IFB®			HSD			VPC		
	Freq	%	Mean	Freq	%	Mean	Freq	%	Mean	Freq	%	Mean	Freq	%	Mean
Sex															
Male	179	37.1		111	25.5		145	31.7		344	44.7		24	43.6	
Female	304	62.9		325	74.5		313	68.3		426	55.3		31	56.4	
Total	483	100.0		436	100.0		458	100.0		770	100.0		55	100.0	
Age															
20 years Below	16	3.3		-	-		4	.9		25	3.2		2	3.6	
21- 30 years	39	8.1		18	4.1		51	11.2		56	7.2		5	9.1	
31- 40 years	123	25.5		118	27.1		142	30.7		242	31.5		16	29.1	
41- 50 years	181	37.5		160	36.7		166	36.4		249	32.4		23	41.8	
51- 60 years	103	21.3		100	22.9		70	15.4		160	20.8		8	14.5	
61 Years and above	21	4.3		40	9.2		25	5.5		38	4.9		1	1.8	
Total	483	100.0	44	436	100.0	46	458	100.0	43	770	100.0	45	55	100.0	40
Marital Status															
Single	22	4.6		75	17.2		23	5.1		27	3.5		7	13.0	
Married	415	86.1		328	75.2		390	84.9		665	86.4		40	74.1	
Widowed	28	5.8		13	3.0		30	6.7		47	6.1		3	5.6	
Divorced	6	1.2		5	1.1		11	2.4		12	1.6		-	-	
Separated	12	2.5		15	3.5		4	.9		19	2.5		4	7.4	
Total	483	100.0		436	100.0		458	100.0		770	100.0		54	100.0	
Major Enterprise															
Fish processing	457	94.6		21	4.8		105	23.1		4	.5		1	1.8	
fish retailing	26	5.4		-	-		345	75.2		2	.3		-	-	
grain processing/storage	-	-		159	36.5		7	1.5		725	94.2		-	-	
fruit & vegetable	-	-		79	18.1		1	.2		14	1.9		31	56.4	
farmer/processor	-	-		-	-		-	-		-	-		22	40.0	
fruit & vegetable	-	-		-	-		-	-		-	-		-	-	
marketer	-	-		-	-		-	-		-	-		-	-	
root & tuber	-	-		177	40.6		-	-		25	3.2		1	1.8	
farmer/processor	-	-		-	-		-	-		-	-		-	-	
Total	483	100.0		436	100.0		458	100.0		770	100.0		55	100.0	

Source: Field survey 2022



Table 1b: Socio-Economics Information of Respondents

	NSK			PSSD			IFB®			HSD			VPC		
	Freq	%	Mean	Freq	%	Mean	Freq	%	Mean	Freq	%	Mean	Freq	%	Mean
Household Size															
5 and below	170	35.3		161	37.2		191	41.9		298	38.5		23	41.8	
6 -10	270	55.7		254	58.0		220	48.2		383	49.9		30	54.5	
11 -15	36	7.5		21	4.8		35	7.2		73	9.5		2	3.7	
16 -20	4	0.8		-	-		12	2.6		16	2.1		-	-	
20 and above	3	0.6		-	-		-	-		-	-		-	-	
Total	483	100.0	7	436	100.0	6	458	100.0	6	770	100.0	7	55	100.0	6
Level of Education															
No formal education	43	8.9		96	22.0		68	14.9		87	11.3		6	10.9	
Primary	161	33.3		84	19.2		48	10.1		115	14.9		5	9.1	
Secondary	48	9.9		98	22.5		136	29.8		218	28.3		22	40.0	
Vocational/technical	43	8.9		24	5.5		24	5.3		55	7.1		7	12.7	
OND/NCE	76	15.7		72	16.5		108	23.7		176	22.9		8	14.5	
HND/BSC	94	19.5		47	10.8		63	13.8		99	12.9		6	10.9	
MSC	17	3.5		15	3.4		11	2.4		17	2.2		-	-	
PhD	1	0.2		-	-		-	-		3	0.4		1	1.8	
Total	483	100.0		436	100.0		458	100.0		770	100.0		55	100.0	
Membership of Association															
No	137	28.4		117	26.9		106	23.1		158	20.5		6	10.9	
Yes	346	71.6		319	73.1		352	76.9		612	79.5		49	89.1	
Total	483	100.0		436	100.0		458	100.0		770	100.0		55	100.0	

