Original Research Article

Effect of Use of Tacit Knowledge Transfer Techniques on Organizational Performance of Kenya Agricultural and Livestock Research Organization Researchers

ABSTRACT

Tacit knowledge is key in managing the performance of agricultural research organizations. This study analyzed the adequacy of various tacit knowledge transfer techniques, how tacit knowledge transfer enables the achievement of KALRO's performance indicators, and the nature of the association between tacit knowledge transfer and researchers' performance. The study adopted a descriptive survey research design, employed cluster sampling and used a semi-structured questionnaire to collect data from 191 respondents in KALRO research centers. A 5-Point Likert Scale and Chi-square test were used to analyze the data. Collaborative research, workshops, and seminars are the most adequate techniques for transferring tacit knowledge among researchers and enhancing their performance. Cognitive Self-Motivation know-how, collective know-how and local know-how are the most useful types of tacit knowledge in enhancing researchers' performance. Management of agricultural research projects and writing of research fund-winning proposals were the performance indicators that researchers were most enabled to attain by tacit knowledge. Chi-square showed that there were significant associations between the types of tacit knowledge: Cognitive Self-Motivation Tacit Knowledge (x^2=62.66, p = .000), Collective Tacit Knowledge (x^2=53.78, p = .000), Global Tacit Knowledge (x^2=48.70, p = .000), Local Tacit Knowledge (x^2=79.307, p = .000), Relational Tacit Knowledge (x^2=46.77, p = .000) and performance of researchers. In conclusion, use of tacit knowledge transfer techniques enhances researchers' ability to achieve their organization's performance indicators and a significant positive association exists between tacit knowledge and researchers' performance. KALRO needs to encourage more use of the most employed techniques in management of agricultural research projects and writing of research fund winning proposals through workshops and seminars, and its policy makers need to ensure researchers apply these techniques to transfer tacit knowledge among themselves.

Keywords: Agricultural Researcher, Knowledge, Tacit Knowledge, Transfer Techniques, Performance

1. INTRODUCTION

Tacit and explicit knowledge management and use are very important in affecting performance of agricultural research organizations and hence transforming national and global economies. Explicit type is knowledge that is articulated, written down, or published academic one found in books, manuals and papers and therefore codified, and transmittable in formal, systematic language (Panahi et al., 2013 and Mucai, 2018). Tacit knowledge on the other hand is knowledge embedded in minds of individuals in form of skills, know-how, expertise, experience, ideas, values, emotions, insight, and mental models that employees obtain as they interact and learn through organizational processes (Chugh, 2015; Cheng and Chang, 2020). Although explicit knowledge is tangible, visible and often given more regard, tacit knowledge is its bedrock because before knowledge becomes explicit, it first exits as tacit. Due to the invisibility nature of tacit knowledge, most organizations mistakenly think, improvement in their organizational performance depends entirely on documented knowledge. In this way, they employ minimal effort to appreciate work done behind scenes by various types of tacit knowledge which include collective, relational, local, global and cognitive self-motivation tacit knowledge (Collins, 2010 and Insch et al., 2008). An organization that wants to sustain its improved performance needs to know the most adequate techniques its employees can use to pass on different types of tacit knowledge among themselves and how this affects their organizational performance. Tacit knowledge transfer techniques used by researchers in agricultural research organizations include, After Action Reviews, Collaboration Research, Communities of Practice, Job Rotation, Knowledge Interviews, Mentorship, Peer Assist Meetings, Retrospective Meetings, Seminars, Staff Meetings, Storytelling and workshops.

Previous studies inside and outside Kenya on tacit knowledge transfer in agricultural research organizations did not address the effect of use of aforementioned techniques on organizational performance of researchers. In this way, information on how researchers in Kenyan Agricultural Research Organizations including KALRO use mentioned techniques to transfer different types of tacit knowledge among themselves and how this affects their performance, is not well documented or known. Such information is very important and necessary to KALRO for coming up with strategic interventions on how tacit knowledge transfer among its researchers can be enhanced for the attainment of its performance indicators and ultimate improved research efforts. This study assessed

the effect of use of tacit knowledge transfer techniques on organizational performance of KALRO researchers by:

1. Analyzing the adequacy of various tacit knowledge transfer techniques for transferring different types of tacit knowledge
2. Determining the usefulness of different types of tacit knowledge in enhancing researchers' ability to perform
3. Establishing the extent to which KALRO performance indicators' achievement is enabled by tacit knowledge transfer
4. Ascertaining the nature of association between tacit knowledge transfer and performance of KALRO researchers.