Source: Field survey 2022



Table 1c: Socio-Economics Information of Respondents

	NSK			PSSD			IFB®			HSD			VPC		
	Freq	%	Mean	Freq	%	Mean	Freq	%	Mean	Freq	%	Mean	Freq	%	Mean
Access to Credit															
No	302	62.5		328	75.2		317	69.2		479	62.3		31	56.4	
Yes	181	37.5		108	24.8		141	30.8		291	37.7		24	43.6	
Total	483	100.0		436	100.0		458	100.0		770	100.0		55	100.0	
Source of Credit															
Institutional	53	29.3		38	35.2		31	22.0		66	22.8		16	66.7	
Non institutional	128	70.7		70	64.8		110	78.0		225	77.2		8	33.3	
Total	181	100.0		108	100.0		141	100.0		291	100.0		24	100.0	
Years of Experience in the Enterprise															
10 years Below	317	65.4		255	58.9		269	58.9		408	53.1		37	68.5	
11-20 years	92	19.2		115	25.9		99	21.7		214	27.6		13	24.1	
21-30 years	37	7.7		55	12.7		48	10.5		89	11.6		3	5.6	
31-40 years	30	6.3		6	1.4		33	7.0		48	6.3		1	1.9	
41-50 years	7	1.5		5	1.2		9	2.0		11	1.4		-	-	
Total	483	100.0	11	436	100.0	12	458	100.0	12	770	100.0	13	54	100.0	11
Mode of Technology Acquisition															
Given by government	429	88.8		398	91.3		401	87.5		656	85.3		42	76.4	
Gifted	3	0.6		15	3.4		-	-		-	-		2	3.6	
Purchased	18	3.7		-	-		8	1.8		12	1.6		7	12.7	
Hired/leased	3	.6		11	2.5		-	-		-	-		2	3.6	
NGO	30	6.2		12	2.8		49	10.7		102	13.1		2	3.6	
Total	483	100.0		436	100.0		458	100.0		770	100.0		55	100.0	

Source: Field survey 2022



Table 1d: Socio-Economics Information of Respondents

	NSK			PSSD			IFB®			HSD			VPC		
	Freq	%	Mean	Freq	%	Mean	Freq	%	Mean	Freq	%	Mean	Freq	%	Mean
Mode of Technology Utilization															
Personal	112	23.2		37	8.5		172	37.4		273	35.5		27	49.1	
Group	169	35.1		275	63.1		149	32.6		230	29.9		12	21.8	
Both	202	41.7		124	28.4		137	30.0		267	34.6		16	29.1	
Total	483	100.0		436	100.0		458	100.0		770	100.0		55	100.0	
Level of Technology Utilization															
Subsistence	30	6.2		32	7.4		36	7.9		92	12.0		8	14.5	
Commercial	180	37.3		179	40.9		199	43.4		295	38.4		24	43.6	
Both	273	56.5		225	51.7		223	48.7		383	49.7		23	41.8	
Total	483	100.0		436	100.0		458	100.0		770	100.0		55	100.0	
Contacts with Extension Agents in the Past 12 Months															
No	88	18.0		65	15.1		97	21.2		145	18.9		12	21.8	
Yes	395	82.0		371	84.9		361	78.8		625	81.1		43	78.2	
Total	483	100.0		436	100.0		458	100.0		770	100.0		55	100.0	
Number of Contacts with Extension Agents in the Past 12 Months															
5 times and below	326	82.5		328	88.4		283	78.4		525	84.1		40	93.0	
6-10 times	46	11.6		29	7.8		67	18.5		73	11.7		3	7.0	
11-15 times	16	4.1		14	3.8		9	2.5		18	2.9		-	-	
16-20 times	6	1.5		-	-		2	.6		7	1.0		-	-	
21 times and above	1	0.3		-	-		-	-		2	.3		-	-	
Total	395	100.0	4	371	100.0	3	361	100.0	4	625	100.0	4	43	100.0	1
Region of Residence															
Rural	185	38.2		214	49.1		154	33.6		242	31.5		7	12.7	
Urban	129	26.8		79	18.1		122	26.7		262	34.1		14	25.5	
Sub-urban	169	35.1		143	32.8		182	39.7		266	34.5		34	61.8	
Total	483	100.0		436	100.0		458	100.0		770	100.0		55	100.0	
Region of Business Operation															
Rural	158	32.8		162	37.2		125	27.3		233	30.3		8	14.5	
Urban	146	30.1		115	26.4		153	33.4		234	30.4		15	27.3	
Sub-urban	179	37.1		159	36.5		180	39.3		303	39.3		32	58.2	
Total	483	100.0		436	100.0		458	100.0		770	100.0		55	100.0	