1.1. Literature Review

1.1.1 Types of Tacit Knowledge

Most studies on tacit knowledge transfer have addressed tacit knowledge as a single entity yet it is of different types such as collective, relational, local, global and cognitive self-motivation know-how (Collins, 2010 and Insch *et al.*, 2008). Relational tacit knowledge refers to knowledge held in secrecy and whether it will be transferred depends on how those who need it relate with **the** knower. Such is the concealed scientific know-how behind technologies and innovations developed in agricultural research organizations. Collective tacit knowledge is know-how held collectively by a given group of people such as employees about how they work. Nkuruziza *et al.* (2016) indicates that employees have and use collective knowledge to deliver products and render service. Local tacit knowledge refers to knowledge used to accomplish short-term tasks while global tacit knowledge is know-how people use to fit long-range objectives of their work into the bigger picture or processes of their organization. Cognitive self-motivation tacit knowledge is know-how of behaviors (frame of mind) that invoke self-drive to deliver goals (Szulanski, 2006) and such behaviors enable employees to meet performance targets (Aswani, 2018).

1.1.2 Tacit Knowledge Transfer Techniques Used by Agricultural Researchers

There are various techniques that agricultural researchers use to transfer tacit knowledge among themselves. Seminars are used by experts including agricultural researchers to transfer tacit knowledge as they address specific topics, peer assist meetings are held to seek advice and

expertise of peers on a given issue, and After Action Reviews are used to review project events so far accomplished (Nikki, 2014) and they involve facilitators, writers, and subject matter professionals (Liebowitz, 2008). Collaborative research as put by Bansal *et al.* (2019) involves researchers, institutions, organizations **working** together in a coordinated manner to achieve agreed upon objectives. Communities of practice as indicated by Mohajan (2017) involve people with similar passions or concerns who interact regularly in group settings to exchange ideas on best practices in their areas of interest. While Lukwago *et al.* (2014) indicate that job rotation is neither common in agricultural research nor among the factors for removing discomfort among researchers, Lu and Yang (2015) indicate that it is an effective method for passing on tacit knowledge in an organization. Retrospective meetings are held at the end of a project or major piece of work to allow working team members to share their experiences, lessons learnt just like Stalesen (2015) indicates that they facilitate shared learning in a team or an organization after an event. In an agricultural research setting, retrospective meetings take a form of end of projects conferences. Knowledge interviews are an avenue where experts such as agricultural researchers are interviewed about their line of work during their tenure or when about to exit. Mentorship is used by mentors to transfer tacit knowledge in a given work area to those they guide. Association of Project Management (2006) indicates that mentorship is a useful way to pass on and increase knowledge. Storytelling involves people transferring their tacit knowledge by telling stories about their work experiences (Venkitachalam and Busch, 2012; Al-Qdah and Salim, 2013). Workshops are an interaction opportunity that enhances understanding (McCabe *et al.*, 2016) and agricultural researchers use them to interact and pass on tacit knowledge to each other for instance as they compile information materials.

1.1.3 Tacit Knowledge Transfer in Agricultural Research Organizations

Kabiru (2015), on “Knowledge management strategies and practices in Nigerian Agricultural Research Institutes”, addressed the techniques through which tacit knowledge is generated but never looked at the extent to which researchers use these techniques to transfer different types of tacit knowledge to each other and the effect thereof on their performance. Baguma (2016), while addressing retention and use of knowledge in agricultural research institutions in Uganda, asserted that knowledge can be retained through continuous acquisition, capturing and storing, using knowledge sharing techniques, availing and applying knowledge. Although this study mentioned ways for retaining knowledge, it did

not address the extent to which researchers use them to pass on different types of tacit knowledge among themselves and the effect this has on their performance. Goga *et al.,* (2017) addressed the role of Knowledge Management Systems (KMS) in retaining tacit knowledge in Kenyan research institutes where they stressed the need to use KMS to retain tacit knowledge but were silent on tacit knowledge retention by transferring its different types from researcher to researcher through use of tacit knowledge transfer techniques. Kahiga (2014) on knowledge sharing practices among crop researchers in former Kenya Agricultural Research Institute, looked at general methods of sharing knowledge but did not address the extent to which those researchers used those means to pass on different types of tacit knowledge among themselves and the effect thereof on their performance.

1.1.4 Tacit Knowledge Transfer Techniques' Effect on Organizational Performance Indicators

The effect of tacit knowledge transfer techniques on employees can be measured by how they enable them meet their organization's performance indicators. Similarly, the effect of use of transfer techniques on KALRO researchers' performance is determined by the extent to which they are enabled by tacit knowledge to achieve KALRO's performance indicators; Generation of Agricultural Technologies and Innovations, Provision of Technical Services, and Packaging and provision of Knowledge, Information and Technologies on agricultural products (Kenya Agricultural and Livestock Research Organization, 2017). (Kenya Agricultural and Livestock Research Organization, 2017). Further, based on performance indicators reported by Murumba et al. (2020) for selected Universities in Kenya, **"**writing research proposals that win funding" and "management of research projects" too qualify to be among performance indicators of a research organization such as KALRO.