Source: Field survey 2022



Feedback Channels

According to Table 2, about 70% of respondents for this survey have never provided feedback(s) on NSPRI technologies. For those who have, these categories of respondents NSK users (45 %), IFB users (59%), and VPC users (48 %) have majorly shared their opinions through the executives of various association they belong to. However, users of PSSD (43%) and HSD (40%) shared opinions through NSPRI extension staff. The high percentage of respondents who have never provided feedback mirrors the low premium placed on feedback in the sector. This phenomenon however is not untypical of the agricultural sector in developing countries Nigeria inclusive, where stakeholders' reliance on extension staff in transmitting and receiving information has been ineffective due to low extension agent to farmer ratio. This dearth of feedback in the technology development space creates a chasm between subject matter specialist and end users of a technology; it leaves the former in the dark as to required improvement while the latter are sometimes stuck with obsolete technologies or those not in sync with current needs and realities of the time.

Table 2: Distribution of Respondents According to Feedback Channels

	NSK		PSSD		IFB®		HSD		VPC	
	Freq.	%	Freq.	%	Freq.	%	Freq	%	Freq	%
Sharing opinions about NSPRI technologies in the past										
No	340	70.7	307	70.4	366	79.9	465	60.5	34	61.8
Yes	143	29.3	129	29.6	92	20.1	305	39.5	21	38.2
Total	483	100.0	436	100.0	458	100.0	770	100.0	55	100.0
Channels of sharing about opinions on NSPRI technologies										
ADPs	32	22.4	40	31.0	13	14.1	56	18.3	3	14.1
NGO	-	-	7	5.4	2	2.2	16	5.3	1	4.7
Association Executives	64	44.8	26	20.2	54	58.7	111	36.4	10	47.7
NSPRI extension staff	47	32.8	56	43.4	23	25.0	122	40.0	7	33.5
Total	143	100.0	129	100.0	92	100.0	305	100.0	21	100.0

Source: Field survey 2022

Feedback on NSPRI Technologies

NSK is a technology for smoking/drying fish and meat. Its major components are the drying chamber with drying trays, a combustion chamber, and an oil collector. The charcoal variant was the focus of this investigation. Table 3a shows the opinion of respondents to be that the following components of the NSK; charcoal tray, door, oil extractor, fish tray, and metal sheet do not require improvement. They however hold that the roller and chimney components require improvements; the rollers are quick to get detached and the chimney needs permanent covering with a mesh.

Table 3a: Perceptions of NSK

	WS/N	Weighted Mean Score (WMS)	Decision
Door Air Tightness	1872/483	3.88	DNRI
Roller	945/483	1.96	RI
Chimney	1331/483	2.75	RI
Holding Capacity (Charcoal Tray)	1815/483	3.76	DNRI
Steel Strength of Kiln	2065/483	4.28	DNRI
Oil Extraction	2038/483	4.22	DNRI
Drying of Fish Smoking Kiln	2230/483	4.62	DNRI
Fish Tray	2038/483	4.22	DNRI

Source: Field Survey, 2022. *DNRI= Does not require improvement

*RI= Requires improvement, *WS= Weighted score, *N= Number of respondents.



PSSD is a form of confined solar dryer. It consists of transparent materials that provide a covering and transmit heat from the sun into the drying chamber. Table 3b shows the opinion of respondents to be that the following components of the PSSD: tray, frame, and aspirator do not require improvement. Similarly, respondents opine that drying time using the PSSD is ideal and products retain their natural color. Nevertheless, they opine that a higher gauge of polypropylene cover would enhance its durability.

Table 3b: Perceptions of PSSD

	WS/N	Weighted Mean Score (WMS)	Decision
Capacity of Tray	1763/436	4.04	DNRI
Durability of Polypropylene Cover	1264/436	2.90	RI
Strength of the Frame	1801/436	4.13	DNRI
Drying Time	1895/436	4.35	DNRI
Aspirator	1732/436	3.97	DNRI

Source: Field Survey, 2022. *DNRI= Does not require improvement

*RI= Requires improvement, *WS= Weighted score, *N= Number of respondents.

IFB® is used for handling, transporting, distributing and marketing of fish. It consists of a double-wall food-grade plastic with insulation between the walls. The box has a tight-fitting lid that is also insulated. As shown in Table 3c, respondents perceive that the size/capacity of box, roller/wheel, tightness of lid/cover do not require improvement. Nonetheless, they opine that outlet for draining of thawed ice be constructed to be at the same level with the floor of the box to allow for complete draining.