1.1.5 Conceptual Framework

This study was based on the Knowledge Spiral Model by Nonaka *et al.* (2000) and which specifies that knowledge is created and managed in an organization through four basic sub-processes of socialization, externalization, combination and internalization. During this processes, knowledge converts from one type to another through four modes, thus from Tacit to Tacit (Socialization), Tacit to Explicit (Externalization), Explicit to Explicit (Combination) and Explicit to Tacit (Internalization). In context of this Model, when KALRO researchers use transfer techniques to pass on tacit knowledge

to each other, they do so through “Tacit to Tacit” process. It is on this basis that the theory becomes the bedrock on which this study is founded because transfer of tacit knowledge from a researcher to another researcher anchors on its “Tacit to Tacit” knowledge conversion or transfer process. Figure 1 shows the relationship between Use of Tacit Knowledge (TK) Transfer Techniques and Researchers' Organizational Performance (ROP). This figure illustrates the relationship between the variables used in the study. Use of TK transfer technique is the independent variable and affects ROP as the dependent variable to end up with Improved Organizational Research Efforts as output.

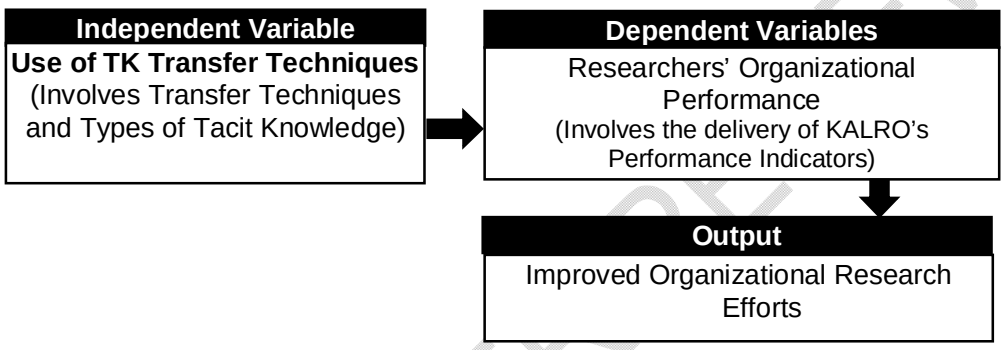

Figure 1 Conceptual Framework

(Source: Authors (2022)

2. RESEARCH METHODOLOGY

This study was done in KALRO centers listed in Table 1. KALRO is a corporation mandated to undertake and regulate agricultural research in Kenya. This study adopted a descriptive survey research design and targeted a population of 402 researchers from who a sample size of 201 was calculated at a confidence level of 95% (alpha level of 0.05) using Yamane (1967) formula as indicated in Figure 2.

$$n = \frac{N}{1+Ne^2} = \frac{402}{1+(402 \times 0.05^2)} = \frac{402}{2.01} = 200.5 = 201$$

Figure 2. Sample size calculation

In this formula, ***n*** is the sample size, ***N*** is the population size, ***e*** is the precision or significance level

This study adopted cluster sampling method since KALRO centers already existed as clusters dispersed across the country. Each center's proportionate sample size was derived by multiplying its population by a sample ratio of 0.5 derived by dividing the population of researchers by the sample size of 201 as shown in Figure 3. The centers' populations and proportionate sample sizes are presented in Table 1.

$$\text{Sample Ratio} = \frac{\text{Sample Size}}{\text{Population}} = \frac{201}{402} = 0.5 \qquad \text{Center's Proportionate Sample Size} = \text{Sample Ratio} \times \text{Center's Population}$$

Figure 3. Sample ratio and Center's proportionate sample size calculation formulae

Table 1 : KALRO Centers and their Populations and Proportionate Sample Sizes

No	Center	Target Population	Sample Ratio	Sample Size	Questionnaires	
					Sent Out	Received
1.	Alupe	3	0.5	2	2	2
2.	Embu	12	0.5	6	6	11
3.	Headquarters	28	0.5	14	14	21
4.	Kabete Biotecnology	15	0.5	7	7	7
5.	Kabete Food Crops	41	0.5	21	21	21
6.	Kakamega	22	0.5	11	11	11
7.	Katumani	24	0.5	12	12	6
8.	Kericho	8	0.5	4	4	1
9.	Kiboko	7	0.5	4	4	7
10.	Kibos Horticulture	12	0.5	6	6	1
11.	Kibos Sugar	21	0.5	10	10	15
12.	Kisii	7	0.5	3	3	1
13.	Kitale	22	0.5	11	11	13
14.	Lanet and Garissa	8	0.5	4	4	3

No	Center	Target Population	Sample Ratio	Sample Size	Questionnaires	
					Sent Out	Received
15.	Macadamia and PTC	6	0.5	3	3	5
16.	Matuga and Mariakani	4	0.5	2	2	3
17.	Marigat Perkerra	4	0.5	2	2	3
18.	Marsabit	8	0.5	4	4	5
19.	Molo	2	0.5	1	1	0
20.	Mtwapa	14	0.5	7	7	3
21.	Muguga Veterinary	18	0.5	9	9	6
22.	Muguga South	24	0.5	12	12	5
23.	Muguga Biotechnology	12	0.5	6	6	1
24.	Muranga Horticulture	12	0.5	6	6	9
25.	Muranga Sericulture	5	0.5	3	3	2
26.	Mwea	8	0.5	4	4	2
27.	Naivasha	11	0.5	5	5	2
28.	Njoro	20	0.5	10	10	13
29.	Ruiru-Coffee Center	16	0.5	8	8	7
30.	Tigoni	8	0.5	4	4	5
	Total	**402**		**201**	**201**	**191**

The 201 researchers were invited through email to fill an online semi-structured questionnaire. Participation in the survey was voluntary, and participants were assured the data they provide would be treated confidentially. The received responses were 191 (a return rate of 95%). Respondents were required to indicate their choices from those provided in the questionnaire. Further, respondents and were not allowed to skip any questions and this checked on submission of incomplete or unanswered questions. Data was collected on the techniques KALRO researchers use to transfer different types of tacit knowledge to each other and on the performance indicators in relation to how their achievement is enabled by tacit knowledge. Likert scale and Chi-square were used in analyzing collected data.

3. RESULTS AND DISCUSSION

The transfer techniques differed in their adequacy in passing on the types of tacit knowledge and in enhancing the researchers' ability to perform. The types of tacit knowledge also varied in their usefulness in enhancing researchers' ability to perform and their transfer among researchers had a positive significant effect on their performance.

3.1 Adequacy of Techniques for Transferring Different Types of Tacit Knowledge

Researchers were subjected to a Likert perception test where they were asked to indicate (on a 5-point Likert scale: 1=Not Adequate, 2=Neutral, 3= Adequate, 4=Very Adequate, 5=Extremely Adequate) the extent to which they found each technique to be adequate for transferring different types of tacit knowledge to each other. The "Not Adequate" and "Neutral" results were retained as such, while those for 3= Adequate, 4=Very Adequate, 5=Extremely Adequate were combined to form the final Adequate opinion. The techniques with the highest percentage for the final adequate (Adequate) opinion were denoted as the most used and adequate for transferring respective types of tacit knowledge.

1) Techniques Used to Transfer Cognitive Self-Motivation Tacit Knowledge

As per the ranking in Table 2, the three most used and adequate techniques in passing on Cognitive Self-Motivation tacit knowledge to enhance researchers' ability to perform were collaborative research, workshops and seminars. Collaborative research was the most adequate technique (90.6%) and this agreed with that of Abbas *et al.* (2019) that collaboration provides an avenue for stakeholders to create new knowledge.

Table 2 : Adequacy of Techniques Used to Pass on Cognitive Self-Motivation Tacit Knowledge

Tacit Knowledge Transfer Techniques	Frequency			Percentage (%)			Rank
	NA	N	A	NA	N	A	
Collaborative Research	1	17	173	0.5	8.9	90.6	1
Workshops	7	29	155	3.7	15.2	81.2	2
Seminars	6	30	155	3.1	15.7	81.2	3

Tacit Knowledge Transfer Techniques	Frequency			Percentage (%)			Rank
	NA	N	A	NA	N	A	
Retrospective meetings	9	32	150	4.7	16.8	78.5	4
After Action Reviews	8	34	149	4.2	17.8	78.0	5
Staff meetings	9	42	140	4.7	22.0	73.3	6
Peer Assist Meetings	13	39	139	6.8	20.4	72.8	7
Communities of Practice	11	45	135	5.8	23.6	70.7	8
Mentorship	6	59	126	3.1	30.9	66.0	9
Storytelling	33	50	108	17.3	26.2	56.5	10
Knowledge Interviews	56	56	79	29.3	29.3	41.4	11
Job Rotation	47	73	71	24.6	38.2	37.2	12

NA= Not Adequate, N= Neutral, A= Adequate

2) Techniques Used to Transfer Collective Tacit Knowledge

As shown in Table 3, Workshops (81.7%). Collaborative research (80.6%) and Seminars (76.4%) were the most used and adequate techniques for transferring collective tacit knowledge among KALRO researchers. Workshops were the first and this coincided with the findings by Azevedo and Rezende (2015) that workshops help in the transfer of tacit knowledge and they are an opportunity for interaction that enhances understanding McCabe *et al.* (2016). This meant that KALRO researchers were most adequately imparted with collective tacit knowledge during work related workshops which could have been for specific disciplines and hence for passing on collective tacit knowledge mostly.