Table 3c: Perceptions of IFB®

	WS/N	Weighted Mean Score (WMS)	Decision
Draining of Thawed Ice	1199/458	2.62	RI
Size/Capacity of Box	1430/458	3.12	DNRI
Roller/Wheel	1630/458	3.56	DNRI
Tightness of Lid/Cover	2029/458	4.43	DNRI

Source: Field Survey, 2022. *DNRI= Does not require improvement

*RI= Requires improvement, *WS= Weighted score, *N= Number of respondents.

HSD are rigid airtight structures used to store durable agricultural produce both at domestic and commercial levels. They have tight-fitting lids which prevent oxygen and water movement between the environment and the stored produce. Table 3d reveals the opinion of respondents to be that the following components of the HSD; capacity of drum lid/cover, and material (steel) do not require improvement. They however hold that the bolted ring is fitted too close to the drum and requires other devices (spanner) to fasten and unfasten.

Table 3d: Perceptions of HSD

	WS/N	Weighted Mean Score (WMS)	Decision
Size/Capacity of Drum	3070/770	3.99	DNRI
Bolted Ring	2038/770	2.65	RI
Lid/Cover	3177/770	4.13	DNRI
Material (Steel)	3406/770	4.42	DNRI

Source: Field Survey, 2022. *DNRI= Does not require improvement

*RI= Requires improvement, *WS= Weighted score, *N= Number of respondents.



VPC are strong, rigid, easy to clean, stackable, nestable and reusable plastic crates for handling of fruits and vegetables. They allow for cross ventilation of air to prevent heat build-up when loaded with fruits and vegetables. As presented in Table 3e, respondents' feedback shows that strength of crate handle, holding capacity, ventilation of produce, durability of crate, and strength of the base function as desired and do not require improvement.

Table 3e: Perceptions of VPC

	WS/N	Weighted Mean Score (WMS)	Decision
Strength of Crate Handle	242/55	4.40	DNRI
Holding Capacity	244/55	4.44	DNRI
Ventilation of Produce	249/55	4.53	DNRI
Durability of Crate	238/55	4.33	DNRI
Strength of the Base	253/55	4.6	DNRI

Source: Field Survey, 2022. *DNRI= Does not require improvement

*WS= Weighted score, *N= Number of respondents.

Challenges Associated with usage of NSPRI Technologies.

Major challenges associated with the use of improved technologies under consideration are as follows NSK: roller, capacity of fish tray, and quality of charcoal tray material; PSSD: Fastening bolts piercing the polypropylene cover, polypropylene cover susceptible to tear, and the structure as a whole lacks protective barrier against domestic animals; IFB®: Scarcity and cost of ice, and small holding capacity; HSD: It is expensive, scarce, and not compatible with dominant practices in the sector; VPC: does not allow flexible arrangement during transportation, not a unit of measurement, and small holding capacity.

Willingness to Recommend Technology

Table 6 revealed an overwhelming majority of users of these technologies (NSK: 94% PSSD: 95.2% IFB®: 91% HSD: 88.6% VPC: 74.5%) were willing to make a recommendation to potential users. This suggests that the advantages of the technologies far exceed the seeming challenges accompanying use of these technologies.

Table 4: Distribution of Respondents According to Their Willingness to Recommend Technology

	NSK		PSSD		IFB®		HSD		VPC	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Will not recommend	4	0.8	-	-	5	1.1	24	3.1	5	9.1
Indifferent	25	5.2	21	4.8	36	7.9	64	8.3	9	16.4
Will recommend	454	94.0	415	95.2	417	91.0	682	88.6	41	74.5
Total	483	100.0	436	100.0	458	100.0	770	100.0	55	100.0

Source: Field Survey, 2022

CONCLUSION AND RECOMMENDATION

This investigation revealed that most users of postharvest technologies have never provided feedback that could aid improvement of technologies or the development of new ones from scratch. The most popular channels of providing feedback among respondents were through executives of various stakeholders' associations, NSPRI Extension Staff and State ADPs. Feedback garnered showed that four of the five technologies of interest had at least one component requiring improvement (NSK: roller and chimney, PSSD: durability of polypropylene cover, IFB®: draining of thawed ice, HSD: bolted ring). Despite the desire for these improvements, respondents' satisfaction with technology components and use parameters



is reflected in strong willingness to recommend these technologies. The positive feedback on most components of these technologies gives credence while negative feedback from the perspective of end-users on a few components call for further research to improve these technologies. It is suggested that long-lasting material be used for the rollers (NSK) and polypropylene cover (PSSD) while opening for draining of defrosted ice (IFB®) and bolted ring (HSD) are positioned optimally.

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