Table 3 : Adequacy of Techniques Used to Transfer Collective Tacit Knowledge

Tacit Knowledge Transfer Techniques	Frequency			Percentage (%)			Rank
	NA	N	A	NA	N	A	
Workshops	7	28	156	3.7	14.7	81.7	1
Collaborative Research	5	32	154	2.6	16.8	80.6	2
Seminars	5	40	146	2.6	20.9	76.4	3
Peer Assist Meetings	11	38	142	5.8	19.9	74.3	4
Retrospective meetings	12	41	138	6.3	21.5	72.3	5

Tacit Knowledge Transfer	Frequency			Percentage (%)			Rank
After Action Reviews	11	46	134	5.8	24.1	70.2	6
Staff meetings	10	50	131	5.2	26.2	68.6	7
Mentorship	10	51	130	5.2	26.7	68.1	8
Communities of Practice	17	56	118	8.9	29.3	61.8	9
Storytelling	34	55	102	17.8	28.8	53.4	10
Knowledge Interviews	40	63	88	20.9	33.0	46.1	11
Job rotation	55	70	66	28.8	36.6	34.6	12

NA= Not Adequate, N= Neutral, A= Adequate

3) Techniques Used to Transfer Local Tacit Knowledge

As per results in Table 4, Collaborative research (76.4%) and Workshops (76.4%) were the most used and adequate techniques for transferring local tacit knowledge among KALRO researchers followed by Seminars (73.3%). This meant that researchers acquired knowledge on how to undertake specific short-term tasks to achieve their own and organizational goals. Further, this showed that researchers interacted more during collaborative research, and convert their existing tacit knowledge to new tacit knowledge according to Mucai (2018), and this happens at individual or local level. This concurs with what Blume (2010) reported that employees' performance involves achieving their own goals and those of their organization.

Table 4: Adequacy of Techniques Used to Transfer Local Tacit Knowledge

Tacit Knowledge Transfer Techniques	Frequency			Percentage (%)			Rank
	NA	N	A	NA	N	A	
Collaborative Research	4	41	146	2.1	21.5	76.4	1
Workshops	10	35	146	5.2	18.3	76.4	2
Seminars	11	40	140	5.8	20.9	73.3	3
After Action Reviews	12	47	132	6.3	24.6	69.1	4
Retrospective meetings	11	50	130	5.8	26.2	68.1	5
Peer Assist Meetings	10	52	129	5.2	27.2	67.5	6
Mentorship	16	48	127	8.4	25.1	66.5	7

Tacit Knowledge	Frequency			Percentage (%)			Rank
Communities of Practice	12	57	122	6.3	29.8	63.9	8
Staff meetings	15	59	117	7.9	30.9	61.3	9
Storytelling	37	64	90	19.4	33.5	47.1	10
Knowledge Interviews	35	66	90	18.3	34.6	47.1	11
Job rotation	61	63	67	31.9	33.0	35.1	12

NA= Not Adequate, N= Neutral, A= Adequate

4) Techniques Used to Transfer Relational Tacit Knowledge

As indicated in Table 5, Collaborative research (74.9%) was the most adequate technique followed by Workshops (73.3%) and Seminars (71.2%) in transferring Relational tacit knowledge among researchers and enhancing their ability to perform. This meant that each researchers acquired new concealed tacit knowledge behind scientific discoveries in line with what Abbas *et al.* (2019) put that a collaboration provide an avenue for stakeholders to create new knowledge.

Table 5 : Adequacy of Techniques Used to Transfer Relational Tacit Knowledge

Tacit Knowledge Transfer Techniques	Frequency			Percentage (%)			Rank
	NA	N	A	NA	N	A	
Collaborative Research	9	39	143	4.7	20.4	74.9	1
Workshops	16	35	140	8.4	18.3	73.3	2
Seminars	13	42	136	6.8	22.0	71.2	3
Retrospective meetings	18	39	134	9.4	20.4	70.2	4
Peer Assist Meetings	15	48	128	7.9	25.1	67.0	5
Communities of Practice	20	45	126	10.5	23.6	66.0	6
Mentorship	20	48	123	10.5	25.1	64.4	7
After Action Reviews	23	59	109	12.0	30.9	57.1	8
Staff meetings	28	54	109	14.7	28.3	57.1	9
Knowledge Interviews	39	52	100	20.4	27.2	52.4	10
Storytelling	42	60	89	22.0	31.4	46.6	11
Job rotation	61	63	67	31.9	33.0	35.1	12

NA= Not Adequate, N= Neutral, A= Adequate

5) Techniques Used to Pass on Global Tacit Knowledge

As shown in Table 6, Workshops (81.7%**)** were the most adequate technique in transferring global tacit knowledge among researchers and were followed by Collaborative Research (78%) and Seminars (72.3%). This indicated that researchers acquired global tacit knowledge more through workshops. This coincides with what Azevedo and Rezende (2015) found that workshops help in transferring tacit knowledge.

Table 6 : Adequacy of Techniques Used to Transfer Global Tacit Knowledge

Tacit Knowledge Transfer Techniques	Frequency			Percentage (%)			Rank
	NA	N	A	NA	N	A	
Workshops	5	30	156	2.6	15.7	81.7	1
Collaborative Research	5	37	149	2.6	19.4	78.0	2
Seminars	7	46	138	3.7	24.1	72.3	3
After Action Reviews	12	53	126	6.3	27.7	66.0	4
Peer Assist Meetings	11	56	124	5.8	29.3	64.9	5
Retrospective meetings	10	58	123	5.2	30.4	64.4	6
Communities of Practice	14	54	123	7.3	28.3	64.4	7
Staff meetings	12	62	117	6.3	32.5	61.3	8
Mentorship	15	63	113	7.9	33.0	59.2	9
Knowledge Interviews	40	66	85	20.9	34.6	44.5	10
Storytelling	42	69	80	22.0	36.1	41.9	11
Job rotation	58	65	68	30.4	34.0	35.6	12

NA= Not Adequate, N= Neutral, A= Adequate

3.2 Usefulness of the Types of Tacit Knowledge in Enhancing Researchers' Performance

The study sought to know how different types of tacit knowledge ranked in their usefulness in enhancing KALRO researchers' performance. A 5-point Likert scale (1=Not Useful, 2=Neutral, 3= Useful, 4=Strongly Useful, 5=Extremely Useful) was used and results for 1=Not Useful and 2=Neutral were retained as such, while for 3= Useful, 4=Strongly Useful, 5=Extremely Useful were combined into a final "Useful" perception as shown in Table 7.

Table 7 : Usefulness of Tacit Knowledge in Enhancing Researchers' Performance

Types of Tacit Knowledge	Frequency			Percentage (%)			Rank
	NU	N	U	NU	N	U	
Cognitive Self-Motivation Tacit Knowledge	0	13	178	0.0	6.8	93.2	1
Collective Tacit Knowledge	0	20	171	0.0	10.5	89.5	2
Local Tacit Knowledge	1	28	162	0.5	14.7	84.8	3
Relational Tacit Knowledge	4	29	158	2.1	15.2	82.7	4
Global Tacit Knowledge	0	40	151	0.0	20.9	79.1	5

NU = Not Useful, N = Neutral, U = Useful

Cognitive self-motivation (93.2%) was the most useful type of tacit knowledge in enhancing researchers' performance meaning that researchers' ability to perform was improved most by self-drive invoking behaviors. This concurred with Aswani (2018) that self-drive empowers employees to achieve goals. Collective tacit knowledge (89.5%) was the second most useful in enhancing researchers' ability to perform indicating that researchers gained tacit knowledge of how work in their fields is done and this resonated with Nkuruziza et al. (2016) that employees have and collective knowledge which they use to deliver products or services. Local tacit knowledge (84.8%) was the third in enhancing researchers' performance. This means that researchers acquired tacit knowledge on how to undertake short-term tasks at work and also achieve their own goals at individual level thus concurring with Blume (2010) that employees' performance involves employee achieving their own goals and those of their organization. Relational tacit knowledge **(**82.7%) was fourth in this enhancement and this showed that researchers related well among themselves to acquire concealed know-how behind the various technologies and innovations. Global tacit knowledge **(**79.1%**)** was fifth

in enhancing researchers' ability to perform and this indicated that this majority of researchers acquired tacit knowledge on how to align long-range objectives of their research projects with the bigger picture of KALRO.

3.3 Performance Indicators' Achievement Enabled by Tacit Knowledge

The study sought to establish the extent to which KALRO performance indicators' achievement by researchers was enabled by use of tacit knowledge transfer techniques. A 5-point Likert scale: (1=Not enabled, 2=Neutral, 3=Enabled, 4=Strongly Enabled, 5=Extremely Enabled), was used in this process and results for 1=Not enabled, 2=Neutral results were retained as such, while those for 3=Enabled, 4=Strongly Enabled, 5=Extremely Enabled were combined into the enabled perception as shown in Table 8.

Table 8 : Performance Indicators Ranked Based on How their Achievement was Enabled by Tacit Knowledge

Performance Indicators	Frequency			Percentage (%)			Rank
	NE	N	E	NE	N	E	
Management of Agricultural Research Projects	5	14	172	2.6	7.3	90.1	1
Writing Research Fund Winning Proposals	6	19	166	3.1	9.9	86.9	2
Agricultural Technologies and Innovations Generation	2	27	162	1	14.1	84.8	3
Knowledge, Information and Technologies Packaging	4	26	161	2.1	13.6	84.3	4
Provision of Technical Services	5	38	148	2.6	19.9	77.5	5

***NE** = Not Enabled, **N** = Neutral, **E** = Enabled*

As shown in Table 8, management of agricultural research projects (90.1%) indicated that tacit knowledge acquired from use of TK transfer techniques empowered them to manage projects. This means that this magnitude of researchers understood how to manage projects through tacit knowledge acquired through work-related workshops, which as put by McCabe *et al.* (2016) are an interaction opportunity that enhances understanding. Writing research fund winning proposals (86.9%) indicated to that tacit knowledge empowered them to write proposals thus concurring with what

Murumba *et al*. (2020) found that tacit knowledge in form of technical know-how is an enabler in writing proposals that attract funds. Agricultural technologies and innovations generation was at (84.8%) indicating h enabled to achieve this performance indicator by tacit knowledge thus concurring with Kabiru (2015) who reported that knowledge generated in Nigerian Agricultural Research Institutes was mainly on managing various crops and produced through use of various tacit knowledge transfer techniques. Knowledge, Information and Technologies (KIT) Packaging (84.3%) indicated that acquired tacit knowledge from their use of tacit knowledge transfer techniques enabled them to deliver this performance indicator thus coinciding with Murumba *et al*. (2020) that among the deliverables tacit knowledge contributes to organizational performance, include publications, collaborations and partnerships. Provision of technical services (77.5%) meant that these researchers were enabled to provide knowledge that is distilled and context-based information for addressing real life issues as put by Igbinovia and Ikenwe (2017).

3.4 Association between Types of Tacit Knowledge and Researchers' Performance

The study found that a positive significant association exists between transferred types of tacit knowledge and researchers' performance. All types of tacit knowledge, as shown in Table 9, had a statistical significance of (p=0.000), whereas each of them had a different Chi-Square value. Cognitive Self-Motivation tacit knowledge had (x^2=62.66), Collective tacit knowledge (x^2=53.78), Global tacit knowledge (x^2=48.70), Local tacit knowledge (x^2=79.30) and Relational tacit knowledge (x^2=46.77). With p-values less than 0.05, transfer of these types of tacit knowledge among researchers had a positive significant effect on their performance and ultimately that of KALRO. This resonates with what Murumba *et al.* (2020) and Muthuveloo *et al.* (2017) indicated that tacit knowledge is a key asset in enabling organizational performance.

Table 9 : Association between Tacit Knowledge and Performance of Researchers

Transferred types of tacit knowledge	Chi-Square (x2) Association Researchers' Performance	P≤Value
Local Tacit Knowledge	79.307	0.000***
Cognitive self-motivation Tacit Knowledge	62.663	0.000***

Transferred types of tacit knowledge	Chi-Square (x2) Association Researchers' Performance	P≤Value
Collective Tacit Knowledge	53.787	0.000***
Global Tacit Knowledge	48.702	0.000***
Relational Tacit Knowledge	46.773	0.000***

*** - significant at p<0.001

4. CONCLUSION AND RECOMMENDATION

The study concludes that agricultural researchers' use of tacit knowledge transfer techniques enhances their ability to perform and empowers them to achieve the performance indicators of their organization. Collaborative research, Workshops and Seminars are the most adequate techniques for transferring tacit knowledge among agricultural researchers and enhancing their performance. Cognitive Self-Motivation know-how is the most useful type of tacit knowledge for enhancing researchers' performance followed by Collective, Local, Relational and Global types of tacit knowledge. The performance indicators that KALRO researchers are most enabled to achieve by tacit knowledge are management of agricultural research projects, writing of research fund-winning proposals, and generation of agricultural technologies and innovations. Furthermore, the study concludes that there is a positive significant association between transferred types of tacit knowledge and performance of researchers.

The study recommends that the most employed techniques need to be used more in management of agricultural research projects and writing of research fund winning proposals through workshops and seminars. Further, this study recommends that policy makers in agricultural research organizations need to ensure their researchers participate in the most employed and adequate techniques for transferring tacit knowledge by putting in place policies that effect and facilitate further use of collaborative research, workshops and seminars.

REFERENCES

1. Abbas A, Avdic A, Xiaobao P, Ming W. University-government collaboration for the generation and commercialization of new knowledge for use in industry. Journal of Innovation & Knowledge. 2019;4(1):23-31.
2. Al-Qdah MS, Salim J. A Conceptual Framework for Managing Tacit Knowledge through ICT Perspective. Procedia Technology. 2013;1:1188–1194.
3. Association of Project Management (APM). APM Body of Knowledge, fifth edn, APM Publishing Limited, High Wycombe, Buckinghamshire, UK; 2006.
4. Aswani JO. Effect of Performance Measurement on Employee Engagement in Multinational Corporations in Kenya: Doctoral Thesis, Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya; 2018.
5. Azevedo FML, Rezende RR. Making university–industry technological partnerships work: A case study in the Brazilian oil innovation system. Journal of Technology Management and Innovation. 2015;10(1):173–187.
6. Baguma SD. Knowledge retention in national agricultural research organizations: the case of Uganda: Doctoral Thesis, Loughborough University, England, UK; 2016.
7. Bansal S, Mahendiratta S, Kumar S, Sarma P, Prakash A, Medhi B. Collaborative research in modern era: Need and challenges. Indian Journal of Pharmacology. 2019;51:137-9.
8. Cheng Q, Chang Y. Influencing factors of knowledge collaboration effects in knowledge alliances, Knowledge Management Research & Practice. 2020;18(4):380-393.
9. Chugh R. Do Australian Universities Encourage Tacit Knowledge Transfer? In: Proceedings of the 7th International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management. 2015;128-135.
10. Collins H. Tacit and Explicit knowledge, The University of Chicago Press, Chicago; 2010.
11. Goga RK, Adienge AA, Kivati CB, Makatiani ET. The Role of Knowledge Management Systems in the Retention of Tacit Knowledge in Research Institutes in Kenya, In: Kwanya T, Kiplang'at J, Wamukoya J. (Ed.s), 1st International Conference on Information and Knowledge Management held from 24-26 August 2016. 2017;173-185.
12. Igbinovia MO, Ikenwe IJ. Knowledge management: processes and systems information impact. Journal of Information and Knowledge Management. 2017;8(3):26-38.

13. Insch GS, McIntyre N, Dawley D. Tacit knowledge: A refinement and empirical test of the academic tacit knowledge scale. The Journal of Psychology. 2008;142(6):561-579.
14. Kabiru DA. Knowledge management strategies and practices in Nigerian Agricultural Research Institutes: PhD. Thesis, University of Kwazulu-Natal, Natal, South Africa; 2015.
15. Kahiga EW. Knowledge Sharing Practices among Crop Researchers at the Kenya Agricultural Research Institute: MSc. Thesis, University of Nairobi, Kenya; 2014.
16. Kenya Agricultural and Livestock Research Organization. Strategic Plan 2017-2021, KALRO, Nairobi, Kenya; 2017.
17. Liebowitz J. Two forgotten elements of a knowledge management strategy. Knowledge Management Research & Practice. 2008;6(3):239-244.
18. Lu HL, Yang CJ. Job Rotation: An Effective Tool to Transfer the Tacit Knowledge within an Enterprise. Journal of Human Resource and Sustainability Studies. 2015;3:34-40.
19. Lukwago G, Basheka BC, Odubuker EP. Using Herzberg's Two Factor Theory to Develop a Construct Validity for Motivation of Employees in Uganda's National Agricultural Research Organization (NARO): A Preliminary Analysis. Global Journal of Commerce & Management Perspective. 2014;3(3):59-65.
20. McCabe A, Parker R, Cox S. The Ceiling to Coproduction in University–Industry Research Collaboration. Higher Education Research and Development. 2016;35(3):560–574.
21. Mucai JM. Tacit Knowledge, Social Networks, Organizational Learning and Competitive Advantage of Information and Communication Technology Content Service Providers in Nairobi: Doctoral Thesis, University of Nairobi, Nairobi, Kenya; 2018.
22. Mohajan HK. The Impact of Knowledge Management Models for the Development of Organizations. Journal of Environmental Treatment Techniques. 2017;5(1):12-33.
23. Murumba JW, Kwanya T, Maina JC. Effects of Tacit Knowledge on the Performance of Selected Universities in Kenya. Management Dynamics in the Knowledge Economy. 2020;8(2):125-144.
24. Muthuveloo R, Shanmugam NS, Teoh AP. The impact of tacit knowledge management on organizational performance: Evidence from Malaysia. Asia Pacific Management Review. 2017;22(4):192-201.
25. Nikki B. Mitigating the Loss of Critical Knowledge. Safety and Reliability. 2014;34(3):61-78.

26. Nkuruziza G, Kasekende F, Otengei OS, Mujabi S, Ntayi JM. An investigation of key predictors of performance of agricultural projects in Sub-Saharan Africa: A case of Uganda. International Journal of Social Economics. 2016;43(7):676-691.
27. Panahi S, Watson J, Partridge H. Towards tacit knowledge sharing over social web tools. Journal of Knowledge Management. 2013;17(3):379–397.
28. Stalesen AM. Agile Retrospectives: An Empirical Study of Characteristics and Organizational Learning: Master Thesis, Norwegian University of Science and Technology, Trondheim, Norway; 2015
29. Szulanski G, Jensen JR. Presumptive Adaptation and the Effectiveness of Knowledge Transfer. Strategic Management Journal. 2006;27(10):937-957.
30. Venkitachalam K, Busch P. Tacit Knowledge: Review and Possible Research Directions. Journal of Knowledge Management. 2012;16(2):356-371.
31. Yamane T. Statistics: An Introductory Analysis, 2nd ed. New York: Harper and Row; 1967